DRAFT

THE BAYLANDS INFRASTRUCTURE REPORT

Prepared for the
City of Brisbane, California
By Baylands Development Incorporated and
BKF Engineers in collaboration with
Brown and Caldwell, Geosyntec, ENGEO,
OJB, Biohabitats, Radius Design, and Meyers+
April 8, 2022

Revised Feb. 22, 2023

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The following is a list of supporting Technical Documents developed for The Baylands and referenced herein that are submitted for review under separate cover:

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1. INTRODUCTION

1.1 Purpose of Infrastructure Master Plan

This Baylands Infrastructure Report provides more detailed information and analysis of the site's remediation, landfill closure, wetland and geotechnical requirements, and the wet utilities (water, wastewater, recycled water, storm drainage and flood control, stormwater) and dry utilities (power, natural gas, communications) required to serve the development (henceforth, "The Baylands") included in The Baylands Specific Plan. The Baylands consists of approximately 641.8 acres, which includes approximately 520 acres of generally undeveloped land on a former railyard and landfill, and the approximately 121.8-acre Brisbane Lagoon.

An additional 11 technical documents are listed and submitted under separate cover that informed completion of this report. This document, and accompanying appendices, supports the Infrastructure Chapter of the Specific Plan.

1.2 Existing Site Conditions

Once part of San Francisco Bay, The Baylands site was home to an estuarine ecosystem inhabited by marshes and mud flats. Starting fill activities in the late 1800's, a combination of increased demand for freight trains and the 1906 earthquake culminated in filling a portion of the San Francisco Bay. By 1914, the railyard was installed and by 1935 the entire approximately 218-acre site west of the railroad tracks (henceforth, "West Side") had been filled with rubble from the 1906 earthquake, debris, soil and local Franciscan bedrock rubble resulting from development of tunnels and roads. Up until the 1960's, the area west of the railroad tracks was utilized as a railyard for servicing trains and distributing goods.

The portion of The Baylands site east of the railroad tracks (henceforth, "East Side") began accepting waste in what was then the San Francisco Bay. In the early 1930s, demand for a solid waste landfill started the process of gradually filling in the Bay east of the railroad tracks. During the 1950s, Highway 101 was constructed, ultimately setting the limit of bay filling activities and defining the eastern boundary of The Baylands site. Landfill operations continued up until 1967, when the site closed and stopped accepting solid waste. Since the landfill closed, the site has been used for construction material and soil recycling operations.

1.3 The Baylands Specific Plan

Multiple land uses and neighborhoods are proposed within The Baylands, complemented and connected by a dynamic open space network. The Baylands Specific Plan describes elements within The Baylands Specific Plan area (henceforth, the "site") that include site and land use plans, open space network, design guidelines and other elements. The proposed land use plan included in The Baylands Specific Plan in shown in Figure 1.1.

The Baylands also includes new and relocated streets, open space, and infrastructure. Major new infrastructure, such as water recycling facilities, are included on the East Side of the site. Except as otherwise noted, all other infrastructure such as linear wet and dry utilities are located within public rights of ways for new and relocated streets and open space areas.

Figure 1.1 The Baylands Land Use Plan

2. SITE GRADING, GEOTECHNICAL, AND ENVIRONMENTAL CONDITIONS

2.1 Existing Site Conditions

2.1.1 EXISTING SITE TOPOGRAPHY

The Baylands has a varying topography across the site, with grades at Visitacion Creek being the lowest and Icehouse Hill being the highest. Existing topographical information is based on an aerial topographic survey performed by Vertical Mapping Resources in February 2021 for both the West Side and the East Side. (See Appendix B).

2.1.1.1 WEST SIDE

On the West Side of The Baylands, grades are generally flat with ground slopes projecting from the edge conditions toward a dirt drainage channel running parallel to and east of the Industrial Way buildings. Portions of the West Side near the Roundhouse and Industrial Way areas drain toward an existing low point elevation of approximately 9 feet near the intersection of Bayshore Boulevard and Industrial Way. The highest elevations are found on top of Icehouse Hill. Existing site conditions are shown on Appendix B for reference.

Elevations referenced in this document are based on the North American Vertical Datum of 1988 ("NAVD 88").

2.1.1.2 EAST SIDE

On the East Side of The Baylands, the topography is widely diverse. After the landfill stopped receiving waste in 1967, the East Side has been used as a soil recycling operation, both receiving and selling fill soil. The soil recycling operation has caused the site topography to change frequently over the years subject to the quantities of soil materials being imported and exported. Because of the soil recycling operation, the site has many dirt mounds with adjacent flat areas that provide access for trucks moving dirt. Visitation Creek divides the site perpendicular to Highway 101 into two areas, and collects runoff from the majority of both side of the East Side. The northernmost areas of the East Side grade toward Beatty Avenue and the southern most areas grade toward the Brisbane Lagoon. Elevations on the East Side range from approximately elevation -3 at the existing drainage channel bottom adjacent to the Highway 101 box culvert, to approximately 80 feet atop the highest dirt mound.

2.1.2 GEOTECHNICAL EVALUATIONS

The detailed explanation of the geotechnical conditions of the site is included in the following reports by ENGEO and summarized below:

- *Brisbane Baylands Landfill Final Landfill Closure Geotechnical Report* by ENGEO Incorporated, dated December 8, 2021, revised May 19, 2022 (See Technical Document 1)
- *Baylands Railyard Infrastructure Improvements Geotechnical Evaluation* by ENGEO Incorporated, dated March 31, 2021, revised January 21, 2022 (See Technical Document 2)

2.1.3 EXISTING SUBSURFACE CONDITIONS

The upper soil layers at the East Side are artificial fill and soil stockpiled from the soil recycling operation. The stockpiled soil is underlain by waste. At the West Side, the upper layer is artificial fill placed during previous land reclamation activities at the site. Below the waste on the East Side and the fill on the West Side, the subsurface layers comprise; from youngest to oldest: (1) Holocene Bay Deposits consisting of Young Bay Mud and marine sand; (2) Pleistocene aeolian, alluvial, and marine deposits; and (3) Franciscan Bedrock. These subsurface strata are discussed in more detail below.

2.1.3.1 ARTIFICIAL FILL AND SOIL STOCKPILE (NON-ENGINEERED FILL)

At the East Side, the upper soil layer consists of soil stockpiled from the soil recycling operation. This layer is highly variable, ranges from sandy clay to gravel with sand, but the majority of the soil is silty clayey sand. Variable amounts of debris consisting of concrete, bricks, tires, steel, and wood were encountered in the borings. The thickness of the fill is highly variable across the East Side. In general, the fill on the northern portion of the site, where the site elevation is lower, is relatively thin, ranging in thickness from 3 to 5 feet. Fill up to 40 feet thick was encountered in borings on the southern portion of the site, but it is likely thicker in the areas of higher elevation. The current site elevation ranges from Elevation 15 to 80 feet due to differing fill thickness.

At the West Side, the fill placed during land reclamation differs consisting of brown or olive grey gravel, sand, clay, and silt that varies from loose to dense or medium stiff to stiff. Rock fragments, organic matter, and “man-made” debris are present throughout the fill. Records regarding the placement and compaction of this material are not available. The variable density of soil sampled from borings indicates that the fill is likely non-engineered. The artificial fill ranges from 6 to 22 feet in thickness.

2.1.3.2 WASTE

The Brisbane Landfill is classified by the San Francisco Regional Water Quality Control Board (RWQCB) as an unlined Class III landfill. Based on the Waste Discharge Requirements from the RWQCB, when the landfill was active, it was primarily used for the disposal of non-hazardous solid waste composed of domestic, industrial, shipyard, sewage, and rubble. The waste material encountered in explorations included wood, paper, plastic, glass, wires, metals, and gravelly soil. Across the East Side, the waste thickness ranges between 15 and 35 feet. Aerial photographs taken during waste and fill placement show subterranean ground failures caused by rotated/subsided Young Bay Mud during waste and fill placement. Such failures likely resulted in intermixing of the waste and Young Bay Mud, as well as creating isolated locations where the thickness of waste is irregular.

2.1.3.3 HOLOCENE BAY DEPOSITS

The Holocene Bay Deposits include intermixed soft to medium stiff clay and silt and loose to medium dense sand deposited by bay and intertidal activities. The Bay Deposits include zones of highly compressible clay, locally known as Young Bay Mud. The thickness of the Young Bay Mud generally increases moving west to east with thicknesses ranging from less than 6 feet along Bayshore Boulevard to up to 60 feet near Highway 101. There are two troughs of deeper Young Bay Mud leading to the former drainage outlets of Visitacion Valley and Guadalupe Valley. In some areas of the site, the Bay Deposits include sandy soil strata underlying the Young Bay Mud. This sandy layer is up to 10 feet thick and is loose to medium dense.

The Young Bay Mud is normally to slightly over consolidated. When subjected to new loads from fill or structures greater than the material has previously experienced, the Young Bay Mud will undergo long-term settlement that could affect the planned improvements in The Baylands area if left unmitigated. Additionally, the sandy layers within the Bay Deposits may be susceptible to liquefaction during cyclic loading. The impact of liquefaction at the site depends on the depth of the layer relative to future elevation of the site grade.

2.1.3.4 PLEISTOCENE AEOLIAN, ALLUVIAL AND MARINE DEPOSITS

Below the Holocene Bay Deposits, the explorations encountered Pleistocene sand and clay that was deposited in aeolian, alluvial, and marine environments. The Pleistocene marine clay deposits are locally known as Old Bay Clay. The Old Bay Clay ranges from greenish gray to olive brown and generally increases in strength with depth. Old Bay Clay generally has similar consolidation properties as Young Bay Mud; however, it is only susceptible to settlement from higher loading conditions since it is over consolidated. The Pleistocene sand deposits range from greenish gray to orangish brown and are medium dense to dense.

2.1.3.5 JURASSIC- AND CRETACEOUS-AGE FRANCISCAN BEDROCK

The Pleistocene deposits are underlain by Jurassic- and Cretaceous-age Franciscan bedrock that is generally composed of interbedded mélange matrix and siltstone/sandstone. Published bedrock maps show that bedrock elevation ranges from Elevation 0 to -257 feet across The Baylands, with the shallower bedrock being at the northern and southwestern extents of the site and the deepest bedrock in the middle. The Franciscan bedrock typical of the area is friable to strong and severely weathered, consisting of Greenstone, Serpentinite, Siltstone, and Greywacke Sandstone.

2.1.4 EXISTING GROUNDWATER CONDITIONS

Geosyntec completed a review of the effects of Sea Level Rise (SLR) on groundwater (see Technical Document 3). The analysis in Technical Document 3 indicates that existing groundwater conditions vary throughout the site and shallow and deep aquifers are present. On the West Side, the shallow groundwater table was observed in monitoring wells between approximately Elevation 6 to 15.5 feet during monitoring in 2019 and 2020. During monitoring on the East Side, the groundwater elevations in the interior of the area were approximately Elevation 10 feet and Elevation 12.5 feet in the northern and southern portions, respectively. The groundwater near the existing internal drainage channel and the edge of Brisbane Lagoon is at approximately Elevation 3 to 4 feet, and it is generally Elevation 4 to 10.5 feet around the exterior of the landfill limits on the East Side. Fluctuations in the level of groundwater may occur due to variations in tidal fluctuations from the San Francisco Bay, earthwork activities, rainfall, irrigation practice, and other factors.

2.1.5 SEA LEVEL RISE ESTIMATES

On November 14, 2008, the Governor issued Executive Order S-13-08 directing state regulatory bodies to address SLR. SLR refers to the increase in elevation of the Earth's water bodies over time. As SLR occurs, there is increased pressure along shoreline areas, thus an evaluation of protections for infrastructure, health, and safety in response to SLR are required. Studies on the effects of climate change on surface water elevations across the Earth continue to evolve as more scientific data is made available.

The Baylands is designed to protect against and accommodate SLR through a combination of permanent SLR grading designs and adaptive management approaches that allows the infrastructure to be adjusted over time in response to measured SLR. The minimum design elevations for the Development Areas are informed by the potential future sea level rise estimates for San Francisco Bay as defined by State of California Sea-Level Rise Guidance, 2018 Update (SLR Guidance), published by the Ocean Protection Council and California Natural Resources Agency, and is the document referenced in the State Water Quality Control Board documents. The SLR Guidance identifies the following SLR estimates for the San Francisco Bay near the site:

- 2050 Medium-High Risk Aversion (1:200 Chance): 1.9-feet (~23 inches)
- 2100 Medium-High Risk Aversion (1:200 Chance): 6.9-feet (~83 inches)
- 2050 Low Risk Aversion (<1:2 Chance): 1.1 feet (~13 inches)
- 2100 Low Risk Aversion (<1:2 Chance): 3.4 feet (~41 inches)

Geosyntec prepared a 100 Year Total Water Level Scenarios Sea Level Rise Vulnerability Assessment (see Technical Document 4) based on two 100-year total water level scenarios. One scenario considered the Low Risk Aversion SLR estimate and the second scenario considered the Medium-High Risk Aversion SLR estimate. The total water level elevation projections are calculated considering combined effects due to sea level rise, astronomical tides, storm surge, wind waves, and wave run-up for both scenarios. The estimated TWLs are incorporated into flood maps prepared using the current Conceptual Grading Plan (see Appendix A) and both surface flooding. In addition, the influences of groundwater in response to SLR is further evaluated in Technical Document 3 by Geosyntec. The evaluations concluded that periodic surface flooding under the two scenarios would be negligible to minimal and groundwater impacts would be minimal. The appropriate TWL elevation was considered in the various design elements of the project.

2.2 Environmental Remediation and Landfill Closure

2.2.1 EAST SIDE

In order to ensure long-term protection of air, water, and land from pollution related to the East Side of the site's use as a landfill, State law (Title 27 of the California Code of Regulations) requires the landowner to submit a Closure Plan and Post-Closure Maintenance Plan (CPCMP) to the RWQCB, San Mateo County Health Services Agency (SMCHSA) in its capacity of the Local Enforcement Agency (EA), and the state of California Department of Resources, Recycling and Recovery (CalRecycle) for review and approval. In addition to the submittals to the RWQCB, SMCHSA, and CalRecycle, the Landfill Gas Collection and Control System Design Plan (a component of the CPCMP) also must be separately submitted to the Bay Area Air Quality Management District (BAAQMD) for review and approval. This plan will identify how remaining subsurface gas (i.e., methane) generated by the closed landfill will be collected, treated, and monitored. Descriptions related to landfill closure outlined below are based on The Baylands CPCMP (See Technical Document 5) that was submitted by Baylands Development Incorporated (BDI) and Engeo to RWQCB, SMCHSA, CalRecycle, and BAAQMD in 2021 for review and approval (pending).

The goal of the CPCMP is to appropriately close, mitigate, and manage the landfill so that it does not pose an unacceptable risk to human health and the environment and supports the intended development land uses. The primary components of the landfill closure will include an engineered cap, leachate collection system, landfill gas collection (LFG) system, geotechnical stabilization, and a long-term monitoring and maintenance program. The primary engineered cap across the landfill site will include a geosynthetic liner, a compacted clay liner or Geomembrane, compliant with Title 27 requirements. Low-permeability pavement for hardscaped areas may be used in the commercial areas proposed in the northern half of the East Side, outside of building footprints. A combinedr geosynthetic and geomembrane liner will be placed beneath Visitation Creek and the surrounding restored wetlands, as an additional preventative measure for leachate seeps into overlying wetlands. Future potential offsite migration of leachate will be managed through the installation and operation of a leachate collection and removal system (LCRS) collection trench with a low permeability cut-off wall to prevent offsite migration of leachate into the San Francisco Bay, surrounding water bodies, and groundwater. The leachate collection system will extend beneath the Visitacion Creek alignment to reduce hydrostatic pressure under the engineered cap beneath the creek. The LFG extraction system will consist of vertical extraction wells installed through the proposed landfill cap. Proposed lateral collection piping will be placed above the final landfill final cover layer (wherever possible), and LFG will be routed and treated through granular activated carbon systems. This will be monitored and maintained under jurisdiction of SFBRWQCB and BAAQMD. Future buildings within the East Side will require LFG intrusion mitigation systems which consist of a vapor barrier and a gas venting system layer beneath building footprints.

As a result of the landfill closure impacts to existing wetlands, Biohabitats has prepared a wetland mitigation plan entitled *The Baylands Wetland Mitigation Plan* (henceforth, "WMP") in February 2022 and associated mitigation design drawings will be developed. Coordination with the U.S. Army Corps of Engineers (USACE) is on-going and review and approval of the wetland mitigation will be required by USACE, SFBRWQCB, the San Francisco Bay Conservation & Development Commission (BCDC), and California Department of Fish and Wildlife (CDFW). The jurisdiction of the other agencies is described in the following paragraphs.

The Landfill Closure Plan will be implemented and enforced by the SFBRWQCB, SMCHSA, and CalRecycle to ensure proper and complete implementation of the approved plan. Implementation is planned to occur between 2024 and 2034. The closure elements will be completed in phases to allow development to commence in the Sustainability District on the southernmost portion of the landfill first, followed by closure and development in the northern portion of the landfill within the East Campus District during later phases. Closure elements for proposed open space areas will commence as soon as the Habitat Mitigation Plan is approved by all agencies with implementation of the plan to follow. Completion of the landfill cap (i.e., soil stabilization, installation of the foundation layer of the cap, and placement of a low-permeability barrier) and approval by the RWQCB, SMCHSA, and CalRecycle for the area to be developed is required prior to the initiation of the vertical construction at that phase of development.

Following closure certification for the subject development area, the RWQCB will issue Closure Waste Discharge Requirements (WDRs). The WDRs will require implementation of the Post Closure Maintenance Plan and will require evidence of financial assurance to ensure sufficient financial resources are allocated to implement the Post Closure Maintenance Plan. As required under Title 27 foreseeable risks to the landfill cap's integrity must be documented and a contingent financial assurance mechanism established. Therefore, among other elements, the Post Closure Maintenance Plan includes a Post-Earthquake Inspection and Corrective Action Plan to address recovery from damage to the landfill closure components that may be caused by future earthquakes.

2.2.1.1 BACKGROUND

Prior to 1932, the area now occupied by the Brisbane Landfill consisted of a low-lying tidal marshland. In 1932, Sanitary Fill Company leased the property from Southern Pacific Transportation Company (SPTC) and by the mid-1930s had subcontracted the day-to-day filling operations to the Easly and Brassy Company. The landfill operated between 1932 and 1967 and was used for the disposal of solid wastes composed principally of domestic, industrial and shipyard waste, sewage, and rubble [Water Board, 2001]. Following the completion of land filling activities in 1967, the landfill ceased to operate. No waste or refuse has been disposed of at the Brisbane Landfill since 1967. During the period between 1932 and 1967, approximately 12.5 million cubic yards of waste were placed in the landfill per the RWQCB. Sunquest Properties, Inc. (now) acquired the Brisbane Landfill, along with most of the railyard, from SPTC in December 1989.

Consistent with landfill practices at that time, no liner was installed at the Brisbane Landfill prior to waste placement. Instead, the waste material was placed directly into the water on top of the Young Bay Mud. Also consistent with landfill practices at that time, leachate collection and removal systems (LCRs) were not utilized. In accordance with Section 20260 of Title 27 of the California Code of Regulations (hereafter referred to as Title 27), the Brisbane Landfill is classified by the RWQCB as a closed, unlined Class III landfill.

The Brisbane Landfill is bounded to the east by U.S. Highway 101, to the west by the UP/JPB railroad tracks, and to the south by the Brisbane Lagoon. The highway provides a physical barrier along the eastern boundary of the landfill that separates San Francisco Bay from the Brisbane Landfill. The northern edge of the Brisbane Landfill is a row of industrial properties located north of Beatty Avenue while the railroad and Tunnel Avenue represent the approximate western boundary for the Brisbane Landfill. Approximate boundaries of the Brisbane Landfill are shown in the CPCMP.

2.2.1.2 HISTORY OF LANDFILL OPERATIONS

The Brisbane Landfill operated and closed before either modern waste disposal practices were developed or formal regulatory designs for closure were required. Waste disposal design features such as liners, segregation of waste into disposal cells, and leachate collection systems were not components at the site. Per the RWQCB, waste containment was consistent with practices in the industry at that time where waste fill was placed directly on native soil in the San Francisco Bay

Approximately 12.5 million cubic yards of waste was placed at the Brisbane Landfill. Of this volume, the RWQCB indicates that an estimated 73% was produced by residential and commercial activities, with inert fill and liquid waste accounting for approximately 25% and 2% of the remaining volume, respectively.

Upon completion of disposal operations, waste material was covered with earth fill and other inert material. Since closure of the Brisbane Landfill, the East Side has been operated as soil recycling facility, resulting in the acceptance and stockpiling of soil. This soil in turn accelerated consolidation of the refuse and compressible Young Bay Mud. A number of structures, such as commercial and industrial buildings and petroleum storage tanks, have been constructed on the East Side since the 1950s. Portions of the East Side, including streets and parking areas, have been paved. Highway 101 was constructed immediately to the east of The Baylands in the middle of the 1950s. The highway was constructed on fill derived from the Candlestick Point and San Bruno Mountain areas.

2.2.1.3 REGULATORY SETTING

2.2.1.3.1 REGULATORY OVERSIGHT

The environmental investigation and any necessary remediation of the Brisbane Landfill is regulated by the RWQCB. The RWQCB adopted WDRs in 2001 to bring the landfill into compliance with the appropriate portions of Title 27 and to establish a discharge monitoring program for the landfill. Since the issuance of the WDRs in 2001, the RWQCB has required period monitoring of groundwater and leachate conditions. No notices of violation have been issued by the RWQCB during this time.

Due to its use as a landfill, the site is subject to oversight by CalRecycle, along with the SMCHSA as the EA, which enforce Title 27 regulations related to landfill closure, post closure maintenance, and LFG monitoring and control. In particular, closure plans and CPCMPs that address the requirements of Title 27 are approved by the EA and CalRecycle. The Brisbane Landfill is currently inspected on a quarterly basis, and according to the CalRecycle Solid Waste Information System (SWIS) last checked February 21, 2022, there are no enforcement action and no notices of violation are noted since 2002.

The BAAQMD is responsible for monitoring site operations that affect air quality, including flaring activities. Air pollution control measures at the site are directed toward minimizing fugitive dust emissions and controlling LFG migration.

2.2.1.4 AFFECTED ENVIRONMENT

2.2.1.4.1 REMEDIAL INVESTIGATIONS CONDUCTED TO DATE

Remedial investigations at the Brisbane Landfill have been conducted since 1987. Groundwater monitoring and FLG monitoring continue on an annual basis as required by the WDRs.

2.2.1.4.2 CONTAMINANTS OF CONCERN (COCS).

Soil: No COCs have been identified for soil. Waste primarily consists of non-hazardous materials, consistent with Class III landfills.

Groundwater: Shallow (Zone A) groundwater at the Brisbane Landfill is naturally brackish to saline. COCs for the shallow and deep groundwater zones at the landfill include the following [SFBRWQCB, 2001]:

- Inorganics (ammonia/un-ionized ammonia, nitrate, sulfate, total dissolved solids (TDS) and total organic carbon (TOC));
- Metals (arsenic, barium, lead, nickel, and selenium);
- Volatile Organic Compounds (VOCs);
- Semi-volatile Organic Compounds (SVOCs); and
- Organochlorine pesticides and PCBs.

LFG: Low concentrations of methane.

2.2.1.4.3 CONTAMINANT DISTRIBUTION

Groundwater monitoring data from August 2020 indicate that COC concentrations are generally low, and are highest in the southern (downgradient) portion of the Brisbane Landfill. Of the inorganic COCs, TDS, TOC, and sulfate are highest in shallow wells, and nitrate is highest in deep groundwater. Of the dissolved metals, concentrations of arsenic, barium, lead, nickel, and selenium are uniformly low in shallow and deep wells. The VOCs methyl tert-butyl ether (MTBE), chlorobenzene, 1,4-dichlorobenzene, and cis- 1,2-dichlorobenzene are present at low levels in shallow groundwater, whereas acetone was the only organic detected above the reporting limit in deep groundwater. The SVOCs acenaphthene and n-nitroso diphenyl were detected above reporting limits in shallow groundwater, but none were detected in deep groundwater. Neither organochlorine pesticides nor PCBs were detected above the reporting limit in shallow or deep groundwater.

2.2.1.5 REMEDIAL ACTIVITIES CONDUCTED TO DATE

2.2.1.5.1 INSTALLATION OF GAS COLLECTION AND CONTROL SYSTEM

An active Gas Collection and Control System (GCCS) was installed at the Brisbane Landfill in 1991. The GCCS operates under a Permit to Operate (PTO) issued by the BAAQMD in 2021.

The GCCS consists of a flare, main header that surrounds the approximately 240-acre area located east of Tunnel Avenue and west of Highway 101), 26 vertical wells and 28 horizontal collectors. Due to limited gas generation at the Landfill, the GCCS does not operate continuously. The PTO requires that the LFG flare system be operated at least seven hours per day. However, if the methane concentration in the main header falls below 20% by volume, or the LFG flow rate falls below 250 cubic feet per minute (cfm) measured at the blower discharge, then the LFG flare system may be operated less than seven hours per day. The current methane generation rate varies and the flare system operates a few hours per week when the flaring threshold is met.

2.2.1.5.2 BRISBANE LAGOON SHORELINE SEEP MITIGATION

To mitigate Brisbane Lagoon shoreline seeps, a Leachate Seep Collection and Transmission System (LSCTS) was designed and constructed with approval by the RWQCB in the 2000's, and the LSCTS began operation on August 7, 2009.

As outlined in the *DRAFT Leachate Management Plan* by Geosyntec and dated August 29, 2008, the LSCTS consists of five extraction wells and four piezometers. The wells, equipped with pneumatic pumps, create an inward gradient to intercept leachate flowing toward the seeps. The leachate is discharged to the Bayshore Sanitary District (BSD) sewer line. As required by the San Francisco Public Utilities Commission (SFPUC), the LSCTS discharge is sampled quarterly for chemicals required by the permit and analytical results reported to SFPUC and BSD.

2.2.1.5.3 PLANNED CLOSURE ACTIVITIES

A CPCMP has been prepared and submitted to the RWQCB, Cal Recycle, and the EA and is pending approval. Final construction drawings for the engineered cap, leachate management system, and LFG extraction system will be prepared with the site grading and improvement plans, once the CPCMP has been approved. The closure activities at the Brisbane Landfill will include the following:

- adoption of Closure WDRs by the Water Board prior to development activities;
- implementation of geotechnical ground improvement to mitigate settlement with settlement monitoring;
- installation of the final cover system over the entire landfill, including Visitacion Creek and the Brisbane Lagoon shoreline;
- continued monitoring of waste settlement;
- Long-term flood protection and stormwater controls;

- operation and maintenance of the existing LSCTS, phased as needed, until a new replacement leachate management system is in place;
- operation and maintenance of the existing GCCS, phased as needed, until a new replacement LFG extraction system is in place;
- Installation, maintenance, and monitoring of the proposed leachate collection and removal system (LCRS);
- Installation, maintenance, and monitoring of the proposed LFG extraction system;
- continued groundwater, surface-water and leachate quality monitoring and evaluation;
- post closure cover inspections and maintenance; and land use controls, including deed restrictions that limit site uses, the extent of which will be based on concentrations of contaminants that remain in place, and requirements for soil management plans (SMPs), non-interference with the soil cap, and annual inspection and reporting of maintenance of land use controls.

2.2.1.5.4 CLOSURE DESIGN AND IMPLEMENTATION SCHEDULE

The CPCMP includes details for design and an implementation schedule. Closure of the landfill will be phased to integrate with the development activities, and it may take 10 years or more to complete.

2.2.2 WEST SIDE

The following Remedial Action Plans (RAPs) for UPC OU-SM and OU-2 were approved by the Department of Toxic Substances Control (DTSC) and SFBRWQCB, respectively, in 2021:

- Final Feasibility Study/Remedial Action Plan (FS/RAP) Brisbane Baylands Operable Unit 2 by Geosyntec, dated December 22, 2021 (Technical Document 10)
- Final Feasibility Stud y/Remedial Action Plan (FS/RAP) San Mateo Portion of UPC Operable Unit (UPC OU-SM) by Geosyntec, dated October 11, 2021 (Technical Document 11)

The remedy approved in each FS/RAP is predicated on the conditions established under General Plan Amendment 1-18 (GP-1-18), which was adopted by the residents of Brisbane in 2018. Among other conditions, GP-1-18 requires that “residential development shall be designed and remediated to accommodate ground level residential uses and ground level residential-supportive uses such as daycare, parks, schools, playgrounds, and medical facilities.”.

Preparation of approved UPC OU-SM and Operable Unit 2 (OU-2) Remedial Design Implementation Plans (RDIPs) are required prior to implementation of the remedy on the West Side. Included in the RDIPs will be the FS/RAP approved remediation goals and a detailed plan for implementing the remedy approved in the FS/RAPs to achieve those goals. Following approval, the RDIPs will be implemented and enforced by the DTSC for UPC OU-SM and the RWQCB for OU-2 to ensure proper and complete implementation of the remedy. Implementation of the remedy is planned to occur between 2024 and 2028.

The remedy will be completed in phases to allow development to commence on the southernmost portion of OU-2 and move north to UPC OU-SM. Specifically, the remedy implementation will start in the southern portion of OU-2 in the Icehouse District, which extends from Main Street south to Icehouse Hill. Once the Icehouse District remedy is complete, remedy implementation will move north to the Roundhouse District, which includes the area between Geneva Street and Main Street. Upon completion of the remedy in Roundhouse District, the remedy implementation will move north to UPC OU-SM in the Bayshore District, which encompasses the area between Sunnydale Avenue and Geneva Street.

The remedy will be considered complete in a specific District when active remediation measures (e.g., groundwater treatment, soil excavation and cap or interim cap installation) have been successfully implemented. The remediation will be coordinated with the geotechnical ground improvements proposed for settlement mitigation. Prior to vertical construction within a District, or part thereof, an approved remedial action completion report for the active remediation at that location must be approved by the applicable environmental agency. Additionally, a vapor intrusion mitigation system (e.g., active or passive sub-slab ventilation, construction over a well-ventilated garage) approved by the applicable environmental agency shall be presumptively required and implemented prior to development. However, if the applicable environmental agency determines in writing, based on an assessment of soil vapor conditions that the development site, future use, and building design are collectively protective of the health of future site users, no vapor intrusion mitigation shall be required.

Following certification of the remedy, including testing of any required vapor intrusion mitigation system, the applicable environmental agency will require that an Operation Monitoring and Maintenance Agreement (OM&M), land use covenant and financial assurance mechanism to be entered into and maintained in perpetuity. Among other elements, the OM&M Plan includes a Post-Earthquake Inspection and requirements to repair components damaged by any earthquakes.

2.2.2.1 UPC OU-SM

2.2.2.1.1 REGULATORY OVERSIGHT

A DTSC Consent Order signed in 2008 establishes legal and administrative responsibilities and procedures for cleanup of chemicals at UPC OU-SM. DTSC also oversees the cleanup of soil, soil vapor, and groundwater at the Schlage Operable Unit (Schlage OU) and Universal Paragon Corporation Operable Unit San Francisco (UPC OU-SF), located adjacent to UPC OU-SM to the north. Groundwater impacts from the Schlage OU have impacted groundwater and soil vapor at UPC OU-SM.

2.2.2.1.2 AFFECTED ENVIRONMENT

2.2.2.1.2.1 REMEDIAL INVESTIGATIONS CONDUCTED TO DATE

Numerous investigations to assess the nature and extent of contaminants have been conducted on the Site, with regulatory oversight, beginning in 1984. Most recently, a data gap investigation was completed in 2018. The data generated by remedial investigations was deemed sufficient for updating the Human Health Risk Assessment (HHRA) and completing a FS/RAP for UPC OU-SM. As of October 2021, both documents have been reviewed and approved by DTSC.

2.2.2.1.2.2 CONTAMINANTS OF CONCERN

The COCs at UPC OU-SM are:

- Metals – arsenic, lead, and mercury; and
- Organics – PAHs, TPH-d, PCB-1260, plus Chlorinated Volatile Organic Compounds (CVOCs) that originated from the Schlage OU.

The HHRA concluded that risks to current users of the property are within the acceptable risk management range. If conditions at UPC OU-SM are not remediated or mitigated, COCs in soil and soil vapor may pose a theoretical risk and noncancer hazard to future commercial/industrial workers, construction workers, and residents. The primary risk driving COCs in soil are arsenic, lead, mercury, carcinogenic PAHs, naphthalene, TPH-d, and PCB-1260. The primary risk exposure pathways are direct contact with the soil, inhalation of contaminated dust and/or vapors, and ingestion of soil by future workers, residents, and visitors (receptors).

Because groundwater in the Fill has been determined by the RWQCB as not having beneficial uses for drinking water, potable uses of groundwater will be prohibited. Therefore, health impacts to future users resulting from exposure to groundwater are not expected. Constituents in Fill zone groundwater were screened against saltwater ecotoxicity criteria with a 100-fold attenuation factor to account for sorption and dilution between the site and San Francisco Bay. No COCs in groundwater exceeded saltwater ecotoxicology screening criteria.

In soil vapor, the risk-driving COCs are tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis- 1,2-DCE), and vinyl chloride (VC). The risk-driving COCs in groundwater for the vapor intrusion pathway are TCE, cis-1,2-DCE, and VC. The risk-driving chlorinated COCs in soil vapor and groundwater that pose a potential vapor intrusion risk are COCs that originated from the Schlage OU, located north of the site, and not from onsite sources. Actions to remediate or mitigate these chlorinated COCs are addressed in the Schlage OU FS/RAP. Specifically, the Remedial Action Objectives (RAOs), or goals for protecting human health and the environment, as well as the cleanup levels (CULs) for VOCs developed for the Schlage OU and UPC OU-SF will also apply to Schlage OU-related VOC impacts at the UPC OU-SM, as required by the Consent Order. Implementation of the remedial action at the Schlage OU was certified by DTSC in 2014 and operation and maintenance of the remedy components are ongoing. Any additional remediation or mitigation of VOCs in soil, soil vapor, and/or groundwater conducted at the Schlage OU and/or UPC OU-SF will also address Schlage-originated COCs that have migrated to UPC OU-SM.

2.2.2.1.2.3 CONTAMINANT DISTRIBUTION

Soil: Historical environmental investigations, including the 2018 Data Gap Investigation, indicated the presence of metals and PAHs in shallow fill soil at elevated concentrations in some areas of the Site. Arsenic and lead were detected most frequently at relatively elevated concentrations in shallow fill soil, likely resulting from the historical application of lead arsenate pesticide by the railroad activities.

OCPs and PCBs were detected at only a few locations, indicating that impacts to soil are localized at the site. CVOCs were detected at only a few locations at low concentrations in soil samples and their distribution in groundwater is indicative of impacts from the adjacent Schlage OU rather than point sources within the UPC OU-SM. TPH-g was detected only at low concentrations, and concentrations of TPH-d were elevated only at a few locations, again indicating that impacts to the subsurface are localized at the Site. Asbestos was not detected in any soil samples.

Groundwater; Historical environmental investigations, including the 2018 Data Gap Investigation, indicated that groundwater and soil vapor are impacted by residual levels of CVOCs emanating from the offsite Schlage OU. CVOC concentrations in groundwater and soil are highest in the northern portion of the UPC OU-SM. Dissolved metals concentrations in groundwater were generally low with localized elevated concentrations.

2.2.2.1.3 REMEDIAL ACTIVITIES CONDUCTED TO DATE

Remediation completed to date at the UPC OU-SM consisted of excavation and removal of a petroleum hydrocarbon source in soil. In addition, an interim remedy for the Schlage OU CVOC plume consisted of groundwater extraction and treatment; extraction wells were located on UPC OU-SM. The groundwater extraction system removed more than 5,800 pounds of PCE and TCE. Shutdown of the system was approved by DTSC [2008b] and groundwater remediation transitioned to in situ enhanced reductive dechlorination (ERD) at the Schlage OU, UPC OU-SF, and UPC OU-SM. In situ treatment of CVOCs in groundwater and assessment of soil gas is ongoing under the remedy approved by DTSC for the Schlage OU.

2.2.2.1.4 REMEDIAL ACTION OBJECTIVES

RAOs are evaluated using Applicable or Relevant and Appropriate Requirements (ARARs) and To-Be-Considered Requirements (TBCs), including the General Plan. The RAOs for UPC OU-SM include the following:

Soil: Prevent exposure to soil with COCs at concentrations exceeding clean up levels (CULs) by eliminating the exposure pathway for future receptors, which include incidental ingestion, inhalation of windblown dust particles, and dermal contact.

Soil Vapor: Prevent exposure to CVOCs in soil vapor at concentrations that exceed the CULs for soil vapor by either demonstrating through a Site-specific risk assessment that no significant risk is present, or by blocking or minimizing the vapor intrusion pathway from CVOCs in soil vapor that originate from the Schlage OU groundwater plume.

Groundwater: Prevent exposure to CVOCs in groundwater associated with the Schlage OU CVOC plume by eliminating inhalation risks through the vapor intrusion pathway where significant risk exists, preventing ingestion and dermal contact through the use of groundwater for potable and agricultural purposes, and minimizing dermal exposure of CVOCs and metals in groundwater to construction workers. Treatment of CVOCs in groundwater that migrated beneath the site from the Schlage OU will continue, as directed in the Schlage OU RAP, until the CULs established for the Schlage OU cleanup have been met (i.e., California MCLs) [MACTEC, 2009].

2.2.2.1.5 CLEANUP LEVELS

The development and application of cleanup levels for site COCs are based on the RAOs and media-specific considerations:

- Soil – CULs were developed for metals, PCBs, and PAHs in soil for areas of the site where soil will not be capped. These soil CULs were selected based on background concentrations and protective health-based concentrations for future residents, commercial/industrial workers, and construction workers, and for protection of ecological receptors in San Francisco Bay.
- Fill Zone Groundwater – the CULs for VOCs and volatile PAHs are the published DTSC RSLs. Because the Fill groundwater has been determined by the Water Board as not being beneficial for drinking water use and an exposure pathway will not exist, there is no regulatory requirement to develop groundwater CULs for metals and non- volatile PAHs.
- Colma and Merced Formation Groundwater - for groundwater in the Colma and Merced Formations, which is considered usable as drinking water, the CULs for groundwater are the California Maximum Contaminant Levels (MCLs).

2.2.2.1.6 REQUIRED REMEDIAL ACTIVITIES

2.2.2.1.6.1 REQUIRED REMEDIAL ACTIONS

Remedial measures and techniques that were approved by the DTSC in the FS/RAP include: localized excavation of impacted soil, installation of a protective cap, consisting of clean soil and/or hardscape surfaces (e.g., building foundations, roads, sidewalks, etc.) over most of the UPC OU-SM, and land use restrictions including administrative and engineering controls. Excavated soil can either be used onsite under the soil cap of disposed offsite. The clean soil cap will have a minimum thickness of five feet of clean imported fill placed over fill or the residual impacted soil. Groundwater treatment at the Schlage OU is also anticipated to further reduce VOC concentrations in groundwater at both the Schlage OU and UPC OU-SM.

Prior to initiating vertical construction of any occupied structure, testing for VOCs in soil gas will take place beneath the proposed structure and the results will be provided to DTSC. Based on the results, DTSC will determine whether VOC soil vapor mitigation will be required (e.g., vapor intrusion mitigation systems) beneath the buildings. As discussed above, a vapor intrusion mitigation system or intrinsically safe build design will be presumptively required by the City; however, if DTSC determines in writing based on a soil vapor assessment that conditions in the context of site use, building design and conditions are protective of future site users, no vapor intrusion mitigation shall be required.

Ongoing operations, monitoring and maintenance of caps and any engineered systems such as soil vapor mitigation systems is required to verify the remedy remains protective. The long-term protectiveness of remedies will be ensured through continuing obligations, including land use covenants, OM&M plans and agreements, financial assurance mechanisms, and ongoing oversight by DTSC.

2.2.2.2 OU-2

2.2.2.2.1 REGULATORY OVERSIGHT

Originally, the DTSC Consent Order signed in 2008 established legal and administrative responsibilities and procedures for cleanup of chemicals at UPC OU-SM and OU-2. In 1995, regulatory oversight for OU-2 was transferred to the RWQCB, which has been the lead agency since that time.

2.2.2.2.2 AFFECTED ENVIRONMENT

2.2.2.2.2.1 REMEDIAL INVESTIGATIONS CONDUCTED TO DATE

Numerous investigations to assess the nature and extent of contaminants have been conducted at OU-2, with regulatory oversight, beginning in 1982. Most recently, a data gap investigation was completed in 2018. The data generated by remedial investigations was deemed sufficient for updating the HHRA and completing an FS/ RAP for OU-2. As of December 2021, both documents have been reviewed and approved by the RWQCB.

2.2.2.2.2.2 CONTAMINANTS OF CONCERN

The COCs at OU-2 are:

- Metals - arsenic and lead
- Organics - benzene, TPH-d, Bunker C oil, plus CVOCs in a limited area of OU-2.

The HHRA concluded that risks to current users of the property are within the acceptable risk management range. If conditions at OU-2 are not remediated or mitigated, COCs in soil and soil vapor may pose a theoretical risk and noncancer hazard to future commercial/industrial workers, construction workers, and residents. The primary risk driving COCs in soil are arsenic, lead, and TPH d, plus CVOCs in a limited area; the primary risk-driving COC in groundwater is benzene, plus CVOCs in a limited area. The primary risk exposure mechanisms are direct contact with soil, inhalation of contaminated dust and vapors, and ingestion of soil by future workers, residents, and visitors (receptors).

Because groundwater in the fill has been determined by the RWQCB as not having beneficial uses for drinking water, groundwater uses for potable purposes will be prohibited. Therefore, health impacts resulting from exposure to groundwater are not expected. Constituents in the fill zone groundwater were screened against saltwater ecotoxicity criteria with a 100-fold attenuation factor to account for sorption and dilution between the site and San Francisco Bay. No COCs in groundwater exceeded saltwater ecotoxicology screening criteria.

2.2.2.2.2.3 CONTAMINANT DISTRIBUTION

Soil: Metals and PAHs are present in shallow fill soil at elevated concentrations across certain areas of OU-2. Specifically, arsenic and lead were detected in nearly every sampling location during the 2018 Data Gap Investigation at relatively elevated concentrations in shallow fill soil, likely resulting from the historical application of lead arsenate pesticide to the ground surface during railyard operations. VOCs, OCPs, and PCBs exceeded screening criteria at only a few locations, indicating that impacts from these COCs to soil are localized. The distribution of Bunker C oil has been delineated and appears to be contained to the fill layer and above the Young Bay Mud layer.

Groundwater: Dissolved metals concentrations in groundwater were generally low with localized elevated concentrations. VOC detections in groundwater were similarly limited. Benzene, ethylbenzene, naphthalene, and xylene exceedances were observed primarily in the former Bunker C oil tank area, and chlorinated solvents were in a localized area in the western central portion of the site.

2.2.2.2.3 REMEDIAL ACTIVITIES CONDUCTED TO DATE

In 2006, the northern portion of the drainage ditch on OU-2 was reconstructed by and design work and permitting by Burns and McDonnell. The work included excavation of the root zone, backfilling, and installation of a high-density polyethylene liner in various portions of the work area. The objective of this work was to minimize the infiltration of surface water in the ditch through the underlying COCs in soil to the fill zone groundwater.

2.2.2.2.4 REMEDIAL ACTION OBJECTIVES

RAOs are evaluated using ARARs and TBCs, including the General Plan. The RAOs for OU-2 include the following:

Soil: Prevent exposure to soil with COCs at concentrations exceeding CULs by eliminating the exposure pathway for future receptors, which include incidental ingestion, inhalation of windblown dust particles, and dermal contact.

Soil Vapor: Prevent exposure to VOCs in soil vapor at concentrations that exceed applicable CULs for soil vapor by blocking or minimizing the vapor intrusion pathway.

Groundwater: Prevent exposure to VOCs in groundwater by eliminating inhalation risks through the vapor intrusion pathway and preventing ingestion and dermal contact through preventing the use of groundwater for potable and agricultural purposes.

2.2.2.2.5 CLEANUP LEVELS

The development and application of cleanup levels for site COCs are based on the RAOs and media-specific considerations:

Soil: CULs were developed for arsenic, lead, tetrachloroethene, cis-1,2-Dichloroethene, trichloroethene, vinyl chloride, and TPHd in soil for areas of the Site where soil cannot be capped. These soil CULs were selected based on background concentrations and residential exposure scenarios. The soil CULs have been developed to accommodate ground level residential uses and ground level residential-supportive uses such as daycare, parks, schools, playgrounds, and medical facilities.

Fill Groundwater: CULs were calculated for benzene, cis-1,2-Dichloroethene, tetrachloroethene, trichloroethene, and vinyl chloride based on the protection of future occupants from vapor intrusion.

Colma and Merced Formation Groundwater: Impacts to groundwater in these deeper formations have not been observed beneath OU-2, thus there are no CULs.

2.2.2.2.6 PROPOSED FUTURE REMEDIAL ACTIVITIES

2.2.2.2.6.1 PROPOSED REMEDIAL ACTIONS

The remedial activities that were approved by the RWQCB in the OU-2 FS/RAP include localized excavation of impacted soil, in-situ treatment of CVOC impacted groundwater, installation of a protective cap, consisting of clean soil and/or hardscape surfaces (e.g., building foundations, roads, sidewalks, etc.) over most of the OU-2, and land use restrictions including administrative and engineering controls. The clean soil cap will have a minimum thickness of five feet of clean imported fill placed over fill or the residual impacted soil.

A vapor intrusion mitigation system or intrinsically safe build design will be presumptively required by the City to address potential soil vapor intrusion risk; however, if the RWQCB determines in writing based on a soil vapor assessment that conditions in the context of site use, building design and conditions are protective of future site users, no vapor intrusion mitigation shall be required.

Ongoing operations, monitoring, and maintenance of caps and any engineered systems such as soil vapor mitigation systems is required to verify the remedy remains protective. The long-term protectiveness of cleanup remedies will be ensured through continuing obligations, including land use covenants OM&M, financial assurance mechanisms and oversight by the RWQCB.

2.3 Proposed Site Grading

The proposed grading designs for both the West Side and East Side of The Baylands are defined by unique infrastructure requirements, geotechnical conditions, and environmental mitigations. Proposed grading designs both the West Side and East Side are included in Figure 2.2 and Appendix A.

2.3.1 EAST SIDE

Proposed grading for the East Side is guided by the large amounts of existing fill on the site and the anticipated settlement of the waste and underlying Young Bay Mud. In order to reduce the amount of export of material from the site, the proposed grades are established at higher elevations, where feasible in context with development, geotechnical, environmental, and ecological designs. The higher grades, however, create more weight on the underlying soil and therefore increase the amount of anticipated settlement the proposed infrastructure and structures over time if left unmitigated. As described below, grading mitigation designs for the development is designed to reduce the amount of future settlement. The feasible amount of settlement accommodated by The Baylands development program varies by development density and uses. Larger amounts of settlement potentially require continued maintenance and more frequent repairs, as well as re-grading of site improvements.

2.3.1.1 SETTLEMENT ON THE EAST SIDE

As described above, the topography of the East Side is characterized by relatively flat areas with large soil stockpiles placed as part of a soil recycling operation. The underlying soil strata includes artificial fill, waste, Holocene Bay Deposits, Young Bay Mud, marine sand, Pleistocene deposits, and bedrock. This site settles over time due to compression/decomposition of the waste and consolidation of the Young Bay Mud and to a lesser extent the Old Bay Clay. The following are general descriptions of anticipated settlement based on the information presented in Technical Documents 1 and 2:

- Settlement Due to Waste Material

  Settlement of waste material occurs due to two main factors: crushing of voids within the refuse under self-weight and external loads and decomposition of the waste material over time. The total amount of settlement expected will depend on the depth, age, and type of waste deposited. Without mitigation, the total settlement due to waste at the landfill site is estimated to range between 11 to 36 inches.

- Settlement Due to Young Bay Mud and Old Bay Clay

  The Young Bay Mud and Old Bay Clay are compressible materials subject to settlement when additional weight from fill or building loads is applied. The amount of settlement of compressible material depends on proposed loads, the thickness, and the stress history. If mitigation is not implemented, it is estimated that future consolidation settlement could be up to 38 inches at the site.

2.3.1.2 EAST SIDE SOIL IMPROVEMENTS

Soil improvement measures will be required within the East Side to mitigate settlement. Without additional mitigation, preliminary geotechnical data indicates that anticipated settlements up to approximately 6 feet may occur based on the proposed conceptual grading plan and development plan. The following potential geotechnical techniques to reduce the amount of anticipated settlement may be considered to support development of The Baylands:

- Deep Dynamic Compaction (DDC)

  DDC is a process whereby a heavy weight is dropped from a determined height above the site surface. The energy of the fall weight compacts the underlying soil and crushes any existing voids within the landfill. As a result, the overall anticipated settlement is reduced and the soil density and stiffness are increased. The improvement will reduce settlement within the waste material due to crushing of voids. After DDC implementation, remaining settlement from the waste material will be reduced to an estimated range from 3 to 24 inches.

- Alternative Potential Waste Improvement Methods

  In addition to DDC, there are several ground improvement methods that could be used to improve the waste at the East Side. These methods would be performed in a grid pattern to provide a site-wide treatment; however, due to the large footprint of The Baylands, it would be more economical to apply these methods locally to support structural building loads or localized improvement areas. Some of these methods are Compaction Grouting, Rigid Inclusions, and Deep Soil Mixing (DSM).

- Surcharging and Wick Drains

  Settlement within Young Bay Mud and Old Bay Clay is due to the consolidation of the soil as pore water is forced out of the void spaces in the material. The rate at which the water is removed depends on the load and drainage distance the pore water must travel. This process can be expedited by placing a larger load on the material and providing a shortened drainage path. The excess load is achieved through a surcharge program, which includes placing large amounts of soil over an area to a predetermined height. The drainage path is reduced by placing wick drains into the material at relatively close spacing to allow the water to escape out of the material up to the groundwater table. Due to environmental concerns with waste and leachate creation (groundwater in contact with waste), the wick drains will terminate under the landfill cover system. After surcharging, the primary settlement from the Young Bay Mud and Old Bay Clay will be negligible. A minor amount of long-term settlement from secondary compression should be anticipated after surcharging. In general, this secondary settlement will be approximately less than 1 inch.

- Compensation Loading with Lightweight Fill

  An alternate consolidation settlement mitigation measure that can be utilized is removing existing fill and replacing it with a lightweight cellular concrete (LWC) as a means to compensate the load being added (either by adding new fill or a relatively light structural load). Cellular concrete is a cement and water mixture mixed with a stable foam to create a low-density material that cures in place without compaction.

These soil improvement mitigation measures will reduce the amount of overall anticipated settlement; however, completely mitigating settlement on the East Side is not feasible due to the inability to fully mitigate decomposition of waste material. To reduce impacts of potential settlement, new buildings can be supported on a deep foundation system consisting of driven concrete piles, steel piles, barrette system, micropiles, drilled auger cast piles, or drilled shafts, which derive their support from embedment into competent soil beneath the Young Bay Mud. Prior to the selection of foundation systems to address potential settlement issues the geotechnical engineers will analyze site specific data to recommend specific foundation systems accordingly.

2.3.1.3 PROPOSED GRADING ON THE EAST SIDE

The East Side finished pad and open space grades vary between Elevation 12 at Lagoon Park to 54.5 feet within pads in East Campus and Sustainability Districts at construction and prior to settlement occurring, with some grades set lower to match existing grades. Roadway grades generally sawtooth between Elevation 12 to 58 feet, and release towards the following areas:

- The Brisbane Lagoon, which will remain.

- The drainage channel adjacent to Highway 101, which is at lower elevations and remains as conform conditions, the improved
- The re-constructed Visitacion Creek.
- Tunnel Avenue and Beatty Avenue

2015 Program Environmental Impact Report (EIR) Mitigation Measures, positive pad drainage requirements, anticipated settlement considerations, adjacency to open space and habitat areas, and relationships to existing facilities to remain area considered in developing grading designs.

2.3.1.3.1 VISITACION CREEK GRADING AND BRISBANE LAGOON GRADING

Visitacion Creek conveys storm water runoff and is graded to maintain a path for overland flow from the culverts within the Joint Power Board (JPB) corridor to the culvert beneath Highway 101. Creek side slopes are proposed to support intertidal wetlands and create an ecotone slope between the tidal and freshwater wetlands up to elevation of approximately 13.6 to 17-feet. This design establishes salt marsh migration and transition areas that are separated from the freshwater wetland by a seepage berm with top elevation conforming to the 2100 “low risk aversion” category of the SLR. The “low risk aversion” category, as established in the 2018 Update of the State’s Guidance Document, is appropriate for mitigation wetlands since they do not contain critical infrastructure and restrict public access.

The north shoreline of Brisbane Lagoon integrates with Lagoon Park to blend landscaping, habitat, and hydrology design solutions. Lagoon Park will be graded with low lying areas for wetland creation. Lagoon Park will be graded with low lying areas for wetland creation. As these low-lying areas fall under the “low risk aversion” category of SLR Guidance, they will be graded to protect against the estimated SLR for the 2100 Low Risk Aversion estimate of approximately 41-inches. In addition, stormwater treatment as described in Section 7 below is designed at higher elevations adjacent to Lagoon Road.

2.3.1.3.2 FRESHWATER WETLANDS IN VISITACION CREEK:

Freshwater wetlands along Visitacion Creek fall under the “low risk aversion” category of the SLR Guidance since they do not contain critical infrastructure and have restricted public access. Grading designs provide room for the upward adjustment of tidal wetlands in response to SLR. In addition, freshwater wetlands are located above the 2100 Low Risk Aversion SLR estimate of approximately 41-inches. Refer to the WMP for more detail.

2.3.1.3.3 THE BAYLANDS PRESERVE

The Baylands Preserve open area adjacent to the Tunnel Road and Visitacion Creek is graded to allow for stormwater treatment from the adjacent parcel and Tunnel Road. The open area will be graded lower than surrounding roadways to direct runoff to low-lying areas where runoff will be treated as conceptually described in Section 7 prior to release into the freshwater wetlands and Visitacion Creek.

2.3.1.3.4 STORMWATER DETENTION AREA

The stormwater detention area is proposed between the JPB corridor, Tunnel Avenue, the Kinder Morgan Tank Farm and the independent parcels for the potential on-site water storage and the WRF. This area is graded with a bottom elevation of approximately 1.5 surrounded berms on three sides set at elevations-based future 100-year storm event hydraulic grade line elevation with tidal flow and estimated Year 2100 Medium-High Risk SLR This area has been sized in response to the hydraulic modeling criteria for the Baylands and connects to Visitacion Creek.

2.3.1.3.5 EXISTING ADJACENT PROPERTIES: KINDER MORGAN TANK FARM / PUBLIC WORKS YARD / GOLDEN

STATE LUMBER / JPB CORRIDOR

As shown on Figure 1.1, existing properties to remain at or adjacent to the East Side include the Kinder Morgan Tank Farm, City or Brisbane Public Works Corporation Yard, Golden State Lumber, and the JPB corridor. Existing grades around the Kinder Morgan Tank Farm range between Elevations 9 to 21 feet, City of Brisbane Public Works Corporation Yard range between Elevations 9 to 15 feet, and Golden State Lumber ranges between Elevations 17 to 23 feet. The JPB corridor ranges between Elevations 12 to 22 feet. Each existing property will maintain the existing grades, with improvements conforming to existing grade adjacent to the property.

These properties adjacent to The Baylands, but not part of the Specific Plan Area, are either completely or partially below future 100-year storm event hydraulic grade line (HGL) elevation with tidal flow and estimated Year 2100 Medium-High Risk Aversion SLR estimates. Existing buildings on these sites will remain at their current elevations with property access provided at the existing grades of these sites. Thus, these properties will require measures by others to adapt to future conditions.

2.3.1.3.6 PROPOSED ON-SITE STREETS

Proposed street grades are set to provide access to proposed development parcel on the West Side. In addition, proposed street grades accommodate the 100-year storm event HGL elevation within the streets with a consideration of tidal flow and SLR. Where proposed streets conform to existing streets—Tunnel Avenue, Lagoon Road, Beatty Avenue, Sierra Point Parkway--or conforms to remain that are lower than the HGL, street elevations are proposed to be graded to match these existing conditions. For existing properties and adjacent streets providing access, elevating existing buildings, installing pump stations, or another adaptive solution are strategies to protect these adjacent facilities from the impacts of anticipated sea level rise are subject to a feasibility evaluation by others. As settlement varies across the site, freeboard provisions for on-going consolidation of underlying soil conditions and refuse settlement are based on the anticipated settlement for a given location and adjacent building finished floor elevations.

Consistent with Program EIR Mitigation Measure 4.H-4a, Key roadways—the proposed on-site extension of Sierra Point Parkway, Tunnel Avenue, Lagoon Road—are available as excavation routes in the event of the 100-year storm event.

2.3.1.3.7 PROPOSED PAD GRADING

As described in Mitigation Measure 4.H-4a of the Program EIR, conceptual finished floor grades at construction are based on settlement estimates and the following:

- The 100-year storm event HGL
- Anticipated SLR estimates for the end of century (2100 Medium-High Risk Aversion) described in Section 2.1.4
- Tidal Flow: Mean Higher High Water +3-feet, which correlates to an elevation of 8.69 feet
- 1-foot of freeboard

Where development parcels are parallel to the train tracks or are adjacent to existing conditions to remain, Lagoon Road, Tunnel Avenue, Industrial Road, Bayshore Boulevard, and Kinder Morgan Tank Farm, building entrances fronting these rights-of-way or on proposed street blocks transitioning to the existing streets conform to the existing grading conditions at the time of construction. At construction where streets serve proposed finished floor elevations for new buildings within the transition between proposed and existing grades, which are below one foot of freeboard standard, grades will be adjusted to provide access to the existing buildings and may require adaptations, such at-grade adjustments and pump stations, to respond to adjacent development and future SLR. Basements without access are acceptable below the 1-foot of freeboard above the 100-year storm event HGL water elevation with tidal flow and estimated SLR for the 2100 Medium-High Risk Aversion estimate. As settlement varies across the site, freeboard provisions for remaining refuse settlement are based on the anticipated settlement for a given location.

2.3.2 PROPOSED GRADING ON THE WEST SIDE

The conceptual grading for the West Side is dictated by required capping of the soil/groundwater contamination, existing structures scheduled to remain, geotechnical mitigations, drainage improvements, and site plan connections to the proposed roadway connections over the JPB corridor. Similar to the East Side, raising of site grade or buildings supported on shallow foundations will increase the potential for settlement caused by consolidation of the underlying Young Bay Mud soil. As described below, ground improvement techniques implemented prior to construction can be designed to reduce settlement impact on future development, alternatively, foundations systems can be designed to accommodate some amount of settlement over time.

2.3.2.1 SETTLEMENT ON THE WEST SIDE

The West Side is susceptible to liquefaction settlement from a seismic event and consolidation settlement due to consolidation of the Young Bay Mud when additional weight from fill or building loads is applied. The estimate of liquefaction induced settlement is generally between 2 to 3 inches, but in localized areas could be up to 4½ inches. Whereas, the estimated settlement of compressible Young Bay Mud material depends on proposed loads, the thickness of the Young Bay Mud, and the soil stress history. If mitigation is not implemented, estimated future consolidation settlement could be up to 40 inches at the West Side.

2.3.2.2 CONSOLIDATION SETTLEMENT MITIGATION ON THE WEST SIDE

Soil improvement measures will be required within the West Side of The Baylands. Without additional mitigation, preliminary geotechnical data indicates that anticipated settlements up to 40 inches may occur based on the proposed conceptual grading plan and development plan. The following potential geotechnical techniques to reduce the amount of anticipated settlement to support the development program may be considered for the West Side:

- Surcharging and Wick Drains

  Settlement within Young Bay Mud and Old Bay Clay is due to the consolidation of the soil as pore water is forced out of the void spaces in the material. The rate at which the water is removed depends on the load and drainage distance the pore water must travel. This process can be expedited by placing a larger load on the material and providing a shorten drainage path. The excess load is achieved through a surcharge program, which includes placing large amounts of soil over an area to a predetermined height. The drainage path is reduced by placing wick drains into the material at relatively close spacing to allow the water to escape out of the material up to the groundwater table. After surcharging, the primary settlement from the Young Bay Mud and Old Bay Clay will be negligible. A minor amount of long-term settlement from secondary compression should be anticipated after surcharging. In general, this secondary settlement will be approximately less than 1 inch.

- Compensation Loading with Lightweight Fill

  An alternate consolidation settlement mitigation measure that can be utilized is removing existing fill and replacing it with a lightweight cellular concrete (LWC) as a means to compensate the load being added (either by adding new fill or a relatively light structural load). Cellular concrete is a cement and water mixture mixed with a stable foam to create a low-density material that cures in place without compaction.

These soil improvement mitigation measures will reduce the amount of overall anticipated settlement. Alternatively, new buildings can be supported on a deep foundation system consisting of driven concrete piles, steel piles, barrette system, micropiles, drilled auger cast piles, or drilled shafts, which derive their support from embedment into competent soil beneath the Young Bay Mud. Prior to the selection of foundation systems, the geotechnical engineer will analyze site specific data to further enhance estimated settlement estimates, and recommend specific foundation systems accordingly.

2.3.2.3 LIQUEFACTION MITIGATIONS ON THE WEST SIDE

Liquefaction settlement is expected to average between 2 to 3 inches at the West Side, which can be accommodated using foundation systems. But if desired, mitigation for liquefaction can include ground improvement techniques, such as Deep Dynamic Compaction (DDC), Drilled Displacement Columns, Deep Soil Mixing (DSM), or aggregate piers. In lieu of ground improvement, new buildings can be supported on a deep foundation system consisting of driven concrete piles, steel piles, barrette system, micropiles, drilled auger cast piles, or drilled shafts, which derive their support from embedment into competent soil beneath the liquefiable material. Prior to the selection of foundation system, the geotechnical engineer will analyze site specific data to further enhance estimated settlement estimates, liquefaction, and recommend specific foundation systems accordingly.

2.3.2.4 PROPOSED GRADING ON THE WEST SIDE

As described, the proposed grading for the West Side is guided by required capping of the soil/groundwater contamination, protection against flooding and SLR, settlement, existing conditions at conforms, and site plan connections to the proposed Geneva Avenue extension over the Caltrain right of way. Refer to Figure 2.13 to Figure 2.13.3 for the conceptual Geneva Avenue profile. West Side grades vary from elevation 190 at the top of Icehouse Hill to and elevation of 9 at the lowest point along Bayshore Boulevard. Overland release is provided through proposed streets, open spaces, the railroad tracks and Visitacion Creek to the east of the railroad tracks. The following are descriptions of the factors that influence the conceptual grading plan for the West Side:

2.3.2.4.1 CAPPING OF SOIL/GROUNDWATER CONTAMINATION AREAS

Specific engineer level design details for capping areas of soil and addressing groundwater contamination will be developed during the preparation of the final RDIPs for UPC OU-SM and OU-2. In addition to settlement constraints, grades on the West Sides are raised to establish a minimum 5-feet soil cap and promote installation of utilities within clean corridors and separated from impacted soil and groundwater. In addition, proposed concrete building foundations, roads, and other hardscaped areas may also act as a cap for the existing soil/groundwater contamination. Where gravity and force utility mains require encroachment into contaminated areas, special construction details and engineering level remedial and mitigation measures will be identified in RDIPs for UPC OU- SM and OU- 2.

2.3.2.4.2 HISTORIC STRUCTURES

Existing on-site buildings to remain include the Roundhouse Building. Existing grades around the Roundhouse structure range between Elevation 10.3 to 12.3 feet. The Roundhouse finished floor will be elevated to approximately Elevation 21.8 feet to provide a minimum of 1 foot of freeboard above the 100-year storm event HGL water elevation with tidal flow and estimated SLR for the 2100 Medium-High Risk Aversion estimate.

2.3.2.4.3 ADJACENT EXISTING BUILDINGS TO REMAIN

Properties adjacent to The Baylands, but not part of The Baylands Specific Plan Area, include the Bayshore Sanitary Pump Station and an adjacent property. The existing buildings will remain at the current elevations with property access provided at the existing grades of these sites. Based on the existing conditions, these properties are located either fully, or partially below future 100-year storm event HGL elevation with tidal flow and estimated Year 2100 Medium-High Risk SLR. These properties, if they remain at existing grades, will require measures by others to adapt to future conditions. As these buildings are not controlled by the developer and are located at an existing low point along Bayshore Boulevard, the properties may need to be raised, pump stations installed, or another strategy incorporated to protect these facilities from the impacts of anticipated SLR.

2.3.2.4.4 OPEN SPACE AREAS

Grading designs for publicly accessible areas incorporate protection measures that demonstrate an ability to manage SLR for the 2050 Medium-High Risk Aversion scenario in accordance with the SLR Guidance, with 1 foot of freeboard above the 100-year storm event HGL elevation with tidal flow. Considerations for adjusting the SLR protection to meet the 2100 Medium-High Risk Aversion SLR estimates will be provided; however, where feasible, grades will set to provide protection for the 2100 Medium-High Risk Aversion SLR estimates of ~ 83-inches.

2.3.2.4.5 PROPOSED ON-SITE STREETS

Proposed street grades are set to provide access to proposed development parcel on the West Side. In addition, proposed street grades accommodate the 100-year storm event HGL elevation within the streets with a consideration of tidal flow and SLR. Where proposed streets conform to existing streets—Bayshore Boulevard, Industrial Way-- or conforms to remain that are lower than the HGL, street elevations are proposed to be graded to match these existing conditions. For existing properties and adjacent streets providing access, elevating existing buildings, installing pump stations, or another adaptive solution are strategies to protect these adjacent facilities from the impacts of anticipated sea level rise are subject to a feasibility evaluation by others. Finish floor elevations within the transition between proposed and existing grades which are below 1 foot of freeboard above the 100-year storm event HGL water elevation with tidal flow and estimated sea level rise for the 2100 Medium-High Risk Aversion estimate are proposed to be designed to allow for entrances and tributary interior spaces to be protected and allow for building occupants to enter and leave buildings or adapted over time in response to SLR conditions. As settlement varies across the site, freeboard provisions for on-going consolidation of underlying soil conditions and refuse settlement are based on the anticipated settlement for a given location and adjacent building finished floor elevations.

2.3.2.4.6 PROPOSED PAD GRADING

As described in Mitigation Measure 4.H-4a of the Program EIR, conceptual finished floor grades at construction are based on settlement estimates and the following:

- The 100-year storm event HGL
- Anticipated SLR estimates for the end of century (2100 Medium-High Risk Aversion) described in Section 2.1.4
- Tidal Flow: Mean Higher High Water +3-feet, which correlates to an elevation of 8.69 feet
- 1-foot of freeboard

Where development parcels are parallel to the train tracks or are adjacent to existing conditions to remain, Industrial Way, Bayshore Boulevard, building entrances fronting these rights-of-way or on proposed street blocks transitioning to the existing streets conform to the existing grading conditions at the time of construction. At construction, buildings with finish floor elevations below 1-foot of freeboard above the 100-year storm event HGL water elevation with tidal flow and estimated SLR for the 2100 Medium-High Risk Aversion estimate are proposed to be designed to allow for entrances and tributary interior spaces to be protected while allowing for building occupants to enter and leave buildings, or adapted over time in response to SLR conditions. Basements without access are acceptable below the 1-foot of freeboard above the 100-year storm event HGL water elevation with tidal flow and estimated SLR for the 2100 Medium-High Risk Aversion estimate. As settlement varies across the site, freeboard provisions for remaining refuse settlement are based on the anticipated settlement for a given location.

2.4 The Earthwork Evaluation for Mass Grading

Using conceptual mass grading plans for The Baylands, exhibits identifying conceptual cut and fill areas and depths within the East Side and West Side have been developed and are included in Appendix C. Given the large volume of soil material on the East Side, The Baylands includes a balanced earthwork cumulatively across the East Side and West Side of The Baylands through synthesizing grading, geotechnical and environment opportunities and constraints.

2.4.1 PRELIMINARY EARTHWORK AND GRADING SEQUENCE

The Baylands requires significant onsite grading, with ongoing grading activities occurring on both the East Side and West Side of the site during the first phase of site development. On the West Side, site grading activities will commence with site preparation, including further demolition of existing structures, remediation, removal of existing underground utilities, and clearing and grubbing. Grading operations will include removal of approximately 2.9 million cubic yards of stockpiled fill suitable for reuse from the East Side to fill and surcharge the West Side of The Baylands.

Grading activities, including remediation and stockpile programs, will commence in the Icehouse District. Once the Icehouse District grading is completed, placement of the Roundhouse District fill and surcharge will commence, using fill material appropriate for reuse from the surcharge overburden in the Icehouse District and additional imported fill from the East Side. Using surcharge overburden from the Roundhouse District and fill appropriate for reuse from the East Side, The Bayshore District will then be graded.

Additionally, with the removal of the stockpiled soil from the East Side, landfill closure activities will commence. Grading activities will also occur in the Sustainability District of the East Side, following landfill closure activities. On the East Side, grading activities start with the wetlands, stormwater, and wastewater treatment and recycling facilities in the Visitation Creek area, and then progress to solar farm in the southeast portion of the site. The last area to be graded for development purposes following landfill closure is the East Campus Area, which is Phase 2 of The Baylands development.

Operations related to earthwork movement within and to/from the site are described in Chapter 09 of The Baylands Specific Plan.

2.4.2 EARTHWORK ANALYSES

2.4.2.1 EAST SIDE MASS GRADING

To achieve conceptual proposed finished grades, the mass grading operation is anticipated to involve approximately 4,300,000 cubic yards of cut and approximately 1,800,000 cubic yards of fill. This has a total net export of approximately 2,500,000 cubic yards of fill.

2.4.2.2 WEST SIDE MASS GRADING

To achieve conceptual proposed finished grades, the mass grading operation will include approximately 10,000 cubic yards of cut and approximately 2,450,000 million cubic yards of fill. This earthwork results in a total net import of approximately 2,440,000 cubic yards of fill.

2.4.2.3 ANTICIPATED WEST SIDE SOIL SURCHARGE IMPORT

Due to potential soil loss upon completion of the soil surcharging program on the West Side and earthwork operations, grading operations may require an additional 460,000 cubic yards of soil import from the East Side, which would include the 60,000 cubic yards of export anticipated in the mass grading analysis. Pad grades on the East Side would be lowered proportionally in response to the additional soil exported from the East Side to the West Side for soil surcharging.

2.4.2.4 CUMULATIVE SITE EARTHWORK SUMMARY

Combining the mass grading earthwork and soil surcharge import volumes for the West Site, approximately 2,900,000 cubic yards of soil will be exported from East Side to the West Side during mass grading operations. No significant import or export of fill material into or outside of The Baylands is anticipated.

2.5 Site Designs to Accommodate Anticipated Settlement

As described above, both the West Side and East Side will undergo ground improvement to mitigate majority of the total consolidation settlement of the Young Bay Mud, where secondary settlement is expected to be nominal (less than 1 inch). However, settlement of the waste material in the landfill from compression and decomposition and areas where consolidation settlement of bay mud is not mitigated is anticipated. Consequently, the potential for differential settlement, which occurs when one area settling at a different rate than an adjacent area, shall be considered in the design of infrastructure based on the recommendations of the geotechnical engineer for specific site conditions. Anticipating and providing designs for the potential change in vertical relationships over time limits the impacts of reversal of surface and utility slopes, damage to pavements, and damage to utility infrastructure.

Differential settlement occurs where conditions of the site change and can be categorized into two categories; 1) Soft Edge, and 2) Hard Edge.

2.5.1 SOFT EDGE CONDITIONS

Soft Edge conditions occur where the change in settlement rates happen over a larger distance. These types of conditions are more typical across the on-grade areas of the site (roadways, parking lots, open space) due to varying soil conditions below the site. Soft Edge conditions require flexible infrastructure designs that can adjust over time and accommodate gradual vertical changes.

2.5.1.1 SURFACE GRADING AND GRAVITY UTILITY DESIGNS

Surface grading and gravity utilities need to be designed to accommodate differential settlements that may occur across the site. This is best accomplished by determining the design grades for the improvements at the completion of construction and then applying the anticipated magnitudes of settlement to check that surface and gravity utility slopes over time will be sufficient to accommodate the design.

As differential settlement occurs, the infrastructure on top of the landfill cap will need to bend and deform to accommodate the change in the vertical relationships. Therefore, the need for materials that will flex with the anticipated settlement and withstand unforeseen conditions is imperative when developing on sites that will settle over time. The following measures are recommended to mitigate the effects of differential settlement on utilities and surface improvements:

- Flexible Surface Improvements

  For vehicular roadway surfaces, the industry standard hardscape material is asphalt concrete for San Mateo County. Standard asphalt both provides some flexibility and is economical to install. For roadway surfaces, any distress in the asphalt can easily be patched/repaired over time. Small cracks can be sealed and periodic overlays requiring larger amounts of asphalt production can be scheduled as needed.

  For curb/gutter and pedestrian areas, concrete improvements are recommended. Concrete generally performs well in these areas and, with sufficient joints, can remain flexible enough to accommodate limited amount of differential settlements over time. The concrete improvements should include adequate reinforcement and the expansion joints with slip dowels to assist in keeping the improvement from vertically separating. Small cracks within these improvements will not require repairs. If cracks become larger, repairs can be made easily enough by removing the section to the nearest expansion joint and re-pouring the concrete improvements.

- Flexible Utility Materials

Industry standard pipe materials, such as ductile iron, Polyvinyl Chloride (PVC), concrete, and vitrified clay are more rigid materials and rely on gasketed or restrained joints. Even with locked joints, the flexibility of these materials is limited, resulting in the potential for the pipes to break or the joints to separate and leak as settlement occurs. These types of pipes will require continuous monitoring and repairs while leaks could potentially damage. To limit the impacts to the integrity of the final landfill cover, future utilities will be designed to be located above the landfill cap. As an alternative, High Density Polyethylene (HDPE) pipe with fusion-welded joints is recommended to provide flexibility to accommodate differential settlement

Fusion-welded HDPE pipe is flexible. For example, a 10-inch HDPE pipe can be bent with a 20-foot radius compared to 200-foot radius for an 8-inch PVC pipe. Fusion welded HDPE is also durable. The fusion welding of HDPE creates one continuous pipe with the welds being stronger than the pipe itself. The tensile strength of HDPE is 3,200 pounds per square inch (psi). Therefore, a 10-inch HDPE pipe (cross sectional area of the pipe wall = 21 square inches) has a tensile strength of 67,200 pounds, while the pull-apart strength of a 10-inch Certa-Lok joint PVC pipe is only 27,200 pounds.

The flexibility and strength of HDPE pipe provide both better long-term performance under anticipated settlement and the added safety factor for unforeseen conditions.

2.5.2 HARD EDGE CONDITIONS

Hard Edge conditions typically occur with artificial improvements such as buildings on deep foundation systems where the ground around the foundation settles but the foundation remains stationary. Hard Edge conditions require special design details that mitigate the shearing effect on infrastructure. These conditions typically require structural hinge slabs for vehicular and pedestrian access to bridge the vertical displacement, and/or special utility elements such as rotating/telescoping joints to accommodate the separation with hangers used to suspend the utilities underneath the building.

Due to the soil conditions at The Baylands and the anticipated sizes of the structures, it is anticipated that the moderate to heavy buildings, which may require deep pile foundations, will exhibit a hard edge condition.

2.5.2.1 DESIGNS FOR UTILITY CONNECTIONS TO BUILDING STRUCTURES

The vertical shear created by the ground settling away from the deep-pile foundation has the potential to damage utility lateral connection points into the building. Design techniques to overcome this potential include flexible utility connections, which are described in the individual utility descriptions below.

2.5.2.2 PEDESTRIAN AND VEHICULAR ACCESSIBILITY TO STRUCTURES

As the ground surrounding pile supported buildings settles while the building elevation remains fixed in elevation, a vertical step will occur at the pedestrian and vehicular access points to the building. The California Building Code identifies that an accessible access path requires a smooth pathway without any obstructions. Allowable slopes along accessible paths of the travel include a maximum cross slope of 2%, and a maximum longitudinal slope of 5% without handrails and up to 8.33% with code-compliant handrails provided. To meet accessibility requirements as settlement occurs, designs require retrofit solutions once these slopes are exceeded. A common design approach for similar projects in the Bay Area is the use of structural hinge slabs to bridge the vertical step between the building access point and the ground that has settled away.

Two options for hinge slab designs are as follows:

- Perpendicular Hinge Slabs

As shown on Figures 2.8 thru 2.11, a typical perpendicular hinge slab would extend out from the building foundation toward an access sidewalk usually adjacent to the parking lot or access roadway. One edge of the hinge slab is supported by the building foundation, while the other is allowed to move as the ground settles. Hinge slabs are typically up to 20 feet long. When designed longer than 20 feet, the structural designs become more substantial and performance standards are not easily achieved.

The hinge slab would be constructed with a maximum slope of 5% up away from the building. As the exhibits show, the grade at the end of the hinge slab will therefore be higher than the finished floor of the building. This condition will require drainage near the building and trench drains within the hinge slab to prevent runoff from entering the building. It will also require specific grading around the building to ensure an overland release path in case the drainage structures become plugged.

The hinge slab is then allowed to rotate to a maximum slope of 5% away from the building. This allows up to 24 inches of settlement to occur before the maximum 5% is exceeded.

However, in the extreme case were settlement to exceed 24 inches the hinge slab could be lifted back up or reconstructed to the original elevation and allow more settlement to occur. This would require taking the access point out of service and reconstructing a large portion of the area around the hinge slab. The exhibits show a typical condition where approximately 6,000 square feet of area in front of the building, including landscape sidewalks, curb/gutter, and pavement, will need to be reconstructed. Once the slab is reset or reconstructed, it could then be allowed to accommodate an additional 24 inches for a total of 48-inches of settlement.

The perpendicular slab option will typically require a 30-foot area in front of the building to accommodate the foundation extension and 20-foot hinge slab. This would need to be repeated at accessible entrance and exit locations.

- Parallel Hinge Slab

As shown on Figures 2.4 through 2.7, a parallel hinge slab and structurally fixed accessible landing at the door extends from the foundation parallel to the building face. This is solution has been implemented at project sites in the City of Brisbane with similar geotechnical and environmental conditions. The exhibits show a slab in each direction. Only one is required but two would allow one to be taken out of service while the other maintained access into the building.

As with the perpendicular design, the parallel slab could start with a slope of 5% up away from the entrance. As the exhibit shows, the grade at the end of the hinge slab will therefore be higher than the finished floor of the building. This condition will require drainage near the building and trench drains within the hinge slab to prevent runoff from entering the building. It will also require specific grading around the building to ensure an overland release path in case the drainage structures become plugged.

The 20-foot hinge slab is then allowed to rotate to a maximum slope of 5% down away from the entrance area. This allows 24 inches of settlement to occur before the maximum 5% is exceeded.

In the extreme case where settlement exceed 24 inches, the hinge slab could be lifted back up or reconstructed to the original elevation and allow more settlement to occur. This would require taking the access point out of service, unless two slabs are used as shown on exhibit, and reconstructing the landscape and sidewalks adjacent to the hinge slab. The sidewalks leading to the hinge slab would need to be extended, or designed with a switchback, to accommodate the 5% maximum slope. The exhibit shows a typical condition where approximately 3,800 square feet of area in front of the building will need to be reconstructed, including landscape and sidewalks. Once the slab is reset or reconstructed, it could then be allowed to accommodate an additional 24 inches for a total of 48 inches of settlement.

The parallel slab option will typically require a 30-foot area in front of the building to accommodate the foundation extension and hinge slab, while maintaining enough landscape area to screen the edges of the hinge slab and providing enough room to install drainage facilities.

Other options besides the use of hinge slabs could include the use of sand set unit paving systems. The amount of settlement a unit paving system can accommodate is a function of the space provided. These systems can easily be removed and reset to accommodate the differential settlement that occurs at the face of the structure. The frequency of the paving stone system replacement is a function of how fast settlement will occur. For accessibility compliance, these systems require pavers to be reset each time a vertical differential greater than ¼-inch occurs.

2.5.2.3 INTERFACE OF STRUCTURED STREETS TO NON-STRUCTURED STREETS

At the interface between the structured streets, such as the Geneva Avenue Bridge and non-structured streets, hinge slab details will be designed to preserve accessible paths and positive surface drainage. Hinge slabs and landscape buffer strips will be provided to ensure smooth pedestrian and vehicular travel surfaces without abrupt changes and positive drainage patterns.

Hard edge differential settlement at the interface of the structured and non-structured streets also affects the utility systems. On the structured slabs, utilities will be installed in utility corridors or attached to the pile-supported structure. Paving and utility details will be developed to mitigate the vertical differential settlement where the structured street areas meet the non-structured streets.

2.5.2.4 INTERFACE BETWEEN STRUCTURED BUILDINGS AND ADJACENT STREETS

As described above, pedestrian and vehicular access into structures on deep foundations requires space to accommodate hinge slabs and paving stone systems. Therefore, as the density of the proposed development increases, the room for these systems will be reduced. In addition, certain type of uses proposed within a development will accommodate the use of hinge slabs better than others. As an example, retail store fronts typically need continuous access in and out of their stores to be successful. Circuitous routes of access to accommodate hinge slabs will therefore not be successful for these types of uses.

2.6 Stormwater Pollution Prevention Plan

2.6.1.1 LANDFILL CLOSURE

The current operations on the Brisbane Landfill operate under two separate Industrial General Stormwater Permits. Both permits issued by the Water Board require a Stormwater Pollution Protection Plan (SWPPP) associated with each permit. The proposed work associated with the soil movement for grading to the West Side and the landfill closure continue under these permits and SWPPPs, or a new SWPPP will be prepared for construction activities for approval and a Notice of Intent (NOI) will be processed with the RWQCB.

2.6.1.2 DEMOLITION, GRADING, AND DEVELOPMENT

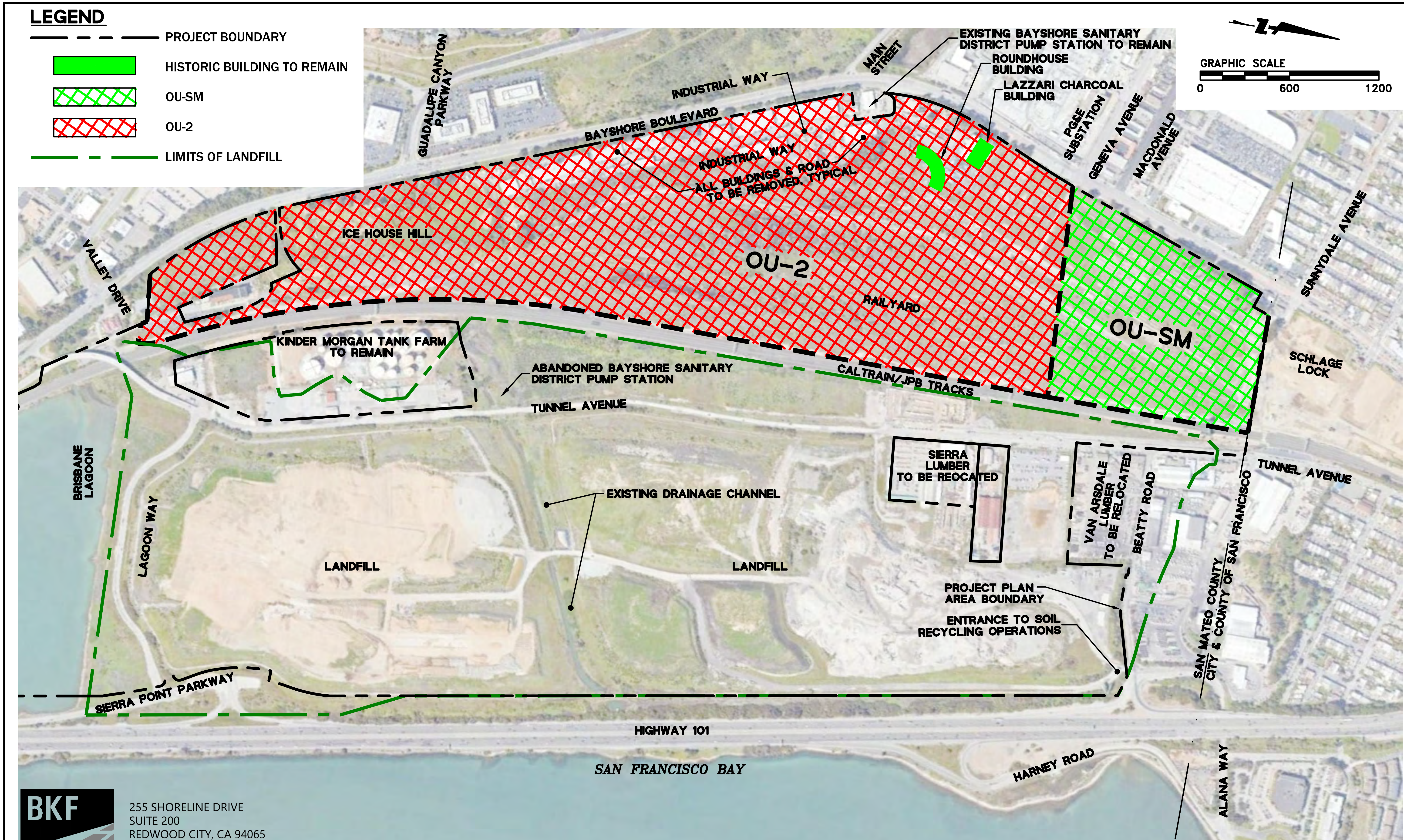
Demolition and construction of site grading and infrastructure includes erosion and sediment control measures to minimize erosion and minimize contamination of downstream bodies of water. Prior to the issuance of a grading permit, a SWPPP will be prepared for construction activities for approval and process a Notice of Intent (NOI) with the Regional Water Quality Control Board.

2.7 Master Grading Plans

Master grading plans including project phasing and detailed layouts, will be prepared in coordination with the City of Brisbane during the design process prior to the completion of the Tentative Maps for The Baylands.

2.8 Sustainability

Implementing the geotechnical improvements, such as grading, ground improvement soil enhancement, and structural support, will minimize and mitigate the risks while allowing for complementary uses on appropriate locations on The Baylands. The proposed techniques will protect the community from the risk of differential settlement and earthquake damage and capping of contamination, as well as continued emergency vehicle access and critical utility service over time as the land settles and in the event of a major seismic event. Grading activities will be designed to minimize haul trips and associated emissions. In addition, the sustainable management of construction materials and waste are tenets of The Baylands. Refer to the Sustainability Framework and Chapter 04 of the Specific Plan for a detailed discussion on The Baylands sustainability approach.



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EXISTING SITE CONDITIONS
SCALE: 1"=600'

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FIGURE 2.1

NOTE:

1. AERIAL IMAGERY AND TOPOGRAPHIC INFORMATION SHOWN HEREON WAS PERFORMED BY VERTICAL MAPPING RESOURCES IN MARCH, 2021 UNDER COMMISSION BY BKF ENGINEERS.

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CONCEPTUAL GRADING PLAN

SCALE: 1"=200'

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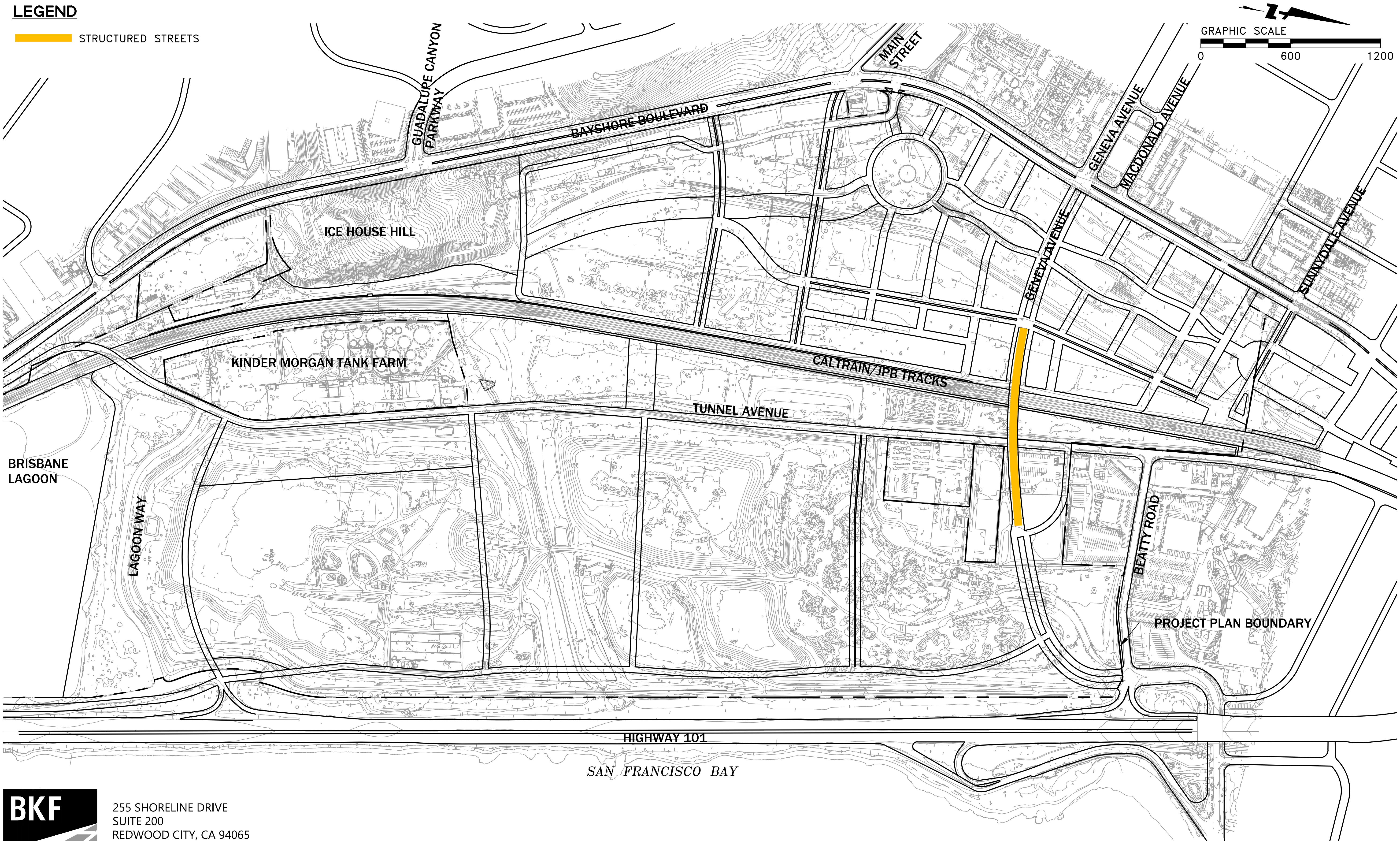
FIGURE 2.2



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LIMITS OF STRUCTURED STREETS

SCALE: 1"=600'

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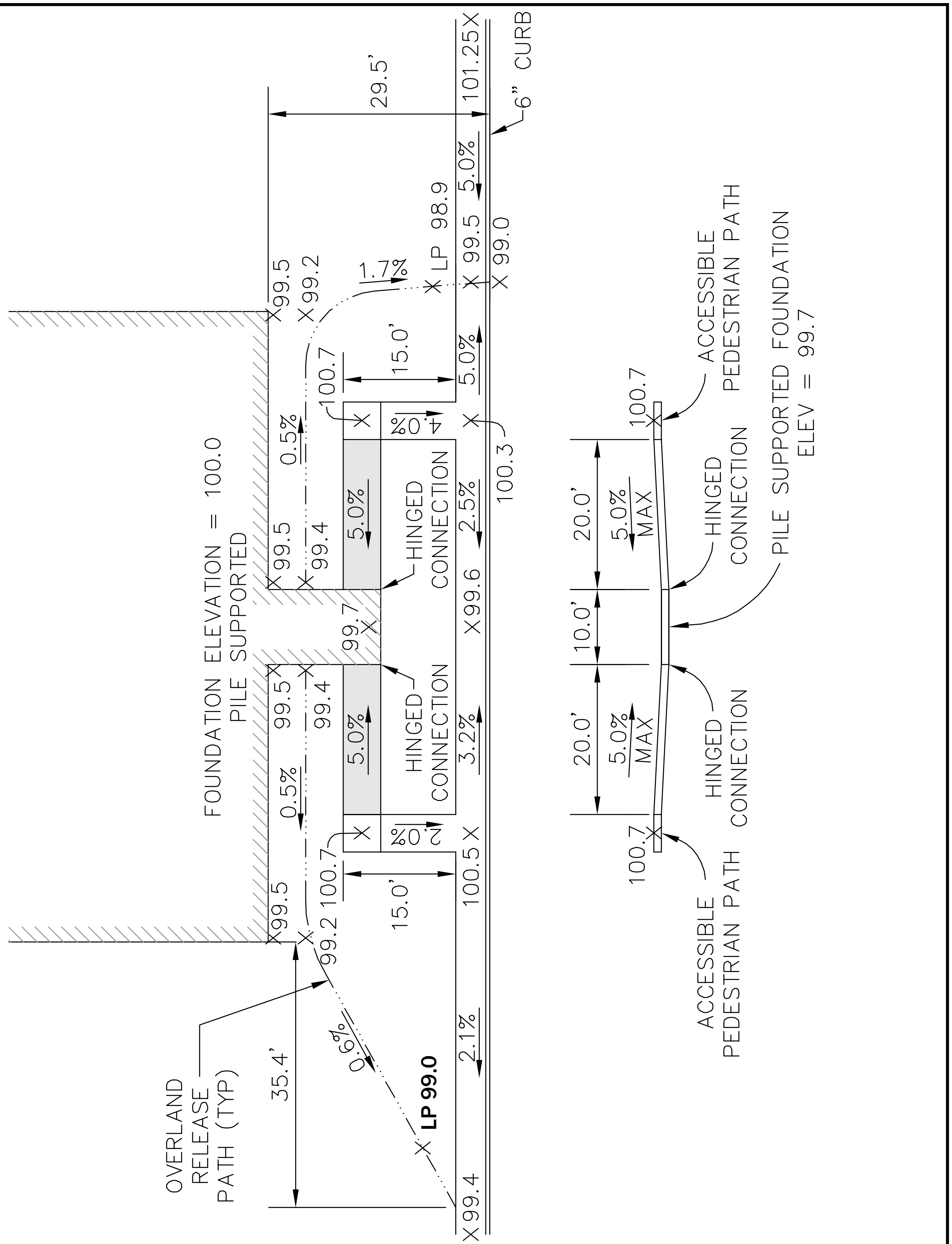
FIGURE 2.3

DRAWING NAME: \\bkf-rc\vol4\2019\190615_brisbane_baylands_r\ENG\EXHIBITS\2021 infrastructure plan\plotted_sheets\02.3_FIGURE.dwg
PLOT DATE: 01-27-23 PLOTTED BY: arra



PARALLEL HINGE SLAB - 0" SETTLEMENT

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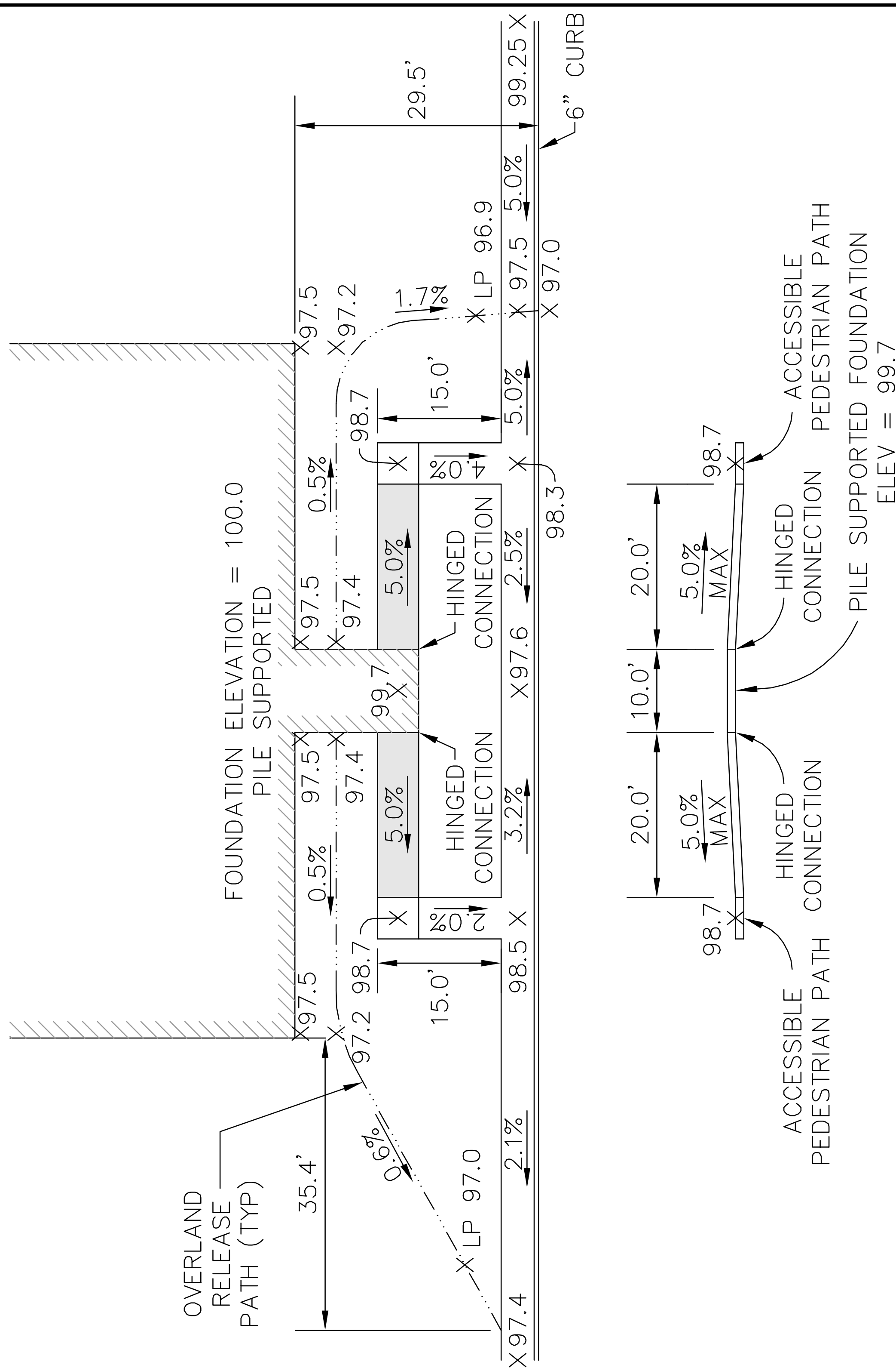
FIGURE 2.4



PARALLEL HINGE SLAB - 24" SETTLEMENT

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FIGURE 2.5

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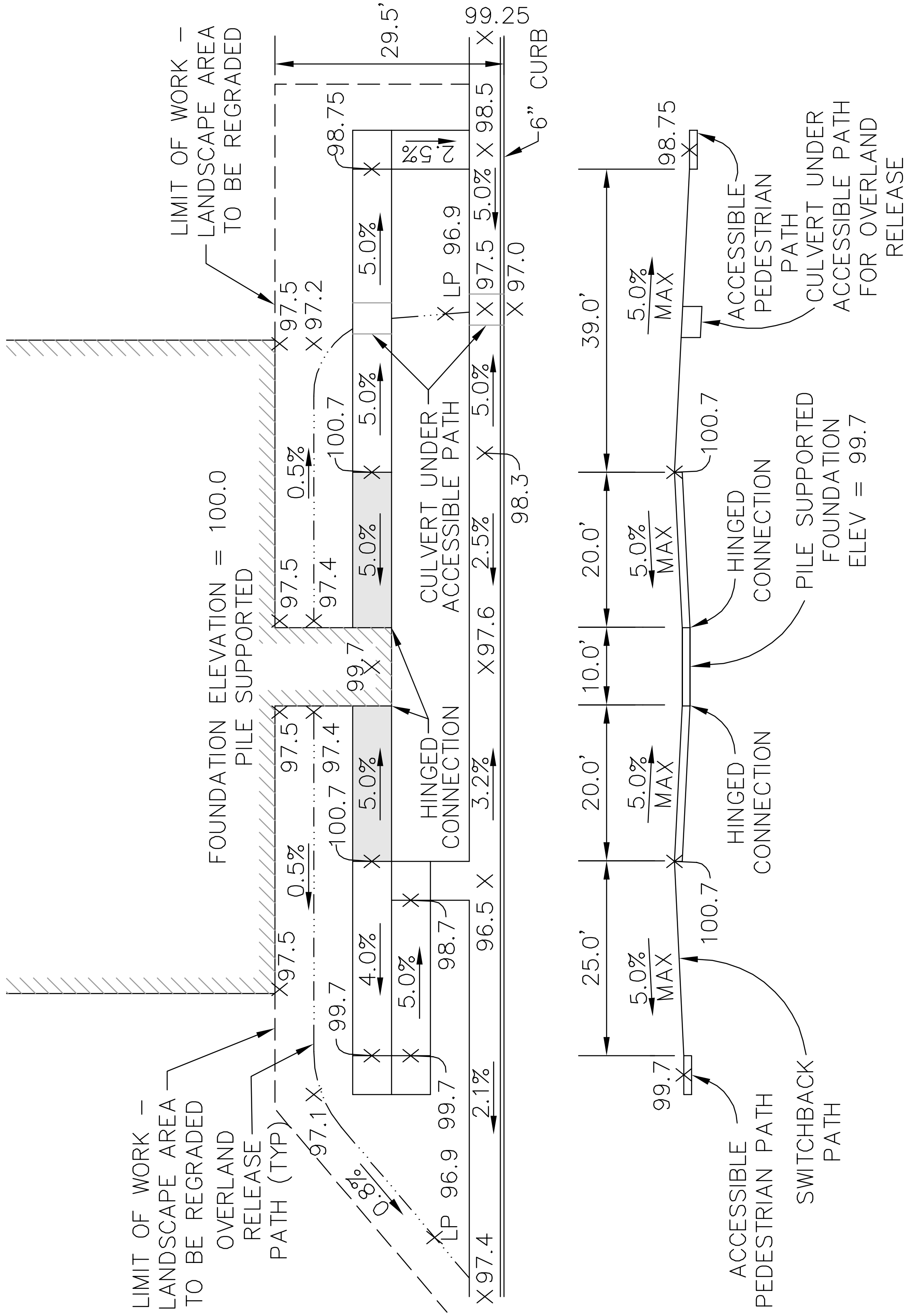
PLOT DATE: 06-15-22 PLOTTED BY: crui



PARALLEL HINGE SLAB - RESET SLAB

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FIGURE 2.6

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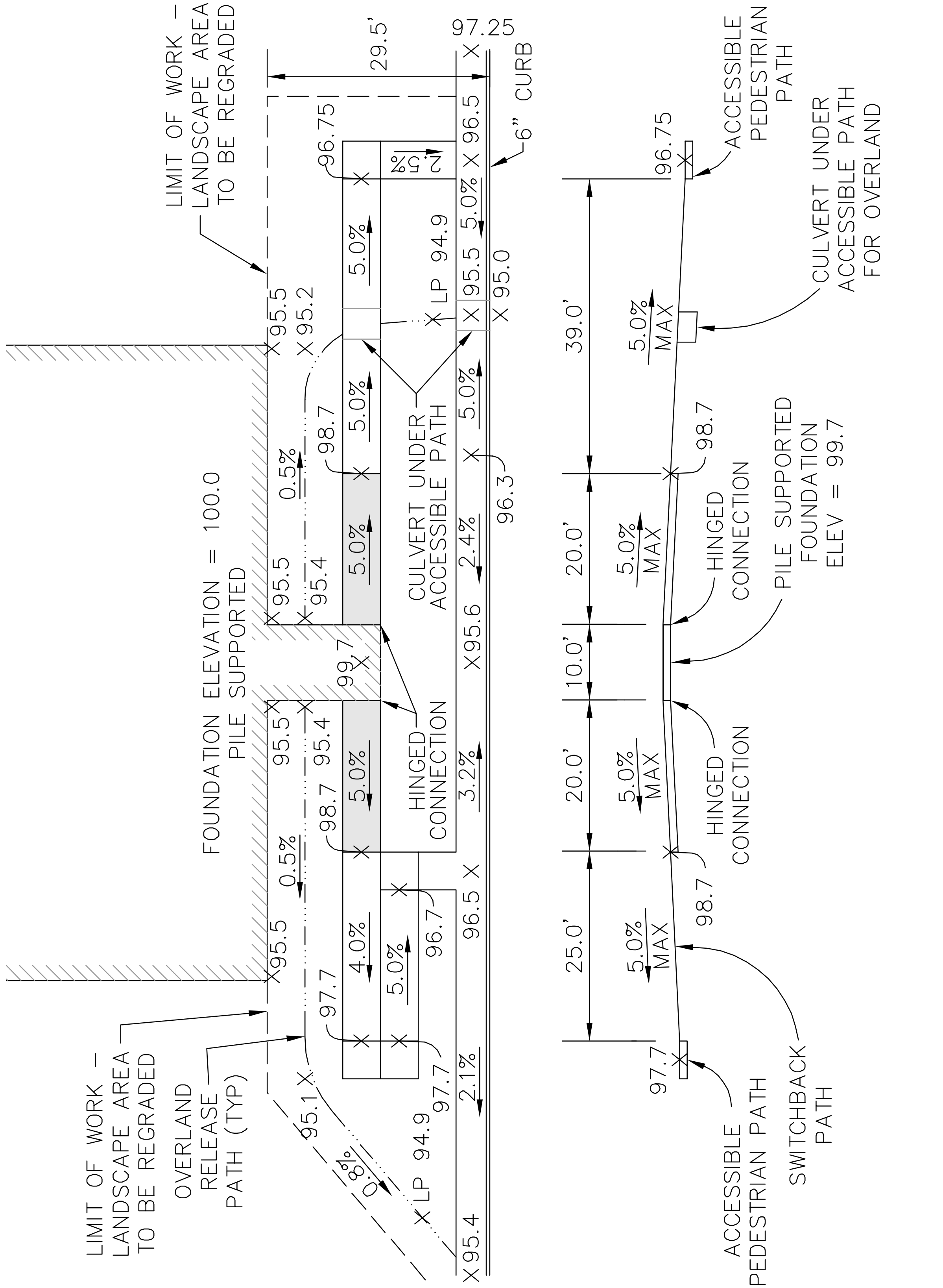

PARALLEL HINGE SLAB - 48" SETTLEMENT

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FIGURE 2.7

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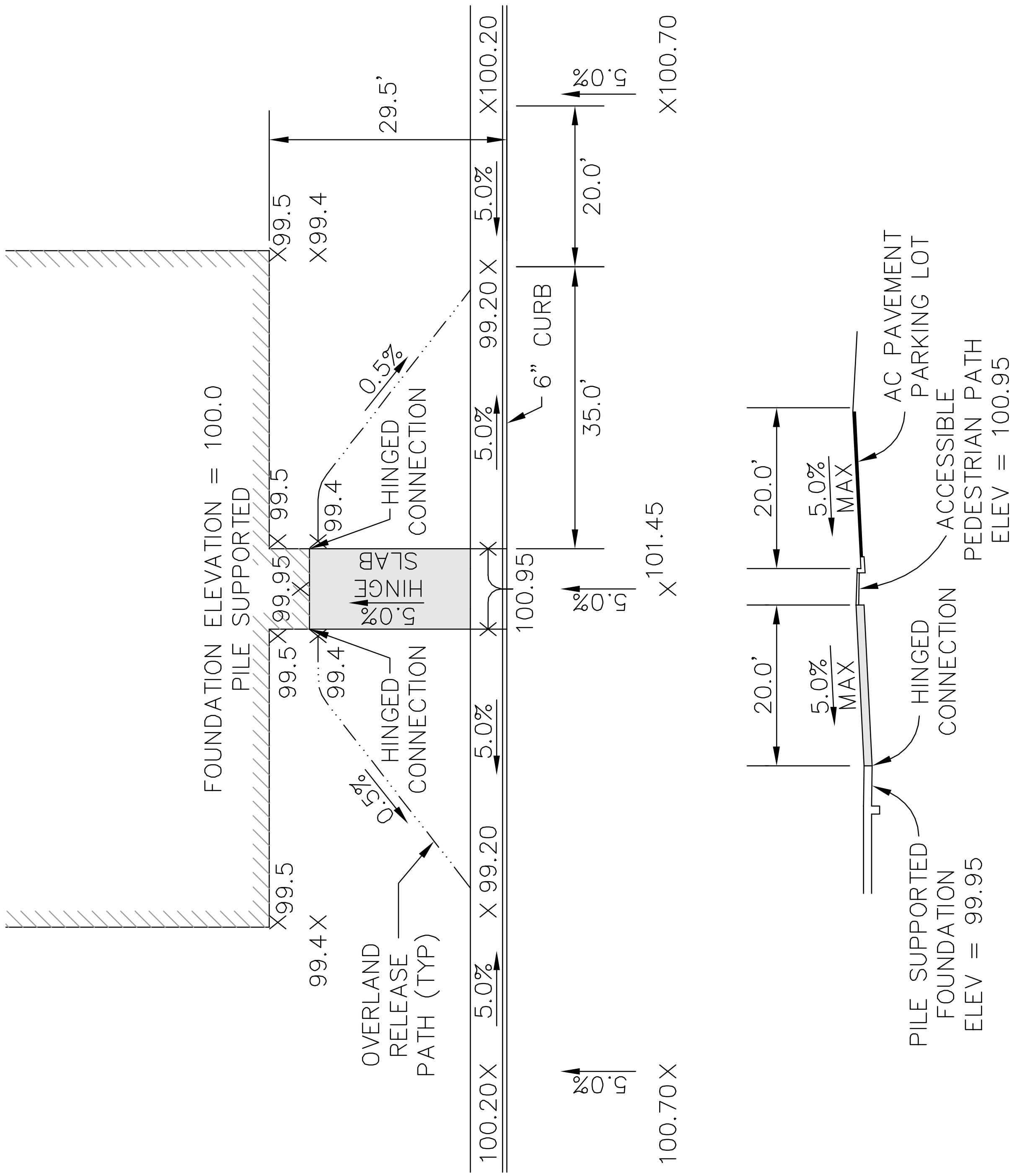

PERPENDICULAR HINGE SLAB - 0" SETTLEMENT

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FIGURE 2.8

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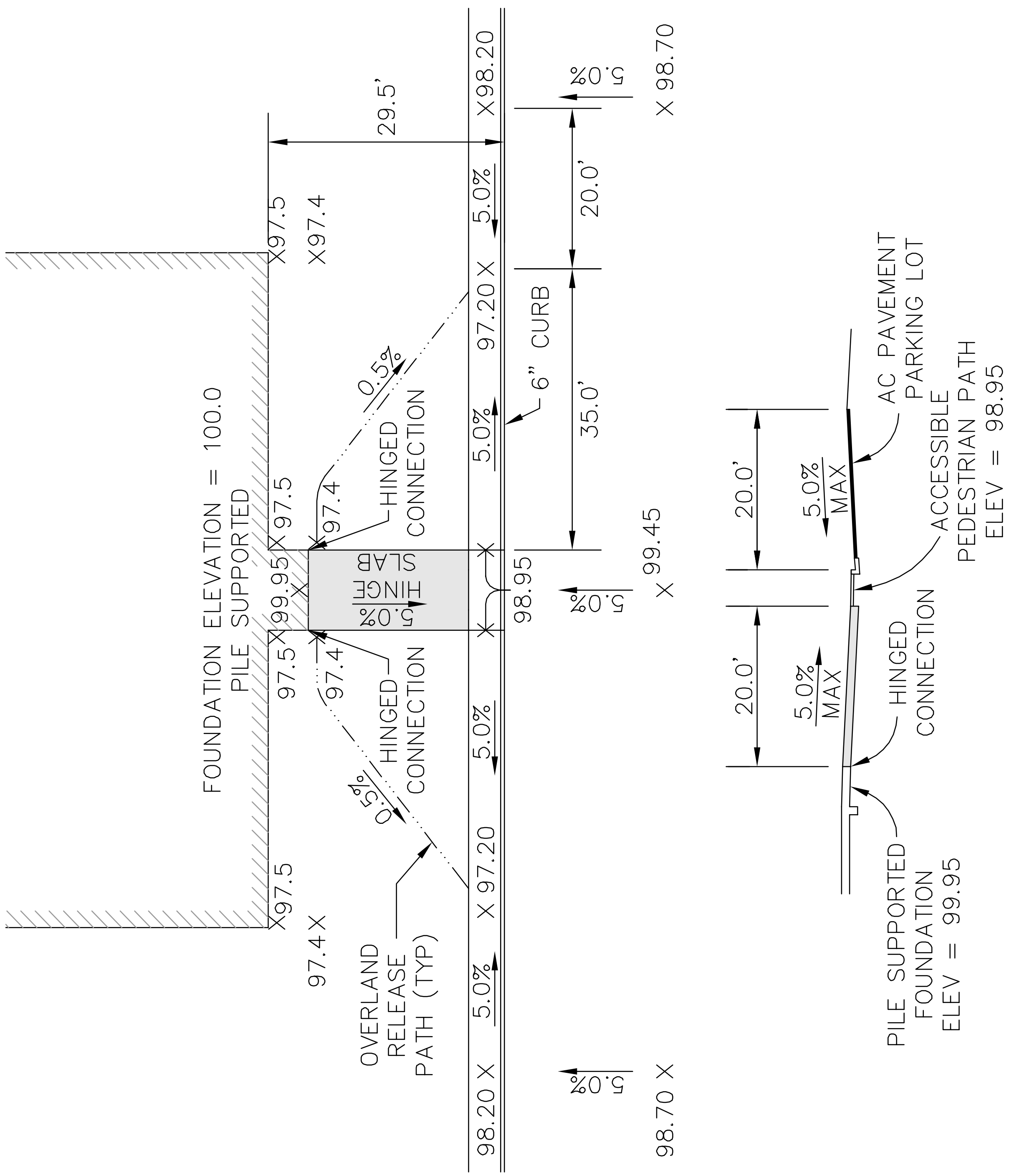

PERPENDICULAR HINGE SLAB - 24" SETTLEMENT

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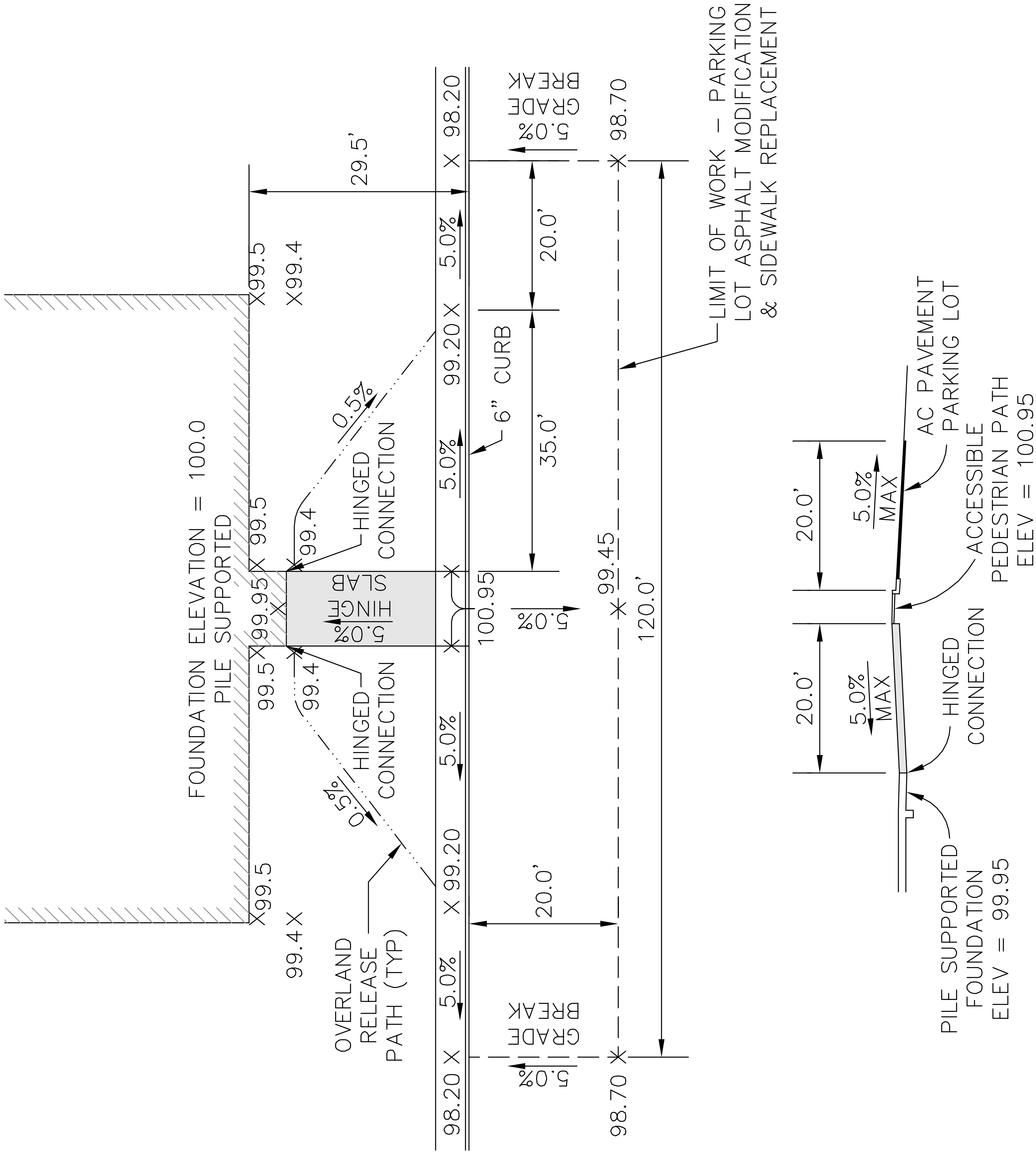
FIGURE 2.9



PERPENDICULAR HINGE SLAB - RESET SLAB

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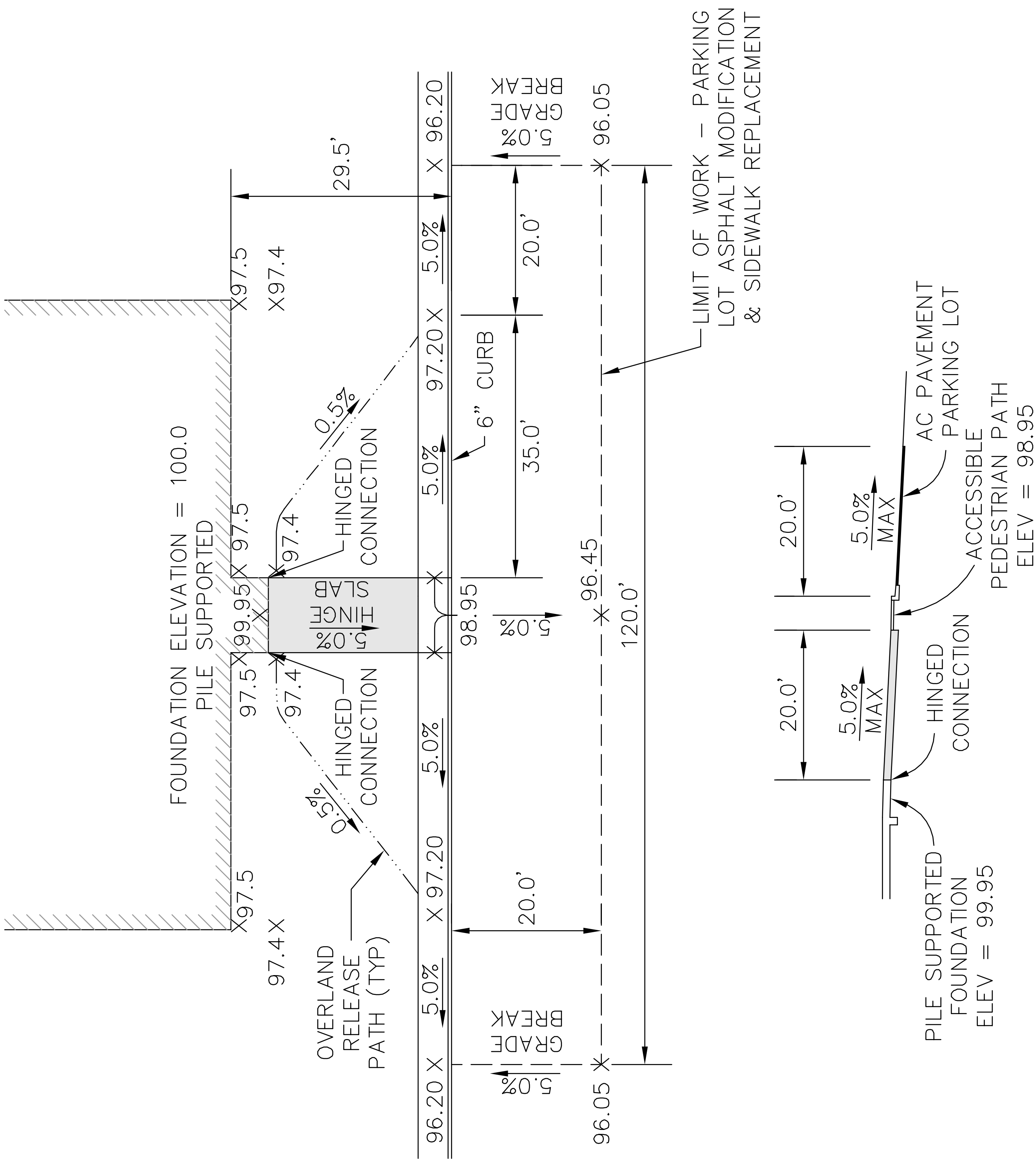
FIGURE 2.10



PERPENDICULAR HINGE SLAB - 48" SETTLEMENT

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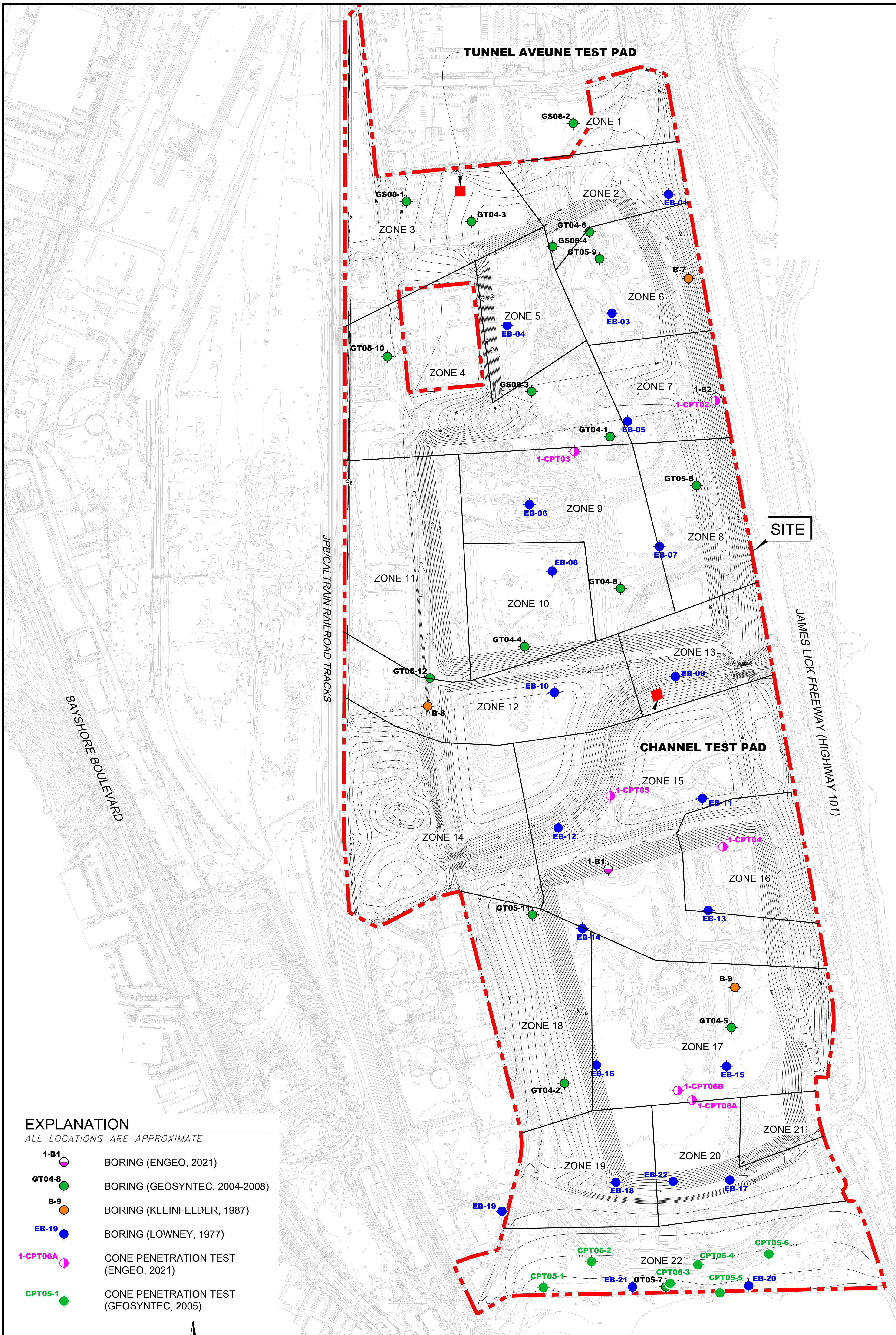
FIGURE 2.11

DRAWING NAME: \\Bkf-rc\vol4\2019\190615_Brisbane_Baylands_R\ENG\EXHIBITS\2021 Infrastructure Plan\PLOTTED_SHEETS\02.11_FIGURE.dwg
PLOT DATE: 06-15-22 PLOTTED BY: crui



ENGEO
Expect Excellence

SETTLEMENT ZONES MAP
BRISBANE BAYLANDS LANDFILL
BRISBANE, CALIFORNIA

PROJECT NO.: 17270.000.002	FIGURE NO. 2.12
SCALE: AS SHOWN	
DRAWN BY: CC	CHECKED BY: LC

ORIGINAL FIGURE PRINTED IN COLOR

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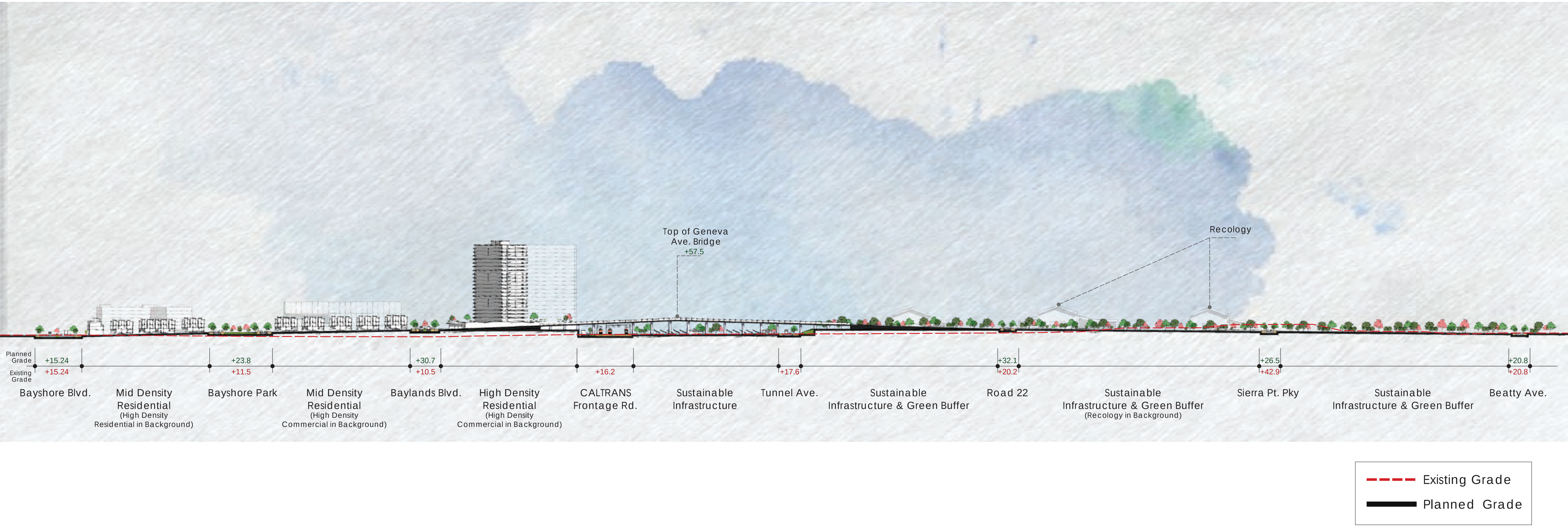


FIGURE 2.13 GENEVA PROFILE

FIGURE 2.13.1 GENEVA PROFILE - WEST

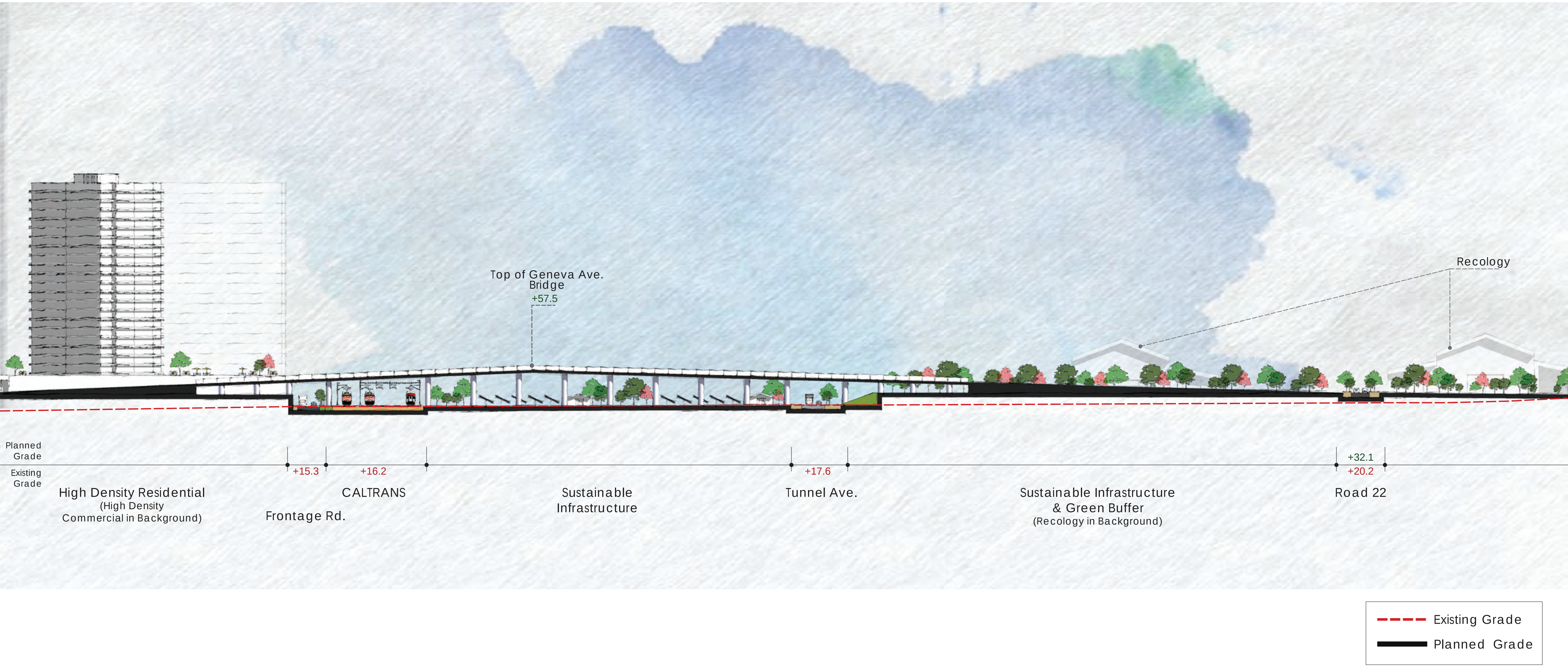


FIGURE 2.13.2 GENEVA PROFILE - CENTER

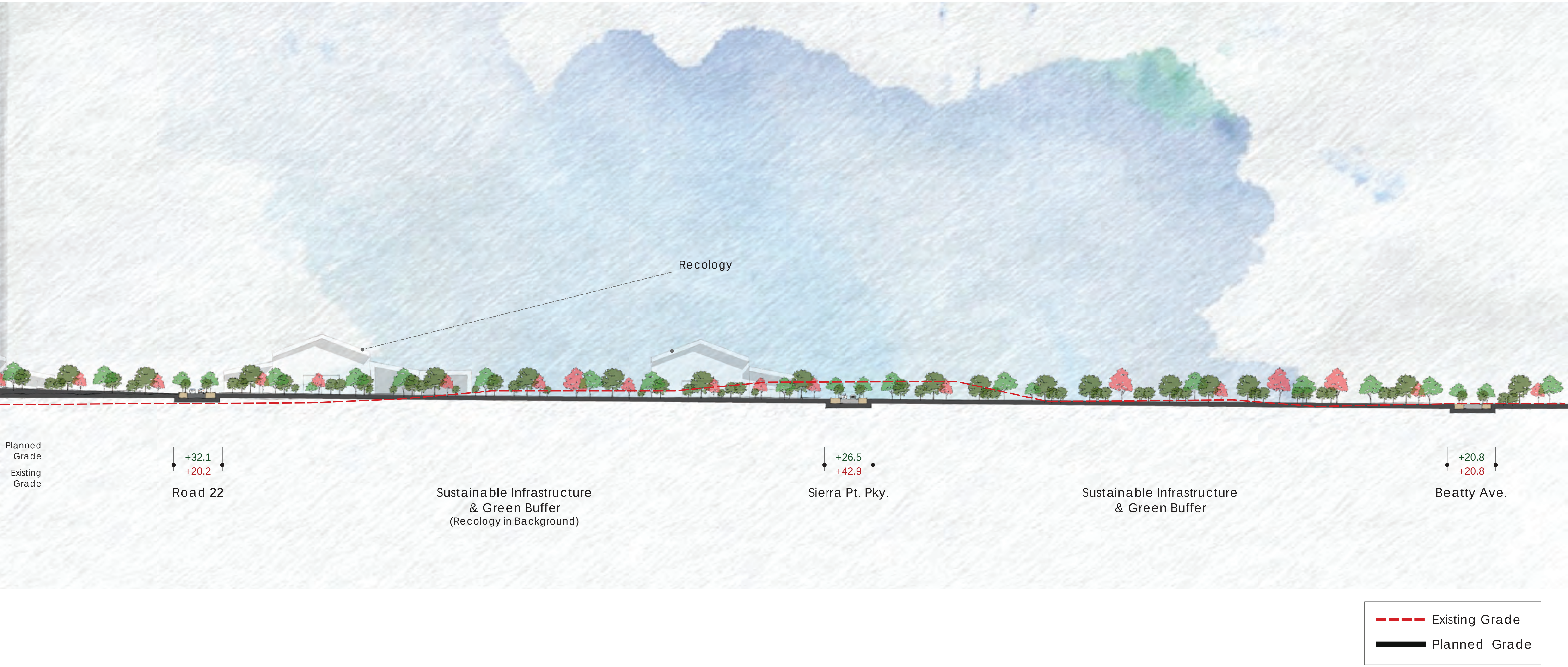


FIGURE 2.13.3 GENEVA PROFILE - EAST

3. POTABLE WATER SYSTEM

3.1 Existing System

The water system for the City of Brisbane and the Guadalupe Valley Municipal Improvement District (GVMID) serves about 4,000 residents (California Department of Finance) within a 3.5-square-mile area. In 2020, the average day demand was about 0.64 million gallons per day (mgd) and maximum day demand was estimated at 1.8 mgd (BAWSCA Annual Survey, 2020). Figure 3.1 includes details related to the existing system.

3.1.1 EXISTING WATER SUPPLY

The City of Brisbane currently purchases all its water from the San Francisco Public Utilities Commission (SFPUC) through 5 connections, or turnouts, to the Hetch Hetchy Regional Water System transmission pipelines that traverse the City. The City currently has no available groundwater resources or surface water supply other than from SFPUC. A review of the State of California groundwater mapping for Brisbane shows no substantial resource opportunity. Similarly, the area has no significant perennial stream flow that the City could use as surface water. Continued citywide conservation efforts could save 3 to 5 percent of future water consumption by 2030.

In addition, the City of Brisbane does not have recycled water available to use because it exports its raw sewage to the SFPUC for treatment and disposal at the Southeast Water Pollution Control Plant (SEPCP). The SEPCP recently has established a recycled water program, but currently has no facility to return recycled water to the City of Brisbane. The City of Brisbane may have future opportunities for recycled water development and use in conjunction with development on The Baylands. In addition, no groundwater resources, desalination, or surface water supplies are currently available to the City of Brisbane.

While existing land uses on The Baylands are served by the City of Brisbane, the City does not currently have a water supply allocation or existing storage to serve full buildout of The Baylands.

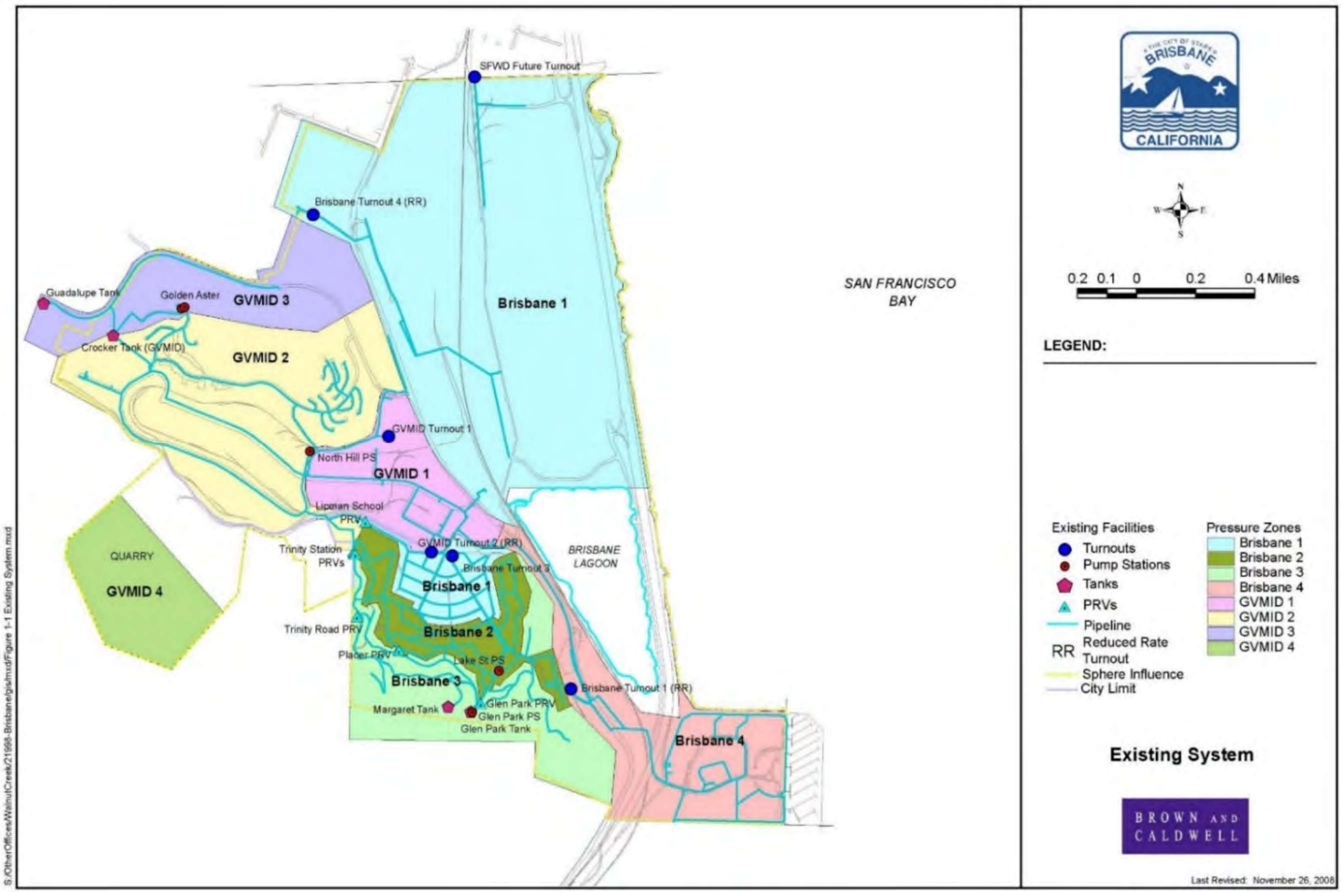
3.1.2 EXISTING SITE WATER DEMANDS

Current potable water use for the existing development within The Baylands is approximately 18.86 acre-feet per year (AFY) as described in Technical Document 6.

3.1.3 WATER DISTRIBUTION SYSTEM

Brown and Caldwell performed an analysis of the City's existing water distribution system in 2008. Since that time, the City's system has not significantly changed. The citywide distribution system includes about 25 miles of water main ranging in diameter from 6 to 16 inches. The system will have capacity to deliver water at a residual pressure of 50 pounds per square inch gage (psig) during peak-hour demand where technically and economically feasible and at least 35 psig in the remaining areas. The system will also maintain at least 20 psig during maximum-day demand coincident with a fire flow. The distribution system is still generally in good condition. Preliminary hydraulic modeling completed by Brown and Caldwell in 2008 identifies the need to add about 21,000 feet of new or replacement water mains, ranging in diameter from 8 to 14 inches, principally to deliver required fire flows and better connect low lying portions of the distribution system. As identified in the City of Brisbane Water Master Plan by Brown and Caldwell and dated 2003 (Brisbane WMP), the low-lying areas all receive service directly from the SFPUC Crystal Springs aqueducts, and could operate as a single pressure zone with additional mains.

FIGURE 3.1 – EXISTING WATER DISTRIBUTION SYSTEM



Glen Park Tank 2

3.1.4 WATER STORAGE

Storage needs have not changed significantly since the last analysis was performed in 2008 by Brown and Caldwell. The distribution system currently has about 2.9 million gallons (MG) of available storage. The steel storage tanks and pipelines connecting them to the distribution system are generally in good condition. The concrete Crocker Tank, oldest in the system, has undergone rehabilitation of the pre-stressed wires and exterior concrete surfaces extending the life of the tank. A structural analysis of Crocker Tank was completed in 2010, and the tank meets the structural design intent of the AWWA D110-04 Standard. Structural analysis of the steel Margaret and Guadalupe Water Storage Tanks was completed in 2010; both tanks were found to meet the intent of the current AWWA Standards, and are expected to perform reasonably well under seismic loading. Major repairs were completed on the existing steel Glen Park Tank in 2006 to correct the structural and seismic deficiencies identified in the Brisbane WMP. The tank built in 2006 adjacent to the existing Glen Park Tank was designed and constructed following the most current AWWA standards at the time.

In Brisbane WMP recommends that the City should increase its system-wide storage by 1.2 MG to improve fire and emergency storage. This recommended future storage did not account for The Baylands. The City has since added a second 0.2 MG storage tank at the Glen Park site. Additional storage at Glen Park reinforces the southern half of the system in general, while helping to respond particularly to the largest potential fire flow (Brown and Caldwell, 2003).

The City currently has no storage directly available to pressure zones connected to the SFPUC aqueducts. Thus, these pressure zones typically must draw peak-hour equalization and fire flows from the aqueducts. Based on past master planning studies, new storage combined with properly-sized interconnecting water mains and control valves on the turnouts connected to the Supervisory Control and Data Acquisition (SCADA) system would allow the lower elevation pressure zones to function as a single zone and not draw peak demands from the SFPUC aqueducts. In addition, The Baylands will consider building an approximately 3.16 MG donut tank on-site to account for future storage conditions. A more detailed siting evaluation will take place prior to tank design and analyses, which is discussed in Section 3.2.3 below.

3.1.5 PUMP STATIONS

The Brisbane WMP identifies that the booster pump stations (PS) are well maintained and generally in good working order. The stations range in total capacity from 700 to 2,000 gallons per minute (gpm). Firm capacity, defined as the pumping capacity with one of the largest pumps out of service for maintenance or repair, ranges from 350 to 1,300 gpm. Pumps range in size from 30 to 75 horsepower (hp). Two PS, located in the hills south of downtown Brisbane, generally serve demands in the upper Brisbane pressure zones and maintain storage in the Margaret and Glen Park tanks. Two PS located in the Guadalupe Valley Municipal Improvement District (GVMID) service area serve demand in upper GVMID pressure zones and maintain storage in the Crocker and Guadalupe tanks. Each PS includes diesel-fueled standby power generation.

The Glen Park Pump Station includes aging mechanical and electrical equipment that warrants near-term renovation and replacement, including increased pumping capacity to meet the City's long-term goal of tank refill after fire flow demand. The North Hill and Golden Aster pump stations need more limited improvements and capacity expansion to meet the City's goal of refilling the storage tanks within 6 hours after tank draw down due to fire flow (Brown and Caldwell, 2003).

3.2 Proposed System

3.2.1 PROPOSED WATER DEMAND

The following describes the proposed water demand for The Baylands based on the analysis presented in Technical Document 6. Water conservation and recycled water are key measures to support sustainable water in The Baylands. These measures are coordinated with the sustainability program described in Chapter 04 of The Baylands Specific Plan and include the following:

- Water budgeting and auditing
- Public education
- Efficient appliance rebates
- Multi-family unit sub metering
- Water-efficient landscaping
- Water-efficient bathroom and kitchen fixtures
- Dual plumbing non-residential buildings for recycled water
- Recycled water production from onsite sources
- Recycled water use for irrigation

3.2.1.1 CONSTRUCTION PHASE WATER DEMANDS

During initial grading and construction activities for The Baylands, potable water will be accessed from the existing Brisbane potable water system. This water will be used primarily for soil compaction, dust control, and concrete work. Annual construction needs are estimated to be 16.6 acre-feet per year (AFY) per year and is sufficiently sourced from the 18.86 AFY currently supplied to existing uses within The Baylands as these uses will be removed upon completion of construction of The Baylands.

3.2.1.2 PROPOSED WATER DEMAND PROGRAMS

Residential and hotel water demand will be met with potable water. Commercial, Office/workplace, biotech, and retail/community demand will be met with potable and non-potable water with the use of dual plumbing. All non-potable water will come from an onsite, district-scale water recycling facility (WRF), which treats wastewater generated by the development.

3.2.1.3 PROPOSED WATER DEMAND CALCULATIONS AND ASSUMPTIONS

Demand calculations were performed using a number of assumptions. Most calculations include conversions of units and occupancy rates to demand. The following are assumptions and calculations used for water demand projections for residential and non-residential land uses.

Residential

Occupancy Rates:

- Occupancy = 2.34 residents/du
- Number of DUs = 2,200
- Percent of residences occupied = 100 percent

Water Use:

- Average indoor per capita residential demand = 42 gallons (gal)/capita/day (gpcd)
- Increase to account for cooling demand = 10 percent
- Residential operation = 365 days/year

Office/Workplace

- Office employee density = 1 employee/250 ft^2
- Water demand per worker per day including cooling = 18.5 gal/employee/day
- Office space operation = 260 days/year

Biotech

- Typical biotech campus water demand including cooling = 0.18 gal/ft^2/day
- Typical biotech campus is composed of is approximately 33 percent office space, 36 percent research and development laboratories, 27 percent manufacturing, and 3 percent amenities.
- Biotech operation = 365 days/year

Retail/Community

- Retail/community water demand = 0.03 gal/ft^2/day
- Retail/community operation = 365 days/year
- Increase to account for cooling demand = 10 percent
- Retail/community would include mixed use commercial retail and clubhouse space

Hotel

- Water demand = 102 gal/room/day, including cooling
- Number of hotel rooms = 800
- Hotel operation = 365 days/year

Utility/Infrastructure

The Baylands program includes parcels E1 and E4 in the Sustainability District dedicated to onsite infrastructure supporting the WRF. These parcels do not include buildings, but have a small number of staff dedicated to operating and maintaining equipment. To support operations, approximately 20 employees would be located on at these parcels and estimated their water use on an employee per day basis as detailed in Section 3.2.1.2.

Irrigation

Biohabitats Inc. prepared estimates of the irrigation water demand for the development using two methods. The maximum annual demand was estimated using the Model Water Efficient Landscape Ordinance (MWELO) methodology for determining the maximum applied water allowance (MAWA) for landscape projects. Biohabitats also prepared a more detailed analysis using the Landscape Coefficient Method, as follows below. This method allowed for the estimation of monthly demand, including peak summer irrigation demand.

- Gross Demand = ETo x KL

where: ETo = Reference Evapotranspiration for the Region, inches
KL = Landscape Coefficient

- Landscape Coefficient KL = ks x kd x kmc

where: ks = Species factor, which considers the different water requirements of different species. Adequately green landscapes can be maintained at about 50 percent of reference ET, therefore the average ks value is 0.5. Truly xeric landscapes that require no additional water after establishment have a ks = 0.
kd = Density factor, accounting for number of plants and total leaf area of a landscape. Sparsely planted areas will have a lower ET rate than densely planted areas.
kmc = Microclimate factor, accounting for landscape variation in temperature, wind exposure, and humidity. The average kmc is 1.0. Higher values occur in landscapes surrounded by heat-absorbing or reflective surfaces, or where wind exposure is unusually high. Examples of high kmc areas are parking lots, west sides of buildings, west and south slopes, medians, and areas experiencing wind-tunneling. Low kmc areas are shady areas, areas protected from wind, north sides of buildings, courtyards, areas under overhangs, and the north sides of slopes.

- Net Demand = (Gross Demand / IE) x CE

where: IE = Irrigation Efficiency, for the project irrigation type, as shown in the following table.

TABLE 3.2.1. IRRIGATION EFFICIENCY BY TYPE

Landscape Type	Irrigation Efficiency (IE)
High Water Use	0.75
Moderate Water Use	0.81

CR = Controller Reduction: all major irrigation projects should use a high-efficiency controller, such as an ET-controller. For the purposes of initial estimation of residential landscaping, CR is assumed to be 0.75.

3.2.1.4 PROPOSED WATER DEMAND RESULTS

The results of the water demand are included in Table 3.2.2 and described in greater detail in The Baylands Water Balance (March 2022 Update to The Baylands Water Demand) (Technical Document 6). The estimated average daily June demand (peak irrigation month) is approximately 1.36 mgd and the average daily December demand (zero irrigation demand) is approximately 1.14 mgd. The total annual water demand (potable and recycled) at build-out of The Baylands is calculated to be 1,408 AFY. 1,122 AFY of the 1,408 AFY demand is required to meet the annual potable water demand.

TABLE 3.2.2. ESTIMATED TOTAL WATER DEMAND SUMMARY			
	Daily Demands		Annual Demand, Including Potable and Non-Potable Uses (AFY)
Demand Category	June Average Daily Demand (mgd)[a]	December Average Daily Demand (mgd)	
Indoor Residential[b]	0.24	0.24	266
Indoor Commercial[b]	0.91	0.91	944
Office	0.22	0.22	179
Biotech	0.59	0.59	666
Retail/Community	0.01	0.01	7
Hotel	0.08	0.08	91
Indoor Subtotal [c]	**1.14**	**1.14**	**1,210**
Irrigation[d]	0.22	-	198
Total Water Demand [c]	**1.36**	**1.14**	**1,408**

a. Based on average daily irrigation demand for the month with the highest demand, June (Biohabitats 2021)
b. Includes cooling demand
c. Totals may not sum due to rounding
d. Estimated by Biohabitats (2021)
e. This quantity represents total demand, including non-potable demand that would be met through alternate supplies.

3.2.2 PROPOSED WATER SUPPLY

The following sections describe the proposed water supply.

3.2.2.1 PRIMARY WATER SUPPLY

The City of Brisbane manages and operates two separate water districts within the City limits; the City of Brisbane and GVMID. The City's current and potential sources of water supply include the following:

- SFPUC: The City receives 100 percent of its potable water supply from the Hetch Hetchy Regional Water System, operated by the City and County of San Francisco by the SFPUC, through the Crystal Springs Aqueducts 1 and 2. The City has five active turn outs from the aqueducts. Currently SFPUC delivers water from both Aqueduct 1 and Aqueduct 2.

  The business relationship between the City and County of San Francisco and its wholesale customers is largely defined by the *Settlement Agreement and Master Water Sales Contract* (Master Contract) executed in 1984. The Master Contract primarily addresses the rate-making methodology used by San Francisco in setting wholesale water rates for its wholesale customers in addition to addressing water supply and water shortages for the regional water system. As part of the Bay Area Water Supply and Conservation Agency (BAWSCA) program, the City of Brisbane service area is currently purchasing approximately 0.24 mgd or 268 ac-ft/yr (BAWSCA 2019) from its three metered turnouts with SFPUC.

- GVMID is a small water system located within the Brisbane City limits bordering the City of Brisbane water system. Both the City of Brisbane and GVMID supply water to the City, and both agencies are managed and operated by the City. Because the two systems are interconnected, the City has the capability of wheeling water at no cost between the two systems when water is needed and available. GVMID's contracted Supply Assurance is 0.52 mgd (583 ac-ft/yr).

3.2.2.2 BAYLANDS WATER SUPPLY

On December 8, 2021, BDI entered into a Memorandum of Understanding (MOU) with the Contra Costa Water District (CCWD) to acquire water supply water and reserve storage capacity at CCWD's Los Vaqueros Reservoir and conveyance to The Baylands Specific Plan Area through the SFPUC system. The CCWD-BDI MOU provides for anticipated delivery of 2,500 Acre Feet per Year (AFY), plus or minus 20 percent depending on final determination of need by BDI. This supply exceeds the 1,122 AFY potable annual demand for The Baylands. The water is conveyed to the South Bay Aqueduct then to the SFPUC regional water system to Brisbane and The Baylands.

3.2.3 PROPOSED WATER STORAGE

The City currently has no storage directly available to the Brisbane 1 and GVMID I pressure zones connected to the SFPUC aqueducts. Thus, these pressure zones must typically draw peak-hour equalization and fire flows from the aqueducts. As shown in Table 3.2.3, additional storage of approximately 3.16 MG is needed for future conditions. This combined with properly sized interconnecting water mains and control valves on the turnouts connected to the SCADA system would allow the lower elevation pressure zones to function as a single zone and not draw peak demands from the SFPUC aqueducts.

TABLE 3.2.3 - SUMMARY OF RECOMMENDED STORAGE REQUIREMENTS

Current Storage, MG	Current conditions		Future Conditions[a]	
	Needed storage, MG	Additional storage, MG	Needed storage, MG	Additional storage, MG
2.8	3.28	0.48	5.9	3.16

[a] Includes Baylands Development.

High level Tank design criteria are summarized below. A more detailed tank selection evaluation will be completed prior to design.

- Material:
  - Pre-stressed concrete or Welded Steel
- Configurations:
  - Height x width ratio
  - Roof Type (Dome or Flat for conc Dome or press-broke for steel)
  - Buried of partially-buried (Concrete)
  - At-grade (steel)
- Geotechnical considerations
  - Settlement analysis
  - Foundation type
  - Retaining walls
  - Seismic ground motion
- Environmental
  - Soil and Groundwater
  - Landfill Closure

- Structural/Seismic Considerations
  - o Freeboard and anchorage requirements for seismic
  - o Flexible connections to pipelines
- Appurtenances
  - o Coating systems, cathodic protection (steel)
  - o Mixing systems (passive or active)
  - o Tank piping (PVC for concrete and metal or PVC for steel)
- Access
  - o Manways (roof only for concrete, side and roof for steel)
  - o Temporary 10-ft setback for construction of prestressed concrete

To meet the current National Fire Protection Association (NFPA) code requirements for the development, the proposed fire flow for the system is 6,000 gpm for a 4-hour period. If sprinkler systems are installed in accordance with the National Fire Protection Association 13 installation standard and with North County Fire Authority approval, the fire flow can be reduced by up to 50 percent. Thus, additional storage of approximately 3.16 MG is required, based on 1.5 times the average daily potable water demand (1.5 X 1.14=1.72 MG) plus a 6,000-gpm fire flow for four hours (1.44 MG).

The final size for the new tank sponsored by The Baylands will be determined through negotiations between the City, Sunquest Properties Inc, and BDI.

3.2.3.1 ONSITE STORAGE TANK

Properly sized interconnecting water mains and control valves on the turnouts connected to the SCADA system would allow the lower elevation pressure zones to function as a single zone and not draw peak demands from the SFPUC aqueducts. The preferred water storage location is constructing an onsite ground level 3.16 MG water storage tank on the area east of the railroad tracks, within the Infrastructure Development parcel, adjacent to the planned water recycling facility, as shown on Figure 3.4. The water tank would be sized approximately 125-feet in diameter and 40-feet tall, with an annual energy demand estimated at 575,000 Kilowatt hours. This location would include a pump station with an emergency standby generator, and sufficient size and elevation to accommodate several million gallons of storage that would deliver adequate pressure to The Baylands.

3.2.4 PROPOSED WATER ON-SITE DISTRIBUTION SYSTEM

The California Code of Regulations, Title 22, requires that the water distribution system be capable of delivering domestic demand coincident with the required fire flow. Based on the preliminary demand calculations described above, the proposed water system will therefore need to deliver the maximum daily flow demand of 1,200 gpm (flow without the use of reclaimed water) across The Baylands plus a fire flow of 6,000 gpm at 20 psig residual pressure.

As shown in Figure 3.2, the preliminary on-site water system for both the East Side and West Side would consist of a grid of 8-inch diameter pipes surrounded by 14-inch diameter loops. To connect the East Side and West Side systems, 14-inch pipes will cross the Caltrain/JPB train tracks at two locations. An additional permanent connection to the existing Tunnel Road 12-inch diameter San Francisco Public Utilities Commission (SFPUC) water main will be provided to loop the proposed on-site water system. These potential emergency connections will be designed to account for the pressure differential between the two systems, and where dead-end lines occur, flushing valves will be provided.

Off-site improvements, including the existing City of Brisbane 20-inch water main in Bayshore Boulevard will feed the on-site grid at two locations are described in Section 3.3 below

3.2.4.1 PROPOSED PIPE MATERIAL

Subject to State of California and City of Brisbane approvals, The Baylands water system is proposed to be constructed from fusion-welded HDPE pipe. Fusion-welded HDPE is being proposed by the applicant due to its flexibility and capacity to handle the substantial soil settlement that is anticipated within The Baylands, thereby reducing the potential for pipe shearing. With the use of HDPE pipe, the only remaining area of concern is the potential for leaks at the water main gate valves. From inspections of the majority of existing water mains, gate valves have historically experienced leaks over time. Thus, to both easily monitor gate valves for leaks and prevent water leaks from entering the closed landfill, gate valves may be installed in an enclosed manhole structure, as shown on Figure 3.3. Although such an installation requires greater separation between utilities, it will allow for easier repairs and operation of the valve. Final design solutions will be confirmed in coordination with the City and State based on construction document design level infrastructure designs.

3.2.4.2 TITLE 22 COORDINATION

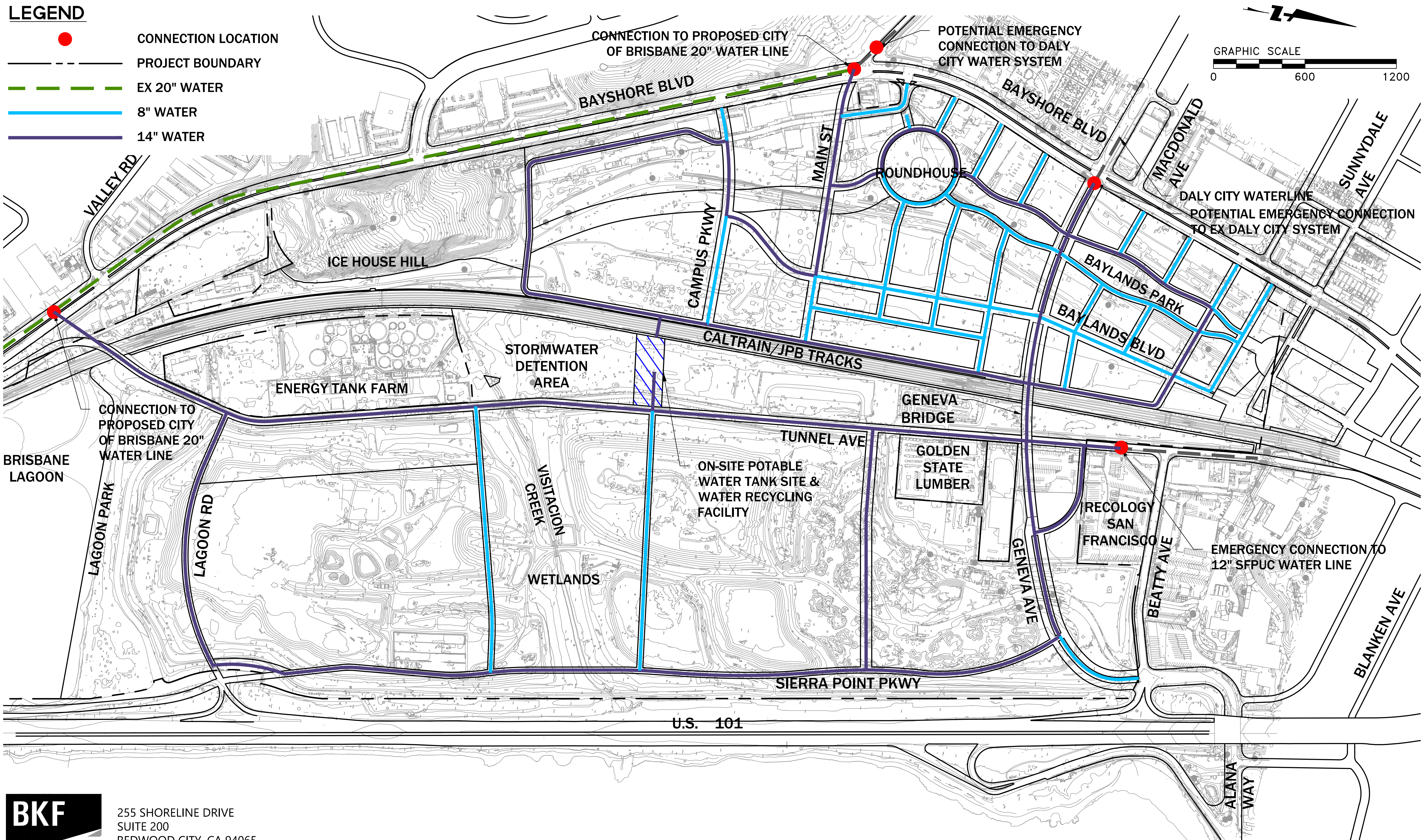
In addition, a waiver will be applied for, in compliance with Section 64572(f), Title 22, California Code of Regulations, to construct water lines on top of the closed landfill, and water system designs will include appropriate mitigations in support of the waiver approval.

3.2.5 FLEXIBLE SERVICE CONNECTIONS AT BUILDINGS

To accommodate hard edge differential settlement at the interface between a proposed building and a HDPE potable or fire water lateral service connection, flexible connections may be provided to mitigate shearing of the utility infrastructure. As the ground and vault settle while the building and its water pipes remain fixed, solutions, such as a flexible stainless steel hose or flex-tend fitting, will adjust with the ground settlement and prevent pipe shearing. In addition, the stainless steel flexible hose may be installed with excess length to accommodate large settlements. In addition, approved backflow prevention devices will be installed for both the fire and domestic water connections either within or outside of the buildings per the applicable regulations. Figures 3.4 and 3.5 show a typical settlement vault and flexible water service connection, respectively.

3.3 Master Utility System Plans and Master Fire Protection Plan

A Master Water System Plan and Master Fire Protection Plan will be prepared in coordination with the City of Brisbane Public Works and Fire Departments during the development of the design documents. The Master Water System Plan will include detail on the layout of the configuration, size, and location of the proposed water tanks, the layout of the domestic water system, hydraulic calculations to determine lines sizes, and phasing. The Master Fire Protection Plan will include a determination of fire flows for The Baylands.

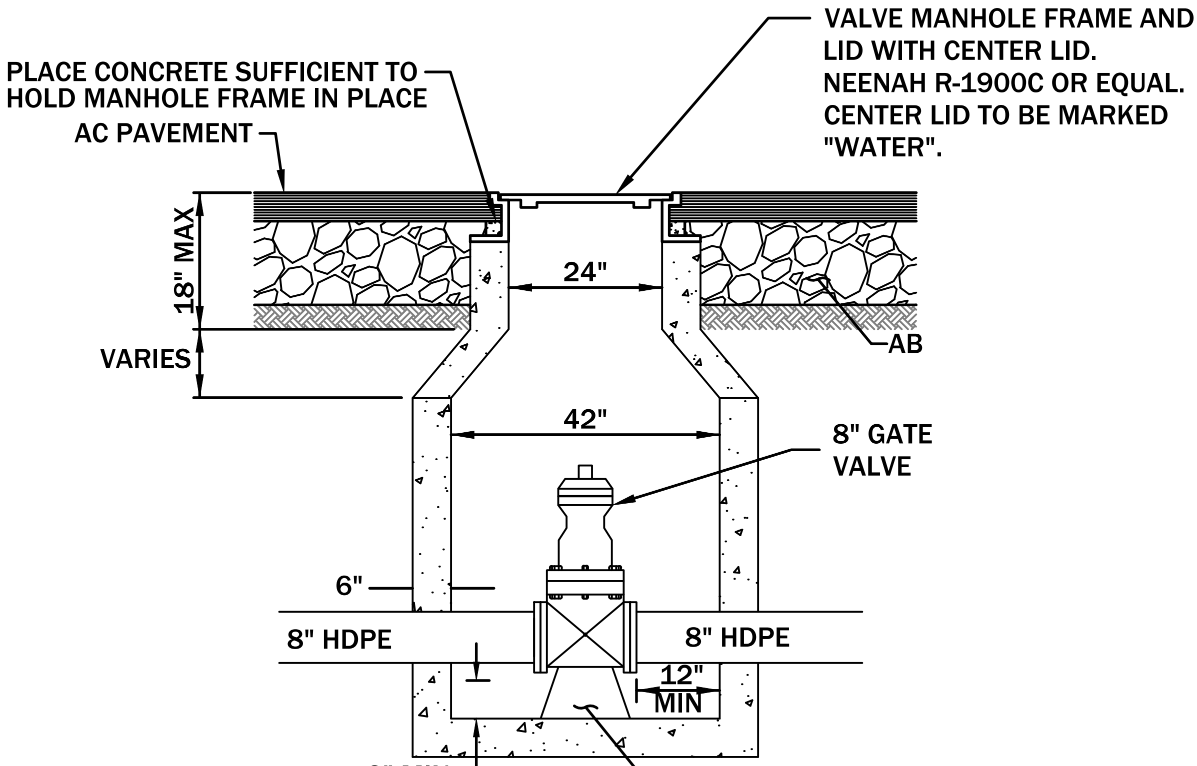


BKF

255 SHORELINE DRIVE
SUITE 200
REDWOOD CITY, CA 94065
(650) 482-6300
www.bkf.com

CONCEPTUAL WATER SYSTEM
SCALE: 1"=600'

BRISBANE BAYLANDS
FIGURE 3.2



SECTION
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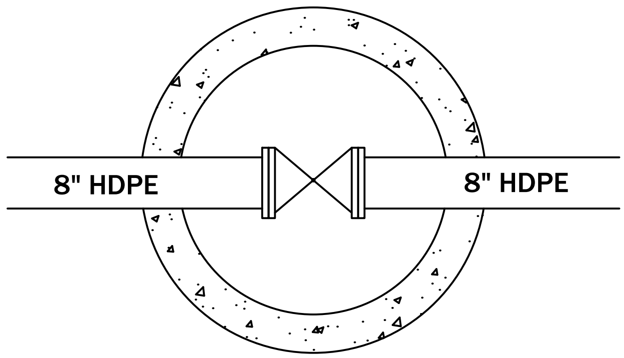

PLAN
NOT TO SCALE

NOTES:

1. ALL MANHOLES SHALL HAVE A STAINLESS STEEL PLACARD SECURELY FASTENED WITH THE FOLLOWING WORDING:

CONFINED SPACE - HAZARDOUS AREA
CONTACT BUILDING MAINTENANCE SUPERVISOR PRIOR TO ENTRY
ENTRY BY AUTHORIZED PERSONNEL ONLY

LEAK DETECTION MANHOLE FOR WATER VALVES

NTS

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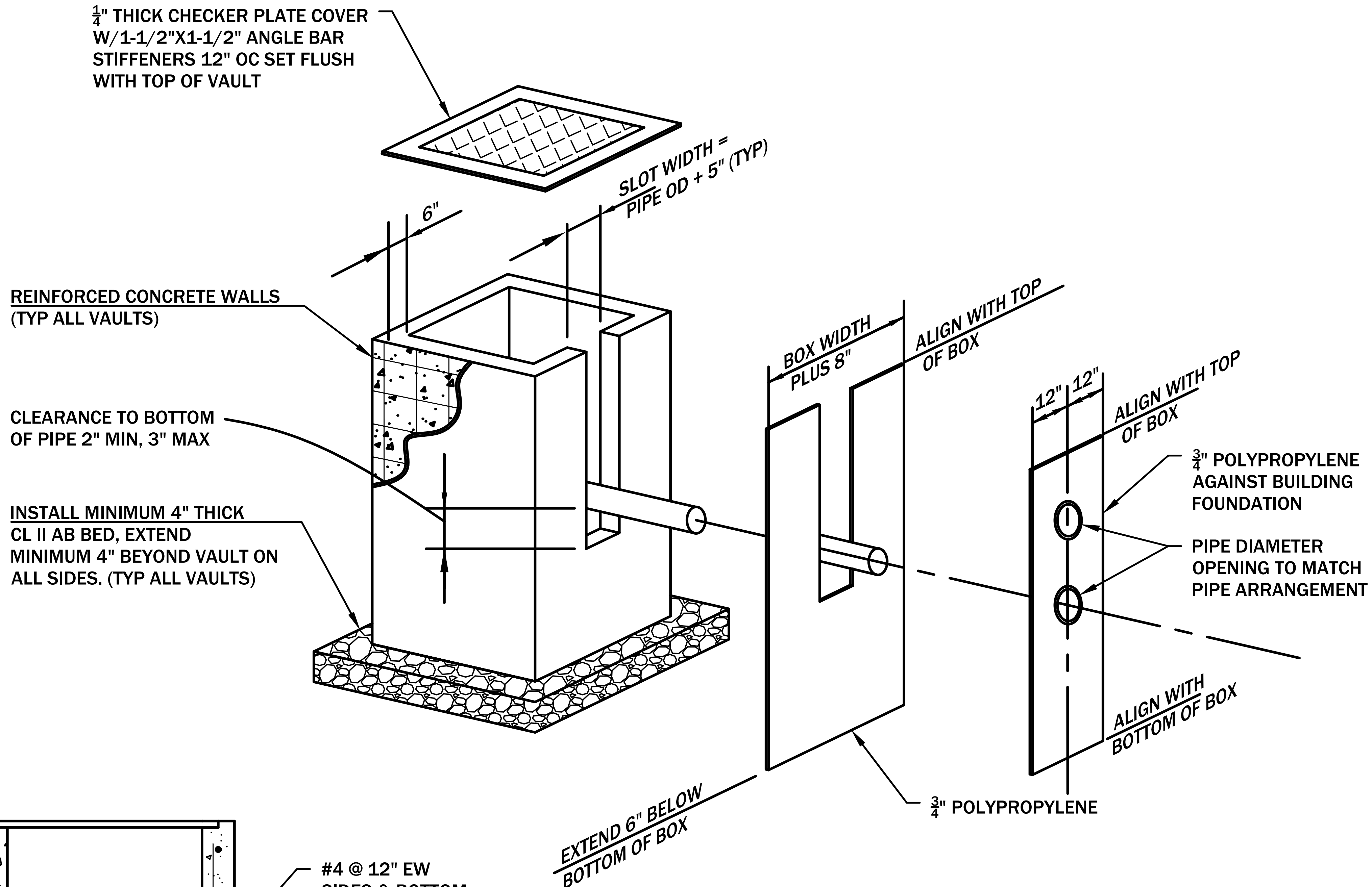
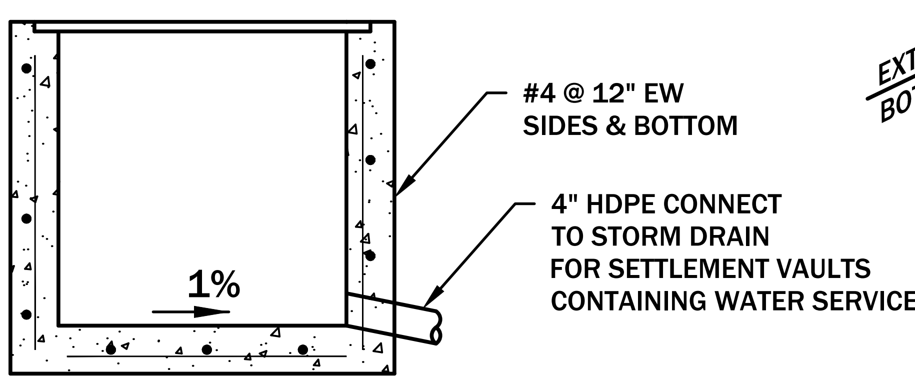
BRISBANE BAYLANDS

FIGURE 3.3





SECTION

NOTE:

ALL SETTLEMENT VAULTS SHALL HAVE A STAINLESS STEEL PLACED SECURELY FASTENED WITH THE FOLLOWING WORDING:

CONFINED SPACE - HAZARDOUS AREA
CONTACT BUILDING MAINTENANCE SUPERVISOR PRIOR TO ENTRY
ENTRY BY AUTHORIZED PERSONNEL ONLY

CONTRACTOR SHALL PROVIDE A SUBMITTAL TO THE ENGINEER FOR APPROVAL PRIOR TO PURCHASE AND INSTALLATION.

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UTILITY SETTLEMENT VAULT

NTS

BRISBANE BAYLANDS

FIGURE 3.4

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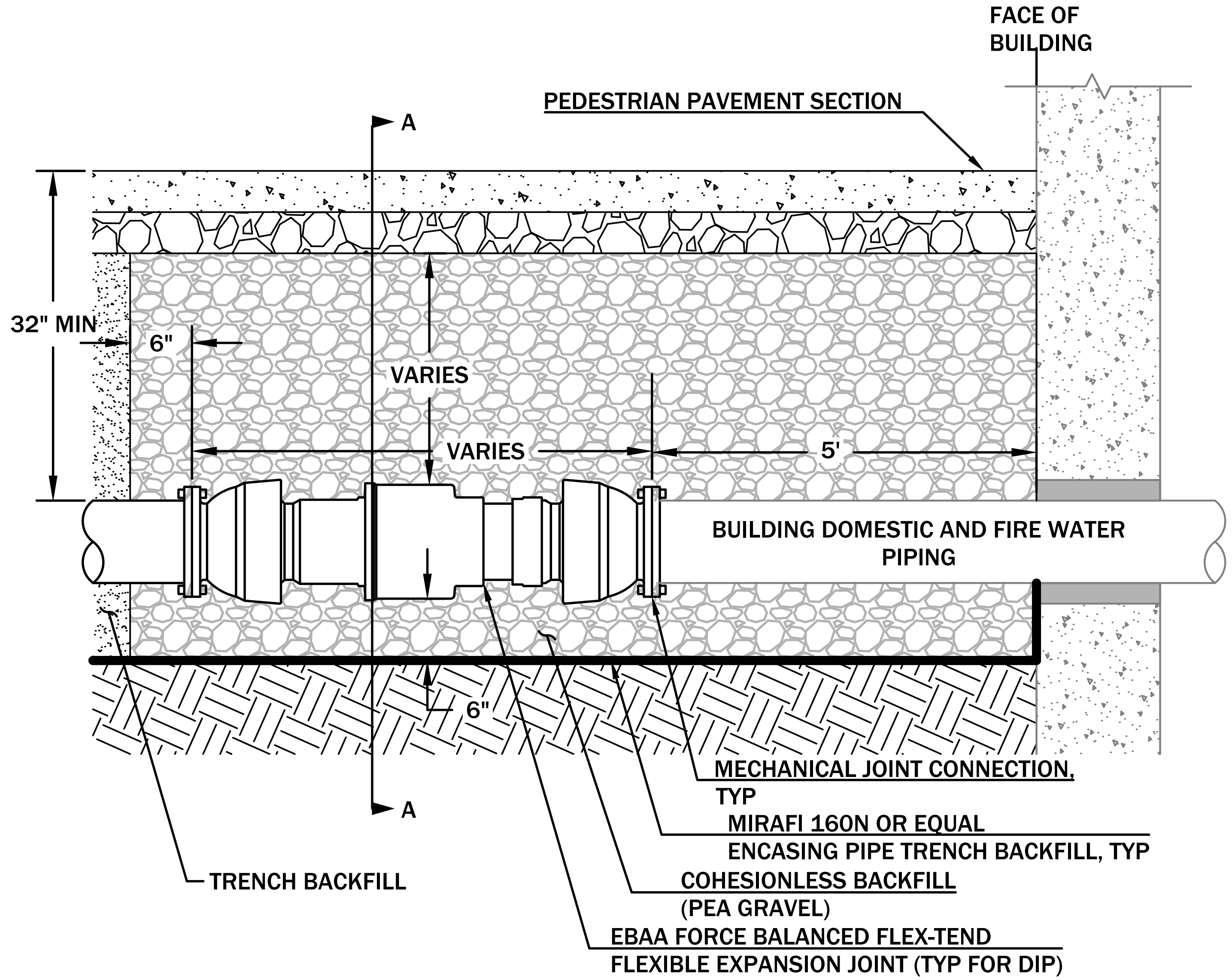
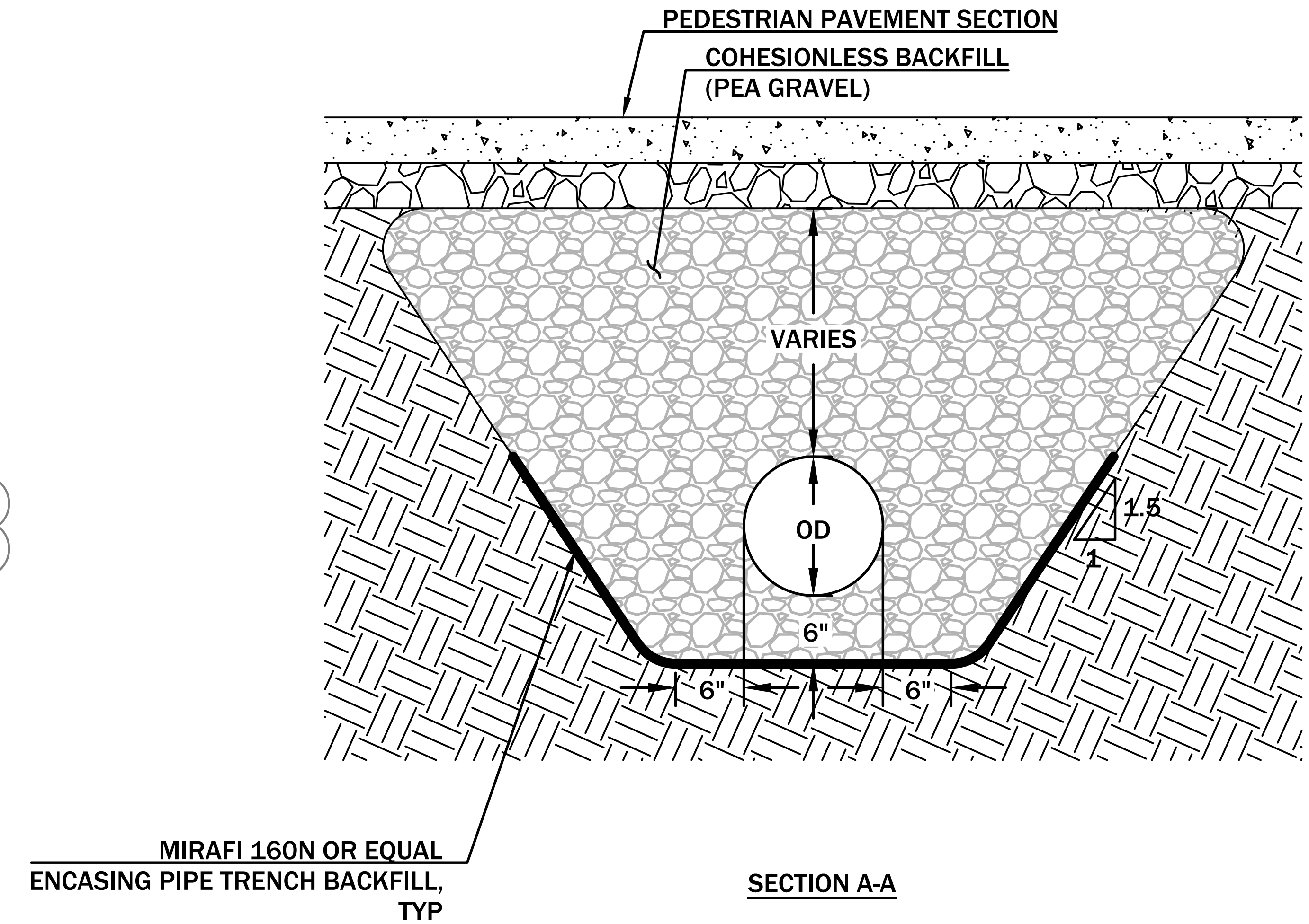
PLOT DATE: 01-27-23 PLOTTED BY: arra





SECTION A-A

NOTES:

1. UNDERGROUND INSTALLATION OF EBAA EXPANSION JOINTS WILL BE PER MANUFACTURER RECOMMENDATIONS, INCLUDING:
   - COHESIONLESS BACKFILL
   - SLOPE SIDE TRENCHES
   - POLYETHYLENE WRAP

2. WATERPROOFER/MEP/STRUCTURAL ENGINEER TO COORDINATE AND SPECIFY WALL PENETRATION MATERIAL, WATERPROOFING DETAIL, ETC.

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DOMESTIC AND FIRE WATER FLEXIBLE CONNECTIONS

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BRISBANE BAYLANDS

FIGURE 3.5

4. WASTEWATER SYSTEM

4.1 Existing Collection System

4.1.1 OVERVIEW OF CONTROLLING AGENCIES AND SYSTEMS

The City of Brisbane Sanitary Sewer District, which incorporates the GVMID, and the BSD own and operate wastewater collection facilities within the Brisbane City limits (See Figure 4.2).

4.1.1.1 CITY OF BRISBANE WASTEWATER COLLECTION SYSTEM

The City of Brisbane operates and maintains a network of gravity mains and laterals, force mains and pump stations to serve the Bayshore, Central Brisbane, Crocker Industrial Park, Guadalupe Canyon, and Sierra Point areas of Brisbane. The sanitary sewer collection system converges at the GVMID wastewater pump station located near the corner of Bayshore Boulevard and Valley Drive. At the Valley Drive pump station, flow is conveyed north along Bayshore Boulevard through a series of 12-inch and 16-inch force mains to the 78-inch combined storm and wastewater main (SFCS) operated by the City and County of San Francisco in Sunnydale Avenue. The SFCS flows by gravity under US Highway 101 to the Harney Way 20’x30’ Box Storage Culvert and Sunnydale lift station. Flow is then conveyed through a series of conduits, tunnels and lift stations, eventually arriving at the SEPCP.

4.1.1.2 BAYSHORE SANITARY DISTRICT WASTEWATER COLLECTION SYSTEM

The BSD was created mainly to collect wastewater generated within Daly City. The district has a large overlap with Brisbane, including the undeveloped areas of the former West Side and East Side portions of The Baylands. In addition, the Brisbane Industrial Park and the Kinder Morgan Tank Farm are currently both served by and within the BSD jurisdiction. Flows from Daly City and the Brisbane Industrial Park are collected through a system of gravity pipes and force mains at the BSD lift station, located near the intersection of Bayshore and Industrial Way. From the Industrial Way lift station, wastewater flow is then pumped to the SFCS and conveyed through a series of pump/lift stations, gravity pipe and force mains to the SEPCP.

4.1.2 EXISTING ON-SITE SYSTEM FACILITIES

Existing sanitary sewer flows from the site are collected and conveyed to the SEPCP through two connections to the existing SFCS transmission main located in Sunnydale Avenue and underneath portions of the Recology San Francisco facility outside of The Baylands.

4.1.2.1 WEST SIDE SANITARY SEWER SYSTEM FACILITIES

Existing sanitary sewer lines serving the Industrial Way buildings and other existing or demolished buildings on the West Side will be removed. The location of these existing facilities conflict with the proposed site plan and do not have adequate capacity to handle the proposed development demands.

4.1.2.2 EAST SIDE SANITARY SEWER SYSTEM FACILITIES

On the East Side, flow from the existing Kinder Morgan Tank Farm is pumped from a small lift station within the property through a 4-inch force main to the 21-Inch BSD line on Tunnel Avenue. Based on the proposed site plan and settlement constraints, the 21-inch sewer line in Tunnel Avenue will be relocated to accommodate the proposed realignment of Tunnel Avenue. The existing tank farm sewer connection will then be re-connected to the relocated Tunnel Avenue main line. From the sewer main in Tunnel Avenue, sanitary sewer flow is conveyed to the SFCS transmission main and on to the SEPCP.

4.1.3 EXISTING SYSTEM CAPACITY

The SFPUC indicates that the SEPCP currently receives an average dry weather flow of 57 mgd, which accounts for approximately 70% of its available dry weather flow capacity of 85.4 mgd. The City of San Francisco upgraded the SEWPCP wet weather flow capacity to 250 mgd in 1994 to comply with Federal regulations requiring a reduction in Combined Sewer Overflow (CSO) discharges to the Bay. In addition, the North Point Wet Weather Facility (NPF) operates when the SEPCP approaches capacity. To further reduce the frequency of combined sewer overflows into the Bay and increase system capacity, the City of San Francisco recently constructed a parallel 169-inch combined sewer facility along the County of San Francisco and County of San Mateo jurisdictional limits directly north of The Baylands.

Under the current contract, as stated in the Brisbane General Plan, the City of Brisbane is allowed to convey dry weather sewer discharges to the SEWPCP of up to 6.7 mgd. whereas the current discharges for dry weather and wet weather conditions are approximately 0.34 mgd and 1.5 mgd, respectively.

Per discussions with Kennedy Jenks in 2008 and 2011, the BSD has no set capacity allocation at the SEPCP based on its current contract. Kennedy Jenks identified that the established BSD protocol has been that if a proposed project requires service for a demand greater than 200,000 gpd, then the district has to notify the staff at the SEPCP to confirm that capacity is available.

4.2 Proposed Wastewater System

To accommodate existing uses and buildout plan for The Baylands, the existing on-site wastewater collection system and associated facilities will be completely replaced in phases. At full build-out, the proposed wastewater collection system will be designed to meet the standards of the City of Brisbane and the site-specific design criteria.

4.2.1 PROPOSED SANITARY SEWER DEMANDS

Based on The Baylands water demands included in Table 3.2.2 of Section 3 of this report, the sewer unit demands are approximately 95% of the proposed domestic water demand and 100% of the indoor non-potable water demand. The following Table 4.1 lists the sanitary sewer demands for The Baylands:

TABLE 4.1. PROPOSED SANITARY SEWER DEMANDS

Land Use	Sewer Demand (GPD)	Average Daily Sewage Generation (MGD)	Peak Daily Sewage Generation (MGD)
Residential	225,910	0.23	1.13
Office/Workspace	216,645	0.22	1.08
Biotech	566,042	0.57	2.83
Retail/Community	6,452	0.01	0.03
Hotel	77,520	0.08	0.39
Total	1,092,569	1.09	5.46

4.2.2 SEWER SYSTEM DESIGN CRITERIA

Designs for sanitary sewer infrastructure in The Baylands is informed and constrained by environmental and geotechnical factors. Given the presence of compressible soils and waste material undergoing decomposition, the design of the sewer system considers large anticipated settlements and maximize impermeability to leachate and other environmental contaminants present at the site. Based on site specific conditions and the 2017 SSMP, the following design criteria were used to develop the conceptual sanitary sewer system design, layout, and model:

• Design/Peak Flows	Average Daily Flow times Peaking Factor
• Peaking Factor (includes I/I)	5 times
• Inflow/Infiltration	Included with Peaking Factor
• Average Dry Weather Sewage Generation Flow	1.09 mgd
• Peak Wet Weather Sewage Generation Flow	5.46 mgd
• Manhole Spacing Distance	300 feet
• Pipe Material	Fusion-welded HDPE SDR35
• Pipe Roughness Factor	0.013
• Minimum Cover to Finished Grade	3 feet
• Maximum Manhole Depth	15-feet for 48-inch diameter manholes 22-feet for 60-inch diameter manholes
• Minimum Gravity Sanitary Sewer Size	8-inch diameter
• Minimum Force Main Sanitary Sewer Size	4-inch diameter
• Minimum Building Lateral Service Size	4-inch diameter
• Maximum Depth of Flow for Pipes at Design Flows	10-inches and smaller: 1/2 full 12-inches and larger: 2/3 full
• Minimum Pipe Cleansing Velocity at Design Flow	10-inches and smaller: 3 fps 12-inches and larger: 2 fps
• Maximum Pipe Cleansing Velocity	10 fps
• Minimum Pipe Slope	10-inches and smaller: 0.0036 12-inches and larger: 0.0024

4.2.3 PROPOSED SEWER SYSTEM PIPE MATERIAL

Fusion-welded HDPE pipe is proposed for both gravity and force main lines. Fusion-welded HDPE is flexible and has a greater capacity to handle the large anticipated settlements at The Baylands. In addition, fusion-welded joints prevent water intrusion and significantly limit Inflow and Infiltration.

4.2.4 PROPOSED SEWER SYSTEM PUMP AND LIFT STATIONS

A series of energy-efficient pump and lift stations will assist in wastewater flow conveyance between the gravity and force mains, and will be located to minimize pipe depth and encroachment into the landfill cap and shallow groundwater. Pump station designs will include axial or centrifugal pumps with redundant pumps, warning lights, and emergency generators to provide uninterrupted operation during power loss. As shown on Figure 4.2, it is anticipated that 10 pump/lift stations will be required to provide the required flow, cover, and clearance to the landfill cap. Final locations, quantity and sizing of pump and lift stations are dependent on the final geotechnical and settlement analysis, final site environmental reports, groundwater analysis and design-level grading plans.

4.2.5 PROPOSED ON-SITE WASTEWATER SYSTEM

4.2.5.1 WASTEWATER RECYCLING FACILITY (WRF)

As a means of reducing The Baylands potable water demands, an on-site WRF will supply recycled water for irrigation and proposed building demands, as discussed in Section 5 below. The WRF is proposed to be located east of the railroad tracks within the Infrastructure Development parcel, adjacent to the potential on-site water tank, and is anticipated to require approximately one acre. In addition, the WRF is proposed to be owned and operated by the City of Brisbane. Conceptual design and planning for the WRF is described in greater detail in Technical Document 9 and summarized below.

4.2.5.1.1 WASTEWATER RECYCLING FACILITY (WRF) PLANNING

The WRF is designed to treat wastewater using a combination of mechanical, biological and chemical treatment systems to produce Title 22 Disinfected Tertiary Recycled Water for irrigation and toilet flushing on The Baylands. The specific treatment technology process train will be determined during final facility design; however, for planning purposes, the WRF is anticipated to primarily involve a membrane bioreactor (MBR) system to treat wastewater, which may include a side stream through other natural treatment system. Solids from the WRF are then returned through the force main leaving the WRF for discharge to the SFCS and transported through the municipal sewer system to the SEPCP.

The following key assumptions have been utilized for WRF planning for The Baylands development:

- Onsite treatment will produce disinfected tertiary recycled water conforming to California Code of Regulations Title 22 water.
- Onsite treatment will have an estimated capacity of 0.52 mgd based on a maximum day irrigation demand of twice the peak-month, average day irrigation demand of approximately 0.44 mgd demand plus the average daily demand of 0.08 mgd from other uses.
- An influent pump station (IPS) will be incorporated into the design to regulate flows
- The WRF will treat enough raw sewage to satisfy onsite demands for recycled water.
- During periods of lower recycled water demands, a bypass pump station (BPS) option to ratchet back the volume of flow by diverting “excess” raw sewage to the SFCS via the force main is included as part of the WRF design subject to final approvals. If a higher demand occurs and construction is deemed feasible, the WRF design and capacity could be scaled accordingly.
- Treatment will include coarse screening, grit removal, and fine screening, as well as washing and dewatering. Screening equipment will be redundant to allow one unit to go out of service for maintenance with the other unit continuing to treat raw sewage. Screens and screen cleaning equipment shall be enclosed in a building with negative pressure and air exhausted through a scrubbing system. All dewatered screenings and grit will be compacted and sent to an approved landfill for disposal.
- Storage tanks, pumps, and emergency generators are additional components of the WRF design.
- The WRF will be covered or fully enclosed in a building with air collected and treated through a two-stage odor scrubbing system, likely biological filtration followed by activated carbon polishing.
- Waste activated sludge (WAS) will be pumped into a BSD force main that connects to SFPUC’s collection system.
- All WRF structures will be designed to minimize visual impacts, e.g., installing berms to decrease ground-level visibility; the structures will receive exterior architectural treatment consistent with other Baylands development.

Although not anticipated as part of the WRF, effluent quality from the on-site WRF generally is suitable for discharge under a separate discharge permit, but direct discharge to the Bay is not currently proposed, as it is likely infeasible due to potential time delays associated with obtaining a discharge permit from the SFRWQCB. The process for final selection of the WRF design and phased implementation is based on siting, environmental and economic constraints, with detailed design resolution confirmed during future design and permitting processes for construction.

4.2.5.1.2 WASTEWATER RECYCLING FACILITY (WRF) IMPLEMENTATION AND PHASING

The WRF is proposed to be constructed and operational once 20% of the full Baylands buildout is complete. Prior to reaching 20% of the full buildout threshold, the following options are considered in Technical Document 9:

- Option 1: Construct the BPS at the first phase of development in parallel with supporting sanitary sewer infrastructure serving proposed uses. The BPS would then divert excess sewer flows generated on-site to the SFPUC combined sewer system. No recycled water would be generated under this option and non-potable uses would be supplied by potable water sources until the WRF is operational.
- Option 2: Construct the IPS and BPS in parallel with the initial treatment process with the first phase of development. Since sufficient on-site sanitary sewer flows are not available until 20% buildout is reached, the non-potable water demand would not be met and the project would draw raw sewage from BSD and the City of Brisbane until onsite activates generated sufficient sewage to meet recycled water demands. The WRF would be expanded in phases to meet development program demands.

Phased construction of an on-site WRF will provide wastewater treatment to meet proposed recycled water demand in The Baylands. If permits for the WRF cannot be obtained, construction of an onsite wastewater collection system that discharges to the SFCS line for treatment at the SEPCP is proposed for evaluation and feasibility as sanitary sewer demands and modeling conservatively assumes that the WRF is non-operational to account for maintenance and operational repairs.

4.2.5.1.3 WASTEWATER MANAGEMENT ALTERNATIVES

Based on the system described, the WRF would require an estimated 1 acre, with final size dependent upon equipment selection and facility organization. Figure 4.1 presents a conceptual-level WRF flow schematic.

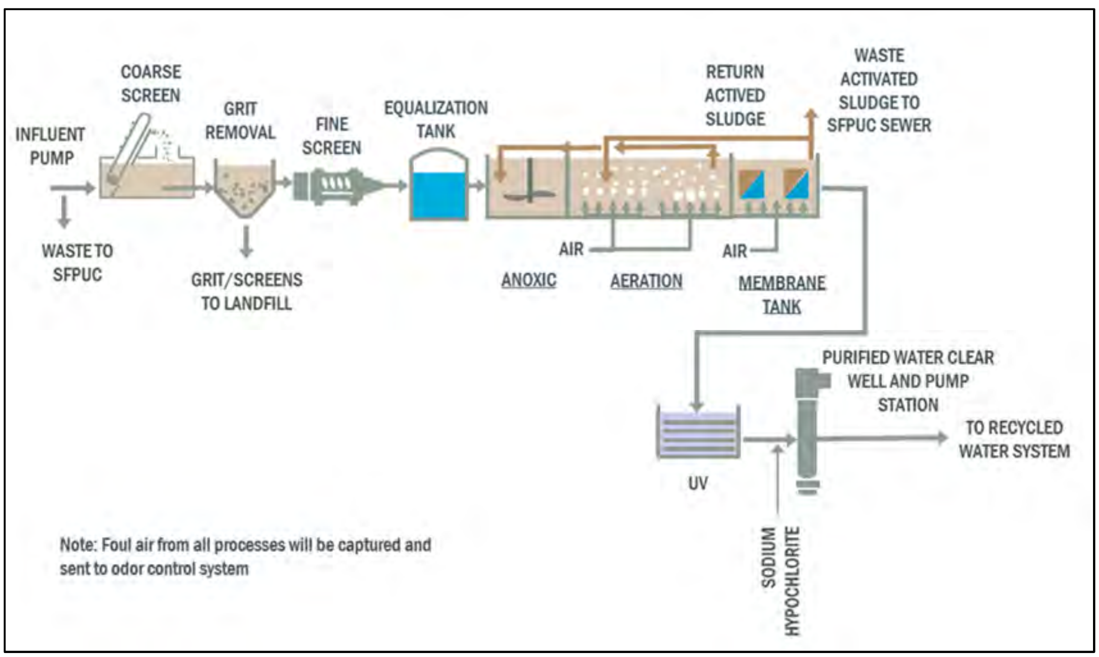


FIGURE 4.1 – CONCEPTUAL LEVEL WRF FLOW SCHEMATIC

4.2.5.2 PROPOSED WASTEWATER COLLECTION SYSTEM

Gravity and force main sanitary sewer mains in combination with pump and lift stations will collect and deliver sewer flows from the development to the WRF. Figure 4.2 identifies the conceptual wastewater collection system layout and pipe sizes. Conceptual sanitary modeling results of the proposed sanitary sewer system shown on Figure 4.2 are included in Technical Document 8.

4.2.5.2.1 PROPOSED WEST SIDE WASTEWATER COLLECTION SYSTEM

On the West Side, wastewater will be collected and conveyed through two subareas—one north of Geneva Avenue in the Bayshore District and one on the southside side of Geneva supporting the Icehouse and Roundhouse Districts. Each subarea conveys wastewater flows through a series of gravity mains and in-line lift stations culminating at the JPB corridor, where flows are then pumped underneath the JPB corridor into the proposed The Baylands WRF on the East Side.

4.2.5.2.2 PROPOSED EAST SIDE WASTEWATER COLLECTION SYSTEM

For the East Side, wastewater will be collected and conveyed through the following three subareas:

- Wastewater flow from the portion of the East Side between the Brisbane Lagoon and Visitacion Creek is collected in a series of gravity mains. In combination with piping system, pump and lift stations convey flow to a new pump station located adjacent to the intersection at the northeast corner of the Kinder Morgan Tank Farm. The wastewater flow is then pumped to the WRF.
- Wastewater flow from a portion of the northernmost area of the East Side around Geneva Avenue is collected by a series of gravity mains. In combination with piping system, a pump station adjacent to northwestern corner of the East Side at Tunnel Avenue will pump wastewater flow to the WRF.
- For the East Side between the Geneva Avenue and Visitacion Creek supporting commercial land uses, wastewater flow is collected by a series of gravity mains and lift stations to the WRF.

Final designs will be confirmed during future detailed design documentation and permitting for the construction on the infrastructure.

4.2.6 FLEXIBLE SANITARY SEWER CONNECTIONS AT BUILDINGS

To accommodate hard edge differential settlement at the interface between a proposed structure and a sanitary sewer lateral service connection, flexible connections with settlement vaults will be provided to mitigate shearing of the utility infrastructure. Figures 4.3 and 4.4 show a typical settlement vault and flexible sanitary sewer connection, respectively.

Alternatively, the Agency accepting the sanitary sewer system may utilize a flexible utility fitting, such as an EBAA Flex-Tend joints at lateral connection or at interfaces between site areas undergoing long-term settlement and areas where settlement is expected to be minimal.

4.3 Proposed System Design and Approval Constraints

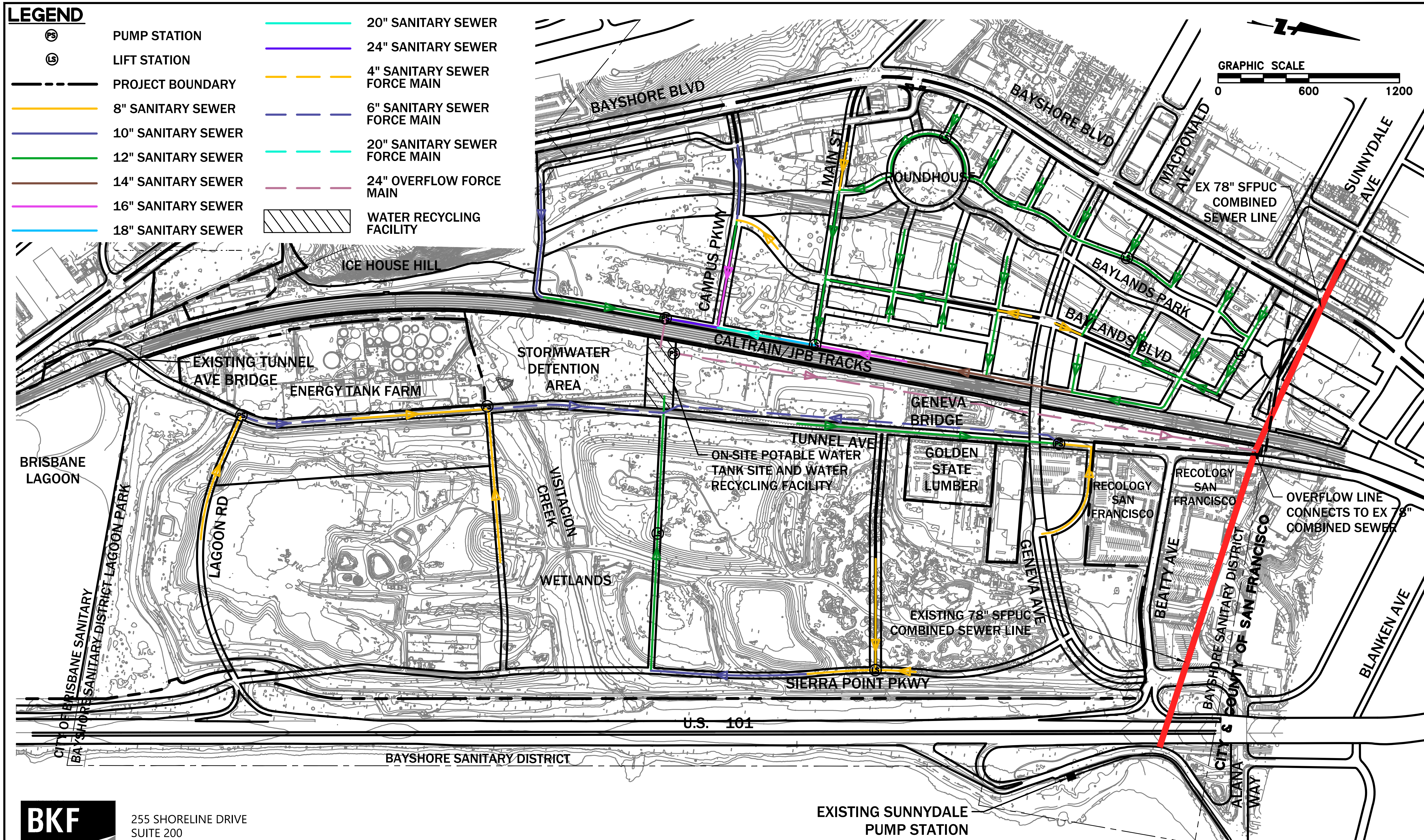
4.3.1 SERVICE AGENCY AND DETACHMENT PROCESS

The Baylands is currently within the BSD service area. The City of Brisbane is interested in adjusting the boundaries of the service boundary area to include The Baylands in the City of Brisbane service area in order to accept ownership and maintenance responsibilities for the wastewater system at The Baylands. This approach provides the City more control over the development and the utilities within its boundaries. The de-annexation process is initiated by either the owners of the properties in The Baylands, or the City and includes coordination with the Lead Agency Formation Commission

(LAFCO). Adequate sewage treatment and export capacity to accommodate development shall be reserved at the time of Specific Plan adoption.

4.4 Master Utility System Plan

A Wastewater System Master Plan will be prepared in coordination with the governing sanitary sewer district accepting the sanitary sewer infrastructure during the development of the final design documents. The Wastewater System Master Plan will include detailed system layouts, specifications, number of pump stations, and pump station design criteria, and phasing of the new wastewater system. Design reports for the new WRF will also be coordinated with the City to determine the design requirements for the new treatment facility.



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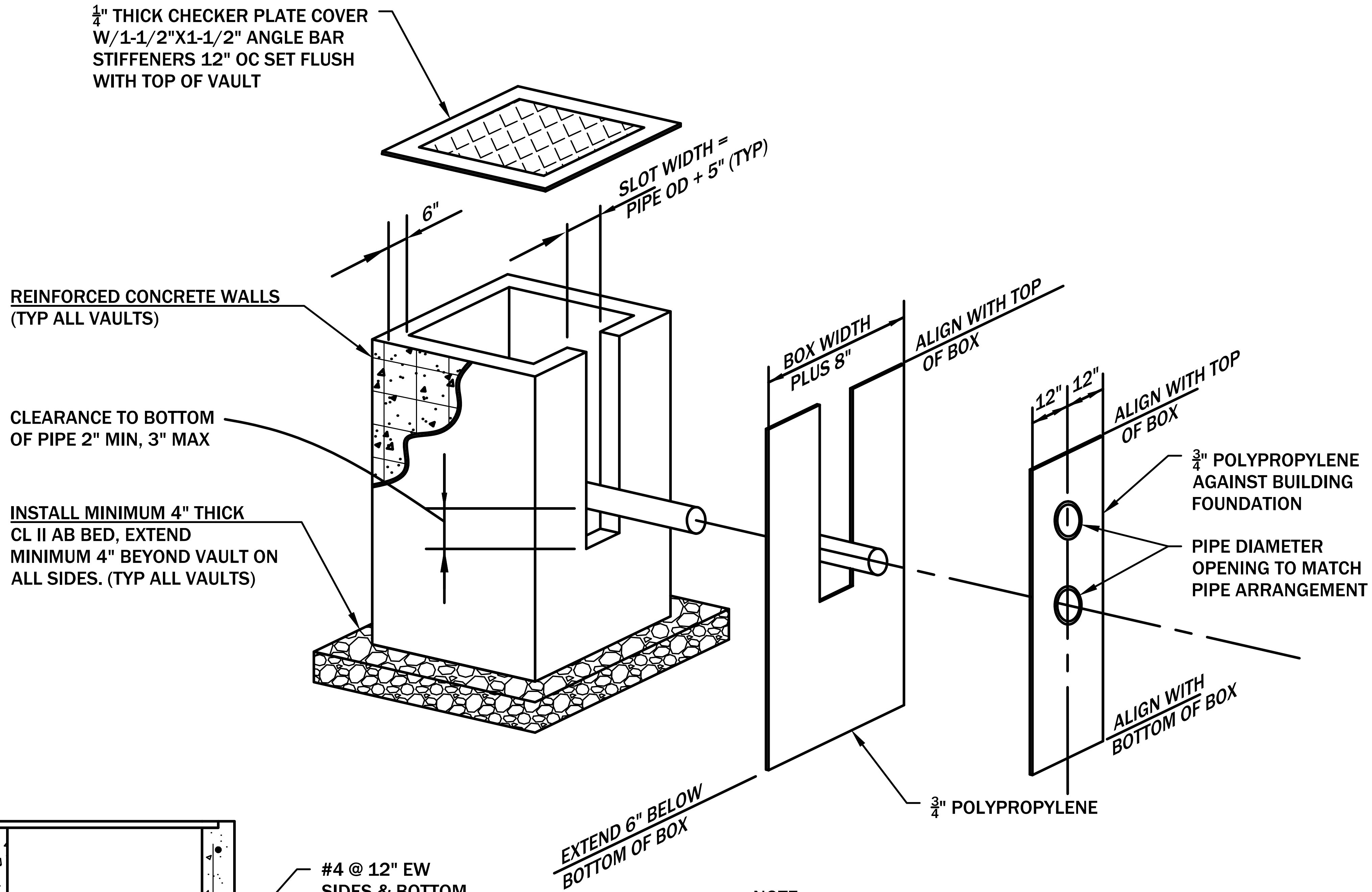
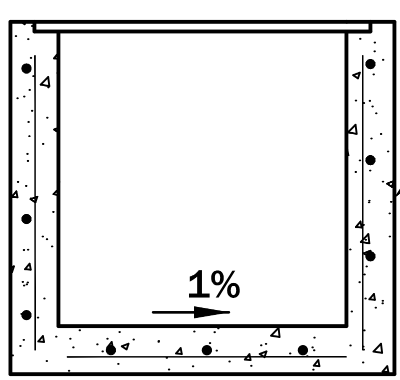
CONCEPTUAL SANITARY SEWER SYSTEM WITH WASTEWATER RECYCLING FACILITY
SCALE: 1"=600'

BRISBANE BAYLANDS
FIGURE 4.2





SECTION

NOTE:

ALL SETTLEMENT VAULTS SHALL HAVE A STAINLESS STEEL PLACED SECURELY FASTENED WITH THE FOLLOWING WORDING:

CONFINED SPACE - HAZARDOUS AREA
CONTACT BUILDING MAINTENANCE SUPERVISOR PRIOR TO ENTRY
ENTRY BY AUTHORIZED PERSONNEL ONLY

CONTRACTOR SHALL PROVIDE A SUBMITTAL TO THE ENGINEER FOR APPROVAL PRIOR TO PURCHASE AND INSTALLATION.

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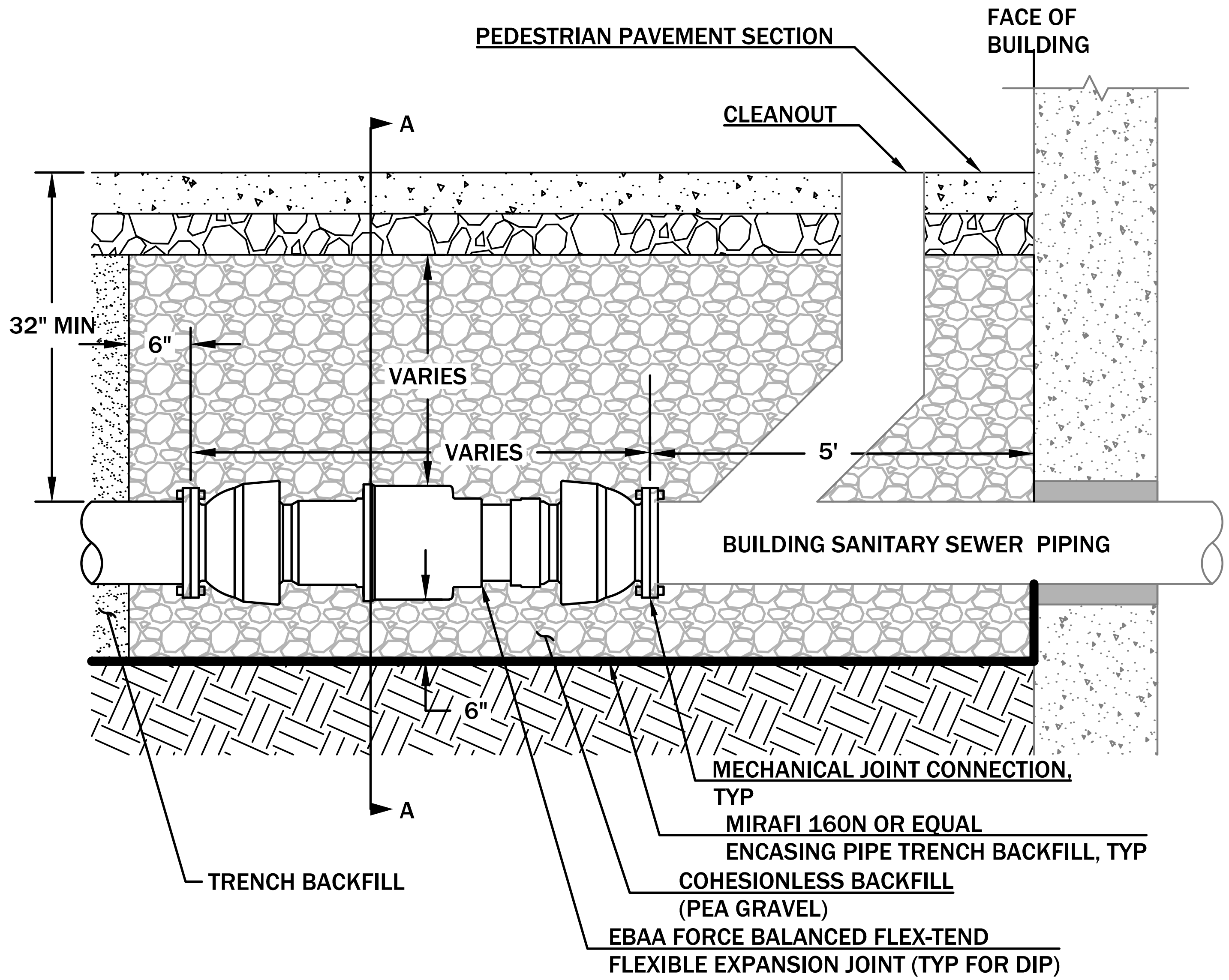
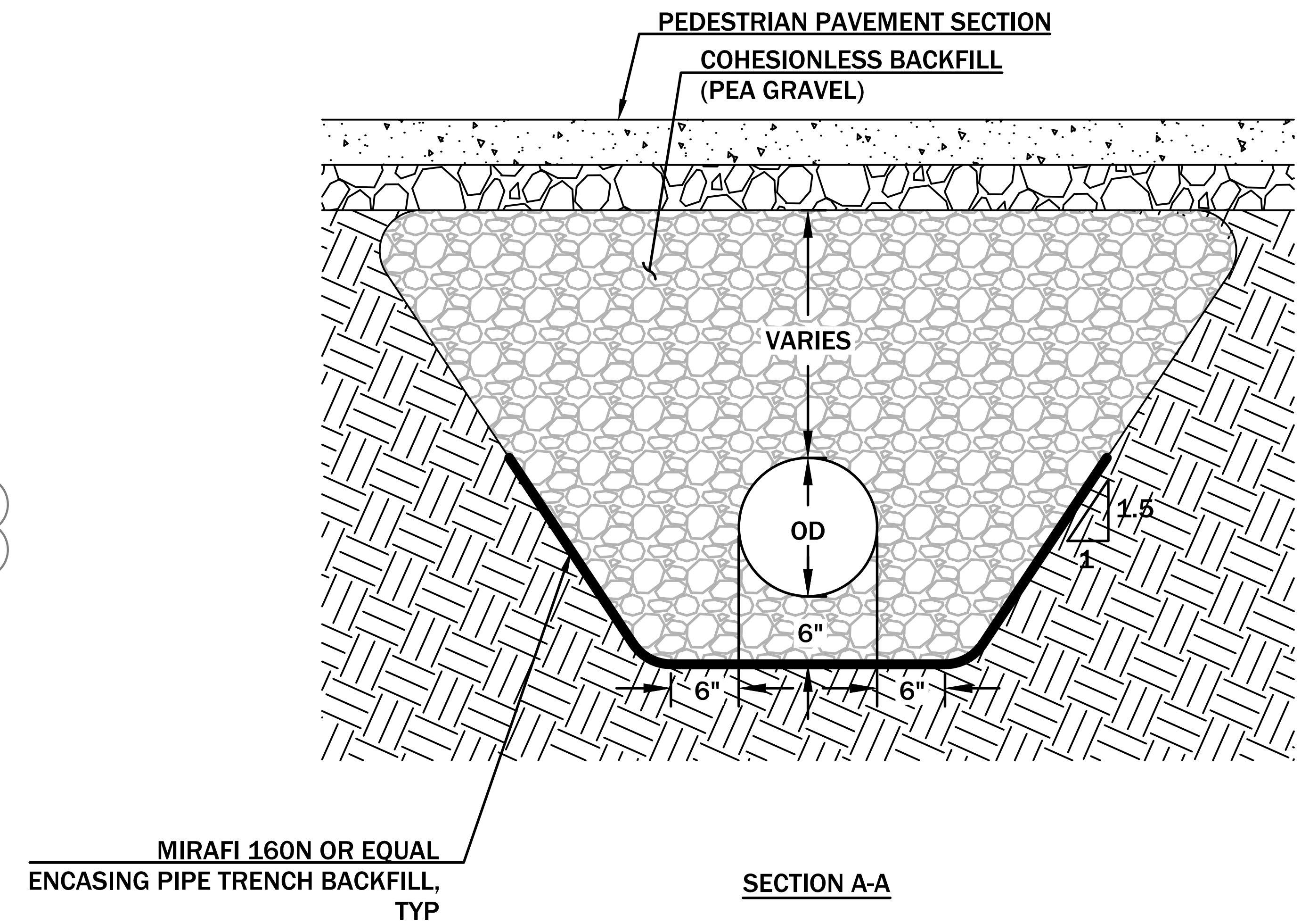
FIGURE 4.3





SECTION A-A

NOTES:

1. UNDERGROUND INSTALLATION OF EBAA EXPANSION JOINTS WILL BE PER MANUFACTURER RECOMMENDATIONS, INCLUDING:
   - COHESIONLESS BACKFILL
   - SLOPE SIDE TRENCHES
   - POLYETHYLENE WRAP

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SANITARY SEWER FLEXIBLE CONNECTIONS

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FIGURE 4.4

5. RECYCLED WATER SYSTEM

The Baylands includes an on-site recycled water system to reduce demand for potable water and meet the sustainability goals as presented in Chapter 04 of The Baylands Specific Plan. The on-site recycled water system is supplied by the WRF. Recycled water generated by the WRF is distributed to uses by way of a separate piping system from the potable water network to prevent unintended use of recycled water and to avoid contamination of the potable water system.

5.1 Existing System

The Baylands site does not currently have a recycled water system.

5.2 Proposed System

5.2.1 RECYCLED WATER DEMAND

Recycled water is proposed for use in irrigating open space areas, roadside planter areas, and landscape water features. To reduce reliance on potable water sources, commercial, office, biotech, and retail buildings are dual-plumbed to supply industrial cooling, non-residential toilet and urinal flushing, and other Title 22 permitted uses.

As described in The Baylands Specific Plan, the open space concept dedicates a minimum of 182.7 acres to diverse typologies of open space, which includes an additional 26 acres of adaptation buffer to accommodate SLR. Of the approximately 494-acre upland area, a minimum of 25 percent of land use is preserved as open space.

Based on The Baylands development program, the maximum recycled water demand in The Baylands is estimated to be approximately 0.30 mgd, which includes approximately 0.22 million gallons per day (MGD) for irrigation use during summer months, and 0.08 MGD for in-building uses year-round. It is assumed that all residential parcels will satisfy indoor water demand with potable water only. A detailed analysis is included in Technical Document 6.

5.2.2 PROPOSED RECYCLED WATER SUPPLY

As described above in Section 4 above, construction of the proposed on-site WRF supplies recycled water to The Baylands and discharge excess sewer flows to the SFCS for treatment at the SEPCP. The WRF is proposed to be located in the Sustainability District within Blocks E1 or E4 and include pump systems to pressurize the recycled water system and deliver the supply to The Baylands.

The sizing of the WRF is 0.52 mgd and based on a summertime maximum day irrigation demand of twice the peak-month, average day irrigation demand of approximately 0.44 mgd demand plus the average daily demand of 0.08 mgd from other uses.

5.2.3 PROPOSED RECYCLED WATER DISTRIBUTION

Distribution piping for recycled water will be provided throughout the development as shown on Figure 5.1. Recycled water distribution mains will consist of a grid of 6-inch HDPE pipe surrounded by an 8-inch to 12-inch HDPE looped system. Final designs for the recycled water system will be confirmed during future detailed design documentation and permitting for the construction on the infrastructure.

5.2.4 PROPOSED RECYCLED WATER STORAGE

Storage for recycled water will be provided according to projected on-site demands of irrigation and other potential uses. Depending on The Baylands demands, the proposed system may require a storage volume of a single max day recycled water demand. Storage for recycled water will be provided at the WRF by either constructing steel or concrete storage tanks or within a clear well sized to include one max day of storage, and/or a combination of constructed wetland areas near the proposed WRF. Pipelines will be constructed to allow for connection of these storage facilities to the distribution system.

Construction of the water storage tank would occur at the same time as the construction of the WRF, which is described in Section 4.2.5 above.

5.3 Flexible Service Connections at Buildings

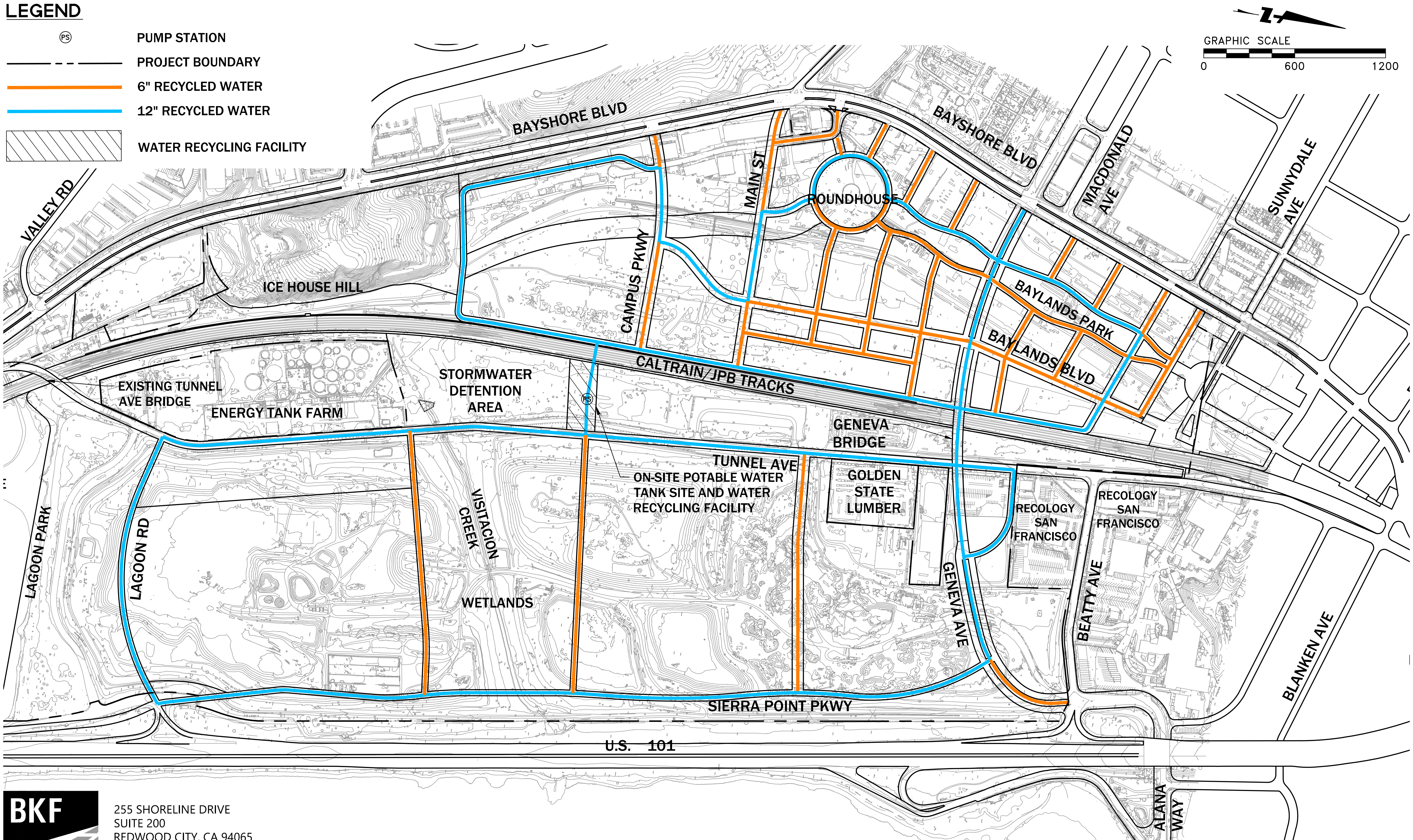
Should recycled water be delivered to dual plumbing systems within the proposed buildings, flexible service connections may be implemented. To accommodate hard edge differential settlement at the interface between a proposed building and a recycled water lateral service connection, flexible connections within settlement vaults may be provided to mitigate shearing of the utility infrastructure. Figures 5.2 and 5.3 show a typical settlement vault and flexible recycled water connection, respectively.

5.4 Master Utility Plan

A Recycled Water Master Plan will be prepared in coordination with the City of Brisbane during the development of design documents. The plan will include the recycled water plant design requirements (in coordination with The Baylands Wastewater Master Plan), detailed layouts, hydraulic calculations for the recycled water system, and system phasing plans.

5.5 Sustainability

As described in Chapter 04 of The Baylands Specific Plan, the use of recycled water for irrigation and building plumbing is a major sustainability component of The Baylands. The construction of the recycled water plant will supply the irrigation demand for the open space landscaping included in the Specific Plan, as well as proposed fixtures in the commercial, office, biotech, and retail buildings. The supply of recycled water will achieve the goal of reducing the overall consumption of potable water from the municipal supply.



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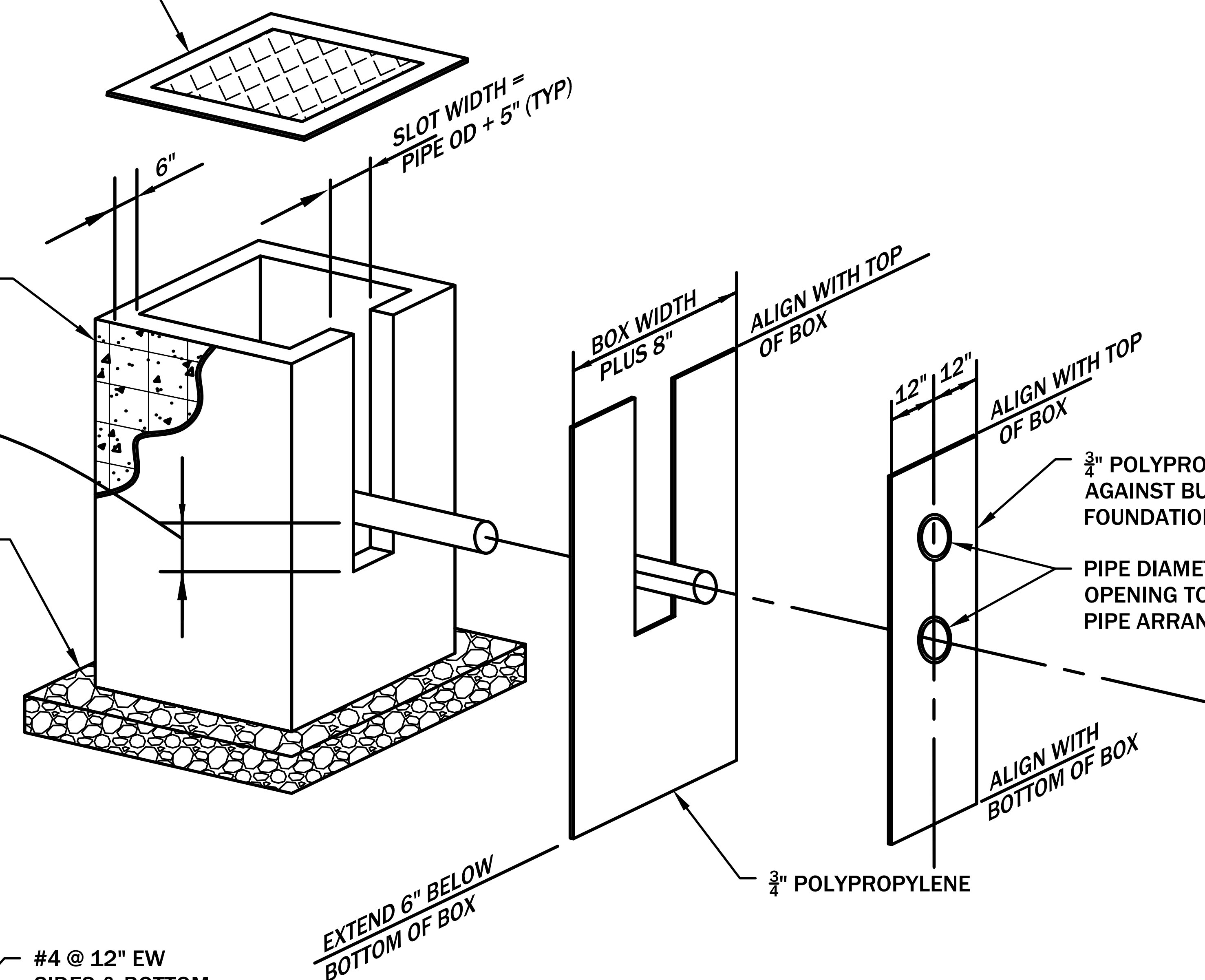
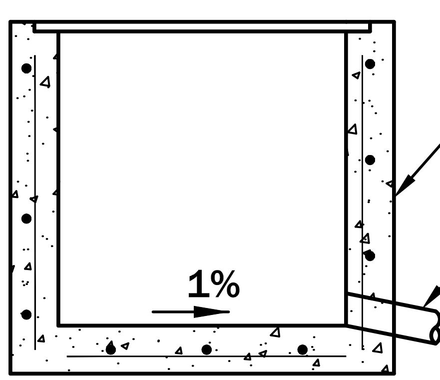
CONCEPTUAL RECYCLED WATER SYSTEM
SCALE: 1"=600'

BRISBANE BAYLANDS
FIGURE 5.1





SECTION

NOTE:

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ENTRY BY AUTHORIZED PERSONNEL ONLY

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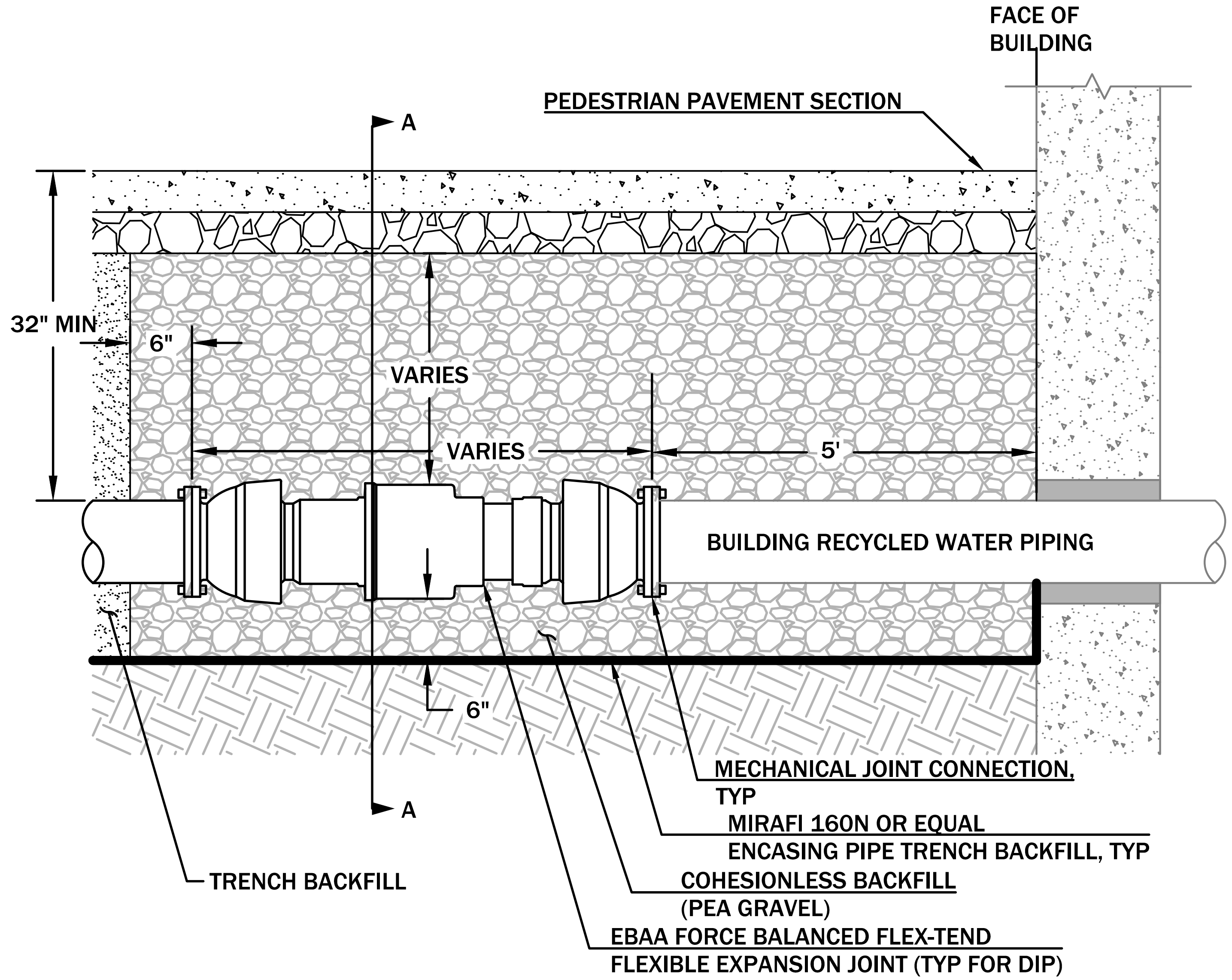
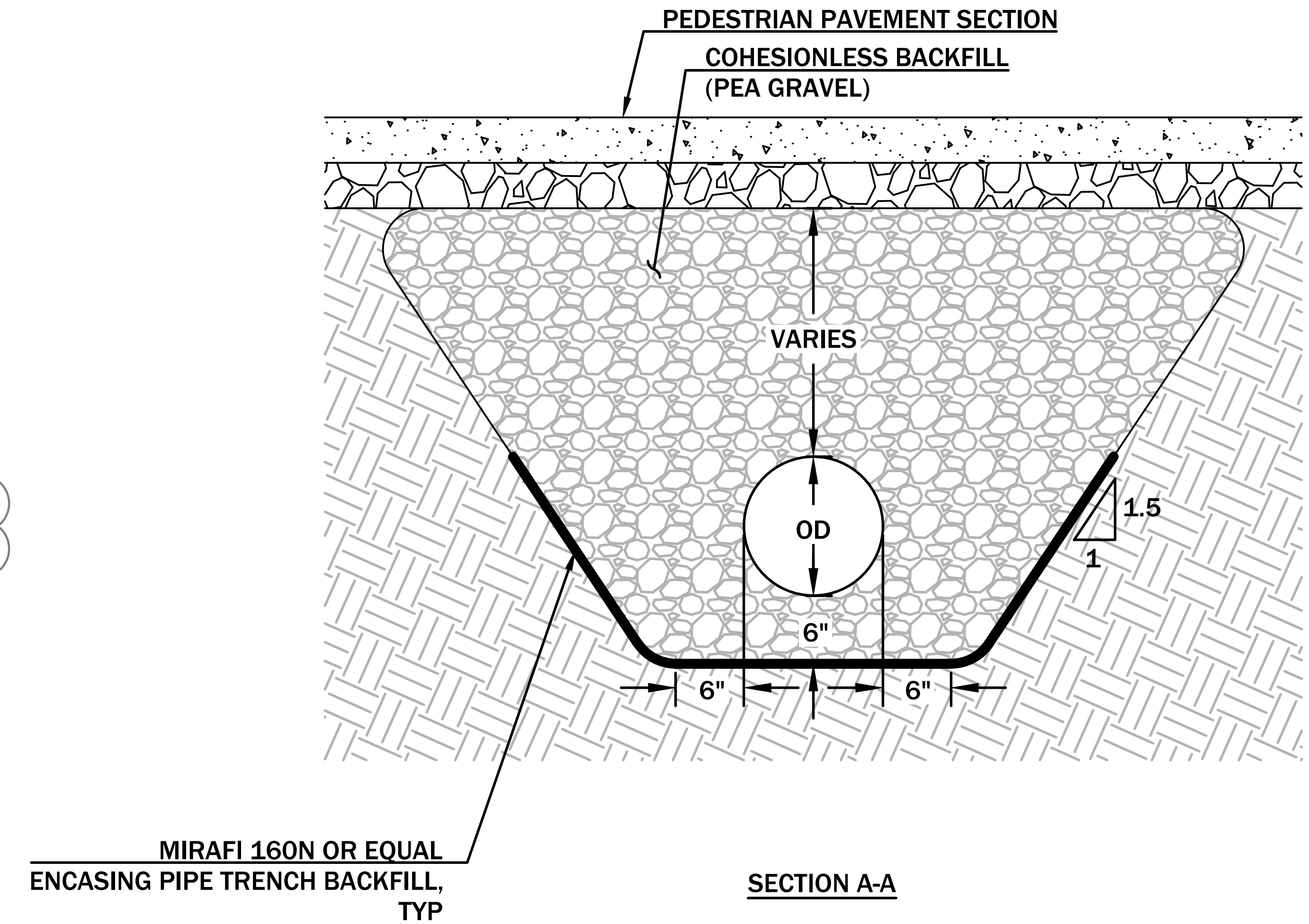
FIGURE 5.2





SECTION A-A

NOTES:

1. UNDERGROUND INSTALLATION OF EBAA EXPANSION JOINTS WILL BE PER MANUFACTURER RECOMMENDATIONS, INCLUDING:
   - COHESIONLESS BACKFILL
   - SLOPE SIDE TRENCHES
   - POLYETHYLENE WRAP

2. WATERPROOFER/MEP/STRUCTURAL ENGINEER TO COORDINATE AND SPECIFY WALL PENETRATION MATERIAL, WATERPROOFING DETAIL, ETC.

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FIGURE 5.3

6. STORM DRAIN SYSTEM

6.1 Existing Storm Water Collection System

The approximately 520-acre (approximately 641.8-acres including the Brisbane Lagoon) of The Baylands is located within the following three existing drainage areas:

- Bayshore: 422 acres
- Brisbane Lagoon: 52 acres
- Beatty Avenue: 46 acres

Existing storm drain pipes, structures, and pumps in the East Side will be removed and/or replaced to allow for installation of the proposed landfill cap and other measures required to complete the landfill closure. Existing pipes and structures on the West Side will be removed as needed to support re-grading and development of The Baylands and to support actions and requirements of the Remedial Action Plans for OU-SM and OU-2.

6.1.1 BAYSHORE DRAINAGE AREA

The Bayshore drainage area is relatively steep and well-defined, bound on the west and south by the slopes of San Bruno Mountain. The Bayshore drainage area is divided into two sections: The Upper Reach and the Lower Reach. Encircling the upstream portion of the Bayshore drainage area west of Bayshore Boulevard, the Upper Reach manages storm water runoff from portions of Daly City, Brisbane, and the San Francisco watershed. Located entirely within the City of Brisbane, the Lower Reach drainage area conveys the storm water runoff from approximately 422 acres of The Baylands east of Bayshore Boulevard and flow from the Upper Reach drainage area for discharge to the San Francisco Bay through a culvert under Highway 101.

The results of the existing storm drain system model and layout are included in Technical Document 7. Refer to Figure 6.1 for locations of existing significant storm drain facilities.

6.1.1.1 UPPER REACH DRAINAGE FACILITIES

- **Daly City Storm Drain Network:** The Daly City pipe network encompasses the western, upstream portion of the Upper Reach, where the highest elevations are located. Much of the runoff from the steeper areas travels along surface routes through natural channels and street gutters before entering the pipe network. The Daly City storm drain network terminates in a 60inch diameter inverted siphon that discharges to the upper open channel on PG&E's Martin Substation on Geneva Avenue substation.
- **Upper Open Channel:** The Daly City storm drain system discharges from the 60-inch inverted siphon at the eastern end of Midway Village into a 1,300-foot-long open channel. The channel winds its way across the southern portion of the Martin substation and the Levinson Property in Brisbane to Bayshore Boulevard. There it discharges to a 90-foot long 8-foot by 5-foot box culvert connected to 54-inch storm drain culvert under Bayshore Boulevard. In the 1990s, replacement of the existing headwall and inoperable weir at the discharge point of the open channel by the City of Brisbane improved system efficiency by allowing unrestricted flow to the box culvert and subsequent 54-inch storm drain line under Bayshore Boulevard.
- **Levinson Overflow Area:** This 3.8-acre parcel is located across Bayshore Boulevard from The Baylands at the northwest corner of Main Street and Bayshore Boulevard. The entire parcel is currently undeveloped and occasionally ponds due to direct precipitation, overflow runoff from the adjacent Martin Substation, and overtopping of the contiguous upper open channel. Fed by a sideways weir in the upper open channel, an approximately 6.5-foot deep, 2.5-acre detention basin acts to alleviate downstream and Bayshore Boulevard

flooding. During a 100-year design storm event, the water level of the detention basin exceeds the height of the berm and overflows onto Bayshore Boulevard.

- **Bayshore Boulevard Drainage Facilities:** Bayshore Boulevard has an approximate low point of elevation 9 located 450 feet north of the Bayshore box culvert. Bayshore Boulevard is currently drained by a 4-foot by 3-foot box culvert located on the west side of the street and two 24-inch-diameter parallel storm drain lines on the east side of the street. Both the eastern and western portions of the Bayshore storm drain system infrastructure discharge into the 54-inch storm drain pipe under Bayshore Boulevard.
- **Brick Arch Sewer:** Storm water from both the 8-foot by 5-foot box culvert and Bayshore Boulevard drainage facilities discharges through the 54-inch storm drain line under Bayshore Boulevard, into a 3,500-foot long, 7.5-foot high by 8-foot wide brick arch sewer. The Brick Arch Sewer conveys flows from the outlet of the Bayshore Boulevard 54-inch storm drain line along Bayshore Boulevard, through the West Side, and discharges on the East Side after crossing under the JPB corridor railroad tracks. Due to its limited capacity and disrepair, the Brick Arch Sewer is recommended for removal or abandonment as feasible.

6.1.1.2 LOWER REACH DRAINAGE FACILITIES

- **Railyard Drainage Channel:** The existing railroad yard drainage channel consists of an earthen channel that parallels Industrial Way for a length of about 2,400 feet and drains the East Side. The average channel bottom width is about 6 feet, and the average top width is about 18 feet. The railroad yard channel discharges to the brick arch sewer about 500 feet upstream of the JPB corridor railroad tracks.
- **Timber Box Culvert:** The brick arch sewer discharges to a 440-foot long, 5.3-foot wide by 10-foot-high timber box culvert located on the West Side. The timber box culvert conveys flow from the JPB corridor to the lower open channel (see below) approximately 150 feet west of Tunnel Avenue. Due to its limited capacity and disrepair, the timber box culvert is recommended for removal.
- **Lower Drainage Channel:** The lower drainage channel is a 2,400-foot-long section of open earthen channel located on the East Side. The average channel bottom width is approximately 17 feet, with an average top width of approximately 60 feet, and the channel is segmented by three road crossings. The western crossing at Tunnel Avenue and the central crossing consist of double 78-inch diameter culverts. The eastern crossing near the frontage road consists of a single 96-inch diameter culvert.
- **Highway 101 Box Culvert**: The lower drainage channel discharges to San Francisco Bay through a 300-foot long, 12-foot by 12-foot box culvert located under Highway 101.

6.1.1.3 EXISTING FLOODING CONDITIONS WITHIN THE BAYSHORE DRAINAGE AREA

- **Bayshore Boulevard:** The top, or crown, elevation of the brick arch sewer is approximately Elevation 12.3 (approximately 3 feet above the low point on Bayshore Boulevard-Industrial Way). During a large storm event, storm water from the brick arch sewer backflows into the Levinson Detention Basin. When the storm water runoff exceeds the capacity of the Levinson Detention Basin, water overtops its eastern berm and discharges to Bayshore Boulevard. In addition, runoff from the PG&E substation discharges overland to Bayshore Boulevard, increasing the flooding conditions during large storm events.
- **Former Railroad Yard:** As a result of storm water runoff from Bayshore Boulevard and the railroad tracks, ponding occurs in the West Side at the outfall of the railyard drainage channel adjacent to Icehouse Hill. Overflow from the railyard drainage channel, east of and parallel to Industrial Way, further exacerbates flooding conditions during large storm events.
- **Timber Box Culvert:** The existing timber box culvert is unable to convey the flow entering the East Side from the brick arch sewer. Due to disrepair and capacity deficiencies, ponding has been observed during large storm events on a triangular portion of the site north of the timber box culvert and between the JPB corridor railroad tracks and Tunnel Avenue.

6.1.2 BEATTY AVENUE DRAINAGE AREA

At the northeastern portion of The Baylands, approximately 46 acres of the East Side drain into the Beatty Avenue storm drain system. Stormwater runoff is captured by a series of inlets in the local streets and conveyed northerly through a succession of 36-inch and 42-inch reinforced concrete pipes. This system connects to a 42-inch storm drain line on Beatty Avenue between Tunnel Avenue and Alana Way before discharging to a 42-inch diameter storm drain line that crosses under Highway 101. The 42-inch storm drain line connects to the City of San Francisco 78-inch combined sewer main, which ultimately discharges to the Harney Way Box Culvert and into the Sunnydale pump station, located east of Highway 101 on Harney Way in Brisbane.

6.1.3 BRISBANE LAGOON DRAINAGE AREA

Adjacent to the 121.8-acre Brisbane Lagoon, approximately 57 acres of the East Side drain to the Brisbane Lagoon. Flow from the existing surface is conveyed through a series of shallow swales adjacent to Lagoon Way, and discharges through small culverts running under Lagoon Way. Upon exiting the Lagoon Way culverts, the flow continues overland southerly to the Brisbane Lagoon.

6.2 Proposed On-site Storm Drainage System

6.2.1 PROPOSED STORM DRAINAGE SYSTEM DESIGN CRITERIA

The proposed Baylands storm drainage collection system will be designed in compliance with the City of Brisbane requirements, the City of Brisbane *Final Report Storm Drainage Master Plan* (BSDMP) by RBF Consulting, dated November 2003 (BSDMP) and supplemental project-specific storm drainage reports. In combination with the rainfall intensity data for the project area, the rational equation is used to develop runoff volumes and flows. Storm drain pipes and structures are then sized based on the calculated flows using Manning's equation. The preliminary storm drain layout, shown on Figure 6.2, is based on the following criteria from the BSDMP, industry standards, and project specific conditions:

- Pipe Material: HDPE and Concrete Culverts
- Manning's Number: 0.013
- Design Storm Event: 25-year within pipes and 100-year through new streets (BSDMP and Program EIR)
- Tidal Flow: Mean Higher High Water +3-feet, which correlates to an elevation of 8.69 feet (BSDMP)
- Key roadways — Lagoon Road, Tunnel Avenue, Geneva Avenue and proposed Sierra Point Parkway — will remain usable as evacuation routes in a 100-year storm event.
- Mean High Highest Water Level of 5.69 feet, with a risked based shift of 3 (BSDMP)
- Minimum Pipe Slope 0.20 percent after settlement
- 3-feet minimum cover over the top of the pipes and culverts
- Flexible connections at storm drain structures and buildings
- Minimizing pipe depths to prevent deepened trenching into refuse and shallow groundwater areas

6.2.2 PROPOSED STORM DRAIN SYSTEM PIPE MATERIALS

The proposed storm drain piping system consists of fusion-welded HDPE pipe. Where minimal cover is available and large capacity required, shallow concrete culverts will be used to avoid encroaching into the landfill cap installed as part of the landfill closure process in compliance with Title 27 of the California Code of Regulations. The pipes will be connected using fusion-welded joints to limit groundwater infiltration and storm water contamination from leachate or West Side groundwater. Since refuse and bay mud soil conditions are susceptible to significant settlement, fusion-welded joints are designed to be flexible and can withstand tolerable levels of differential settlement.

6.2.3 PROPOSED ON-SITE STORM DRAIN COLLECTION SYSTEM

The results of the proposed storm drain system model and layout are included in Technical Document 7 and described in more detail below.

6.2.3.1 BAYSHORE DRAINAGE AREA

The proposed storm drain piping system for the Bayshore watershed will consist of a series of 18-inch to 66-inch fusion-welded HDPE pipes, as large as 78-inch diameter reinforced concrete pipes, culverts and cast-in-place U-shaped channels. Existing storm drainage pipes, structures, and pumps will be removed and/or replaced to allow for the installation of the proposed landfill cap, RAOs, and other measures required to complete the landfill closure and RDIP implementation. In support of ecological and sustainable infrastructure, the combination of on-site pipes, culverts, and conveyance and catchment structures will direct the storm water runoff to stormwater treatment measures and the freshwater wetlands prior to discharging to the proposed Visitacion Creek. See Figure 6.2 for conceptual locations of proposed storm drainage.

6.2.3.2 PROPOSED DEWATERING STRUCTURES

To convey runoff into Stromwater Treatment areas described in Section 7, some storm drainage facilities will require special manholes to pump treatment flows to treatment facilities. Treatment will occur typically at the point of capture of stormwater runoff. In cases where treatment at point of capture is not feasible, stormwater flow will be captured within the storm drain main when flows enter a manhole at a lower elevation than the outfall invert. At the sump within the manhole a dewatering pump will convey treatment flows to a storm drain force main line at a higher invert elevation. See Figure 6.5 for typical construction details.

6.2.3.3 BEATTY AVENUE DRAINAGE AREA

A combination of proposed site planning and roadway alignments, and revised grading have resulted in shifting approximately 19 acres of catchment area from the Beatty Avenue drainage area to the Bayshore drainage area. This change results in reducing the catchment area of the Beatty Avenue watershed to approximately 27 acres, which helps alleviate existing downstream combined sewer overflows in the Harney Way box culvert. Existing storm drain infrastructure within the 19 acres being transferred to the Bayshore drainage area will be removed. Unless relocation or reconstruction is required to support the development, the infrastructure within the remaining 27 acres within the Beatty Avenue drainage area will be preserved in its current location, and will continue to operate as it does in its current condition. The proposed adjustment in drainage areas is identified on Figure 6.6.

6.2.3.4 BRISBANE LAGOON DRAINAGE AREA

Adjacent to the Brisbane Lagoon, approximately 52 acres of the development at the southern portion of the East Side contribute stormwater flow to the Brisbane Lagoon watershed. The existing culverts under Lagoon Way will be removed as part of the landfill closure process. In support of The Baylands, a minimum of two new outfalls to the Brisbane Lagoon discharge runoff captured in the tributary catchment areas.

Prior to discharging to Brisbane Lagoon, stormwater runoff is treated in compliance with the latest RWQCB Municipal Regional Permit Provision C.3 regulations, and local San Mateo County and City of Brisbane stormwater quality guidelines. Stormwater treatment facilities have been programed into the design of Lagoon Park and The Baylands Preserve to provide treatment of flow tributary to the Brisbane Lagoon This system has not been included in the storm drain model, but will be modeled during the detailed design phase.

6.2.3.5 EXISTING BAYSHORE BOULEVARD AND INDUSTRIAL WAY AREA

Properties adjacent to The Baylands at the intersection of Industrial Way and Bayshore Boulevard, but not part of The Baylands Specific Plan Area, include the Bayshore Sanitary Pump Station and an adjacent property, the existing buildings will remain at the current elevations with property access provided at the existing grades of these sites. Based on the existing conditions, these properties are located either fully, or partially below future 100-year storm HGL elevation with tidal flow and estimated Year 2100 Medium-High Risk SLR. These properties, if they remain at existing grades, will require measures by others to adapt to future conditions. As these buildings are not controlled by the developer and are located at an existing low point along Bayshore Boulevard, the properties may need to be raised, pump stations installed, or another strategy incorporated to protect these facilities from the impacts of anticipated SLR.

6.2.3.6 EXISTING KINDER MORGAN TANK FARM, CITY OF BRISBANE CORPORATION YARD AND JPB TRACKS

Existing Portions of the East Side finished grades adjacent to the existing Kinder Morgan Tank Farm/City of Brisbane Corporation Yard, and Caltrain/JPB tracks will be lower than HGL elevations when the estimated mid-century and end of century SLR estimates are applied adjacent to these areas. Raising grades in these areas is constrained by existing improvements to remain and the need to avoid causing settlement of the railroad tracks. These properties, if they remain at existing grades, will require measures by others to adapt to future conditions. If required in the future in response to sea level rise, drainage systems in the areas below can be installed with pump stations and back flow devices in order to protect existing streets and buildings during large storm events subject to approval of the City of Brisbane and property owners.

6.3 Proposed System Wide Storm Drain Improvement Projects

In response to the Brisbane Storm Drain Master Plan (BSDMP), improvements to the existing City and private storm drainage facilities are identified at certain onsite and offsite locations in order to increase capacity and convey runoff from both the proposed development and existing City streets. Descriptions of the proposed designs to address recommended capital improvements are as follows:

6.3.1 BAYSHORE BOULEVARD IMPROVEMENTS

Currently, during a 100-year storm event with tidal flow, up to 2.5 feet of flooding occurs for a period of 176 minutes near the Bayshore Boulevard- and Industrial Way intersection. Bayshore Boulevard drainage inlets fronting the Levinson Overflow area are proposed to be hydraulically isolated from the existing Bayshore system and brick arch sewer, which is proposed for removal. In addition, a new large drainage inlet structure is proposed to be installed near the existing low point. These improvements act to both reduce flooding conditions and increase the conveyance capacity of the Bayshore Boulevard storm drainage system. Stormwater flows are then routed through the West Side to the proposed Visitacion Creek within The Baylands through a U-Channel and culvert(s) that discharges to Visitacion Creek east of the JPB corridor. Because of the improvements, flooding during the 100-year design storm event will be reduced to approximately 1.2-feet over a 109-minute period, and the 25-year design storm event will be contained within the proposed storm drain pipe system.

See Figure 6.2 for locations of the Bayshore Boulevard storm drainage improvements.

6.3.2 VISITACION CREEK IMPROVEMENTS

Visitacion Creek is the main component of Bayshore drainage area. The existing drainage channel between the railroad tracks and U.S. 101 is improved and enhanced with expanded hydraulic capacity, open space, mitigation wetland creation, and ecological environments. In addition to discharges from upstream off-site areas tributary to the site, runoff from The Baylands on both the East Side and West Side is collected in the on-site collection system and then directed to stormwater treatment areas for cleansing. Upon discharge from the stormwater treatment areas, runoff is routed to the freshwater wetlands to support this important habitat area or flows into Visitacion Creek through proposed outfall structures. These structures include the culvert beneath the JPB corridor that outfalls to Visitacion Creek on the East Side. An inline detention area for stormwater storage is proposed adjacent to Visitacion Creek between the railroad tracks and Tunnel Avenue to attenuate the peak runoff rate and volume on the West Side and mitigate flooding on Bayshore Boulevard. Refer to the WMP for more detail.

6.3.2.1 VISITACION CREEK DESIGN CRITERIA

Hydraulically linked to the tidal conditions of the San Francisco Bay, Visitacion Creek will be rebuilt and improved with an open channel design integrated with salt marsh and freshwater wetlands that, as a system, will accommodate the overlapping of a 100-year design storm event, including additional flows from Bayshore Boulevard storm drainage improvements, with tidal flow, and with consideration of estimated low risk SLR estimates through the year 2100. The upstream runoff, 100-year precipitation hydrograph and tidal flows are modeled using the XPSWMM analysis software. Both freshwater and tidal wetlands will be created as part of a cohesive ecological and habitat improvement strategy, while providing slope stability. An impermeable liner will be installed within the channel bottom and side slopes to prevent leachate from permeating the channel. The final designs for the liner or approved alternative will be developed in conjunction with the WDRs and RWQCB review and approval process. Dewatering systems will be required during construction due to the high groundwater table in the area. Given the presence of waste material, extracted water will be disposed per applicable regulations at an off-site location.

6.3.2.2 VISITACION CREEK GRADING GUIDELINES

6.3.2.2.1 TIDAL INFLUENCE DESIGN CRITERIA

As indicated in the BSDMP and the accompanying storm drain model, the current MHHW elevation is approximately 5.69 feet. In addition, when completing the hydraulic analysis, the BSDMP indicates that recent analyses of storm surge have shown that high tides are expected to occur during large storm events. Per the BSDMP, the storm drainage model uses a tidal cycle with a maximum elevation of 5.69 feet with an additional 3 feet risk-based shift overlapped with the 100-year storm event when developing the water levels and HGL within Visitacion Creek.

6.3.2.2.2 FUTURE WATER SURFACE ELEVATIONS DUE TO SEA LEVEL RISE

As indicated above, the storm drainage model uses a tidal flow with a maximum elevation of 8.69 feet overlapped with the 100-year storm event when developing the water levels and HGL within Visitacion Creek. As documented in Technical Document 7, a model was completed to assess the impacts of SLR on the HGL of Visitacion Creek. When the anticipated sea level rise is incorporated into the model, the maximum HGL in Visitacion Creek at the JPB corridor rises to an elevation of approximately 13.4 feet by the end of the century under the low risk aversion SLR estimates.

6.3.2.2.3 VISITACION CREEK GRADING ON THE EAST SIDE

Visitacion Creek grading on the East Side has been designed to accommodate the anticipated mid-century HGL elevations within the creek banks. Based on the adjusted mid-century HGL in the portion of the Visitacion Creek between the railroad tracks and Tunnel Road, the maximum top of bank elevation ranging from 13.6 to 17 feet adjacent to the freshwater wetlands provides approximately 3 to 4 feet of freeboard from the maximum HGL based on the 100-year storm with tidal flow and the 2100 low risk aversion SLR estimate.

At the end of century, it is anticipated that approximately 12-inches of freeboard will be available adjacent to Visitation Creek given an HGL elevation of 13.9 and assuming approximately 2 feet of settlement. In anticipation of on-going settlement of the waste material and to provide freeboard, the top of bank elevations adjacent to the channel may need to be raised as part of future adaptive strategies and the WMP. As required for consistency with the approved WMP, the banks enclosing the Visitation Creek will be designed to be adaptive, where necessary, in order that the top of bank elevation can be raised and the width of the top of bank reduced to provide freeboard.

6.3.2.3 PROPOSED RAILROAD CROSSING CULVERT

To maximize the storage capacity of the in-line detention area between Tunnel Avenue and the JPB corridor railroad tracks, the proposed railroad crossing will be constructed at approximately elevation 2.3 and consist of two approximately 175-foot long, 6.5-foot diameter circular pipes with structural headwalls on each side for structural support of the tracks (See Figure 6.2). The design of the culverts and the adjacent detention area will include backflow prevention solutions through natural or mechanical solutions to prevent tidal influence from reaching the West Side and detention area. Maintenance of the Stormwater Detention Area is focused on preserving the integrity of the ecological focused planting through selective pruning and minimized root system disturbance, maintaining hydraulic capacity, and ensuring side slope stability through non-invasive activities. Alternative designs may be considered during the preparation of final construction documents and pending future coordination with the JPB.

6.3.2.4 VISITACION CREEK DRAINAGE CHANNEL CULVERTS ON THE EAST SIDE

As described in the BSDMP Capital Improvement Project U description, the existing culverts at Tunnel Avenue and Sierra Point Parkway are under-sized and deteriorated. Both of the culverts will be removed and replaced to improve the efficiency of the system. Clear span bridge structure is proposed along Sierra Point Parkway across Visitation Creek, while Tunnel Avenue will be proposed as a bridge or culvert crossing at Visitacion Creek, as shown on Figure 6.2.

6.3.2.5 US HIGHWAY 101 BOX CULVERT AND SAN FRANCISCO BAY OUTFALL

Stormwater from the central drainage channel discharges into the existing 10-foot by 10-foot box culvert under US Highway 101. To reduce friction losses and improve the functional capacity of the box culvert, a thorough cleaning to remove sediment buildup and refuse and repair of large cracks is recommended. During the peak attenuation of the tidal flow and precipitation hydrographs, the San Francisco Bay outfall will be submerged; however, water will not overtop the upstream drainage channel due to excess channel capacity.

6.3.2.6 STORMWATER DETENTION AREA

Runoff from both the hydraulically isolated portion of Bayshore Boulevard and the majority of the proposed West Side outfalls to the culvert crossing through the JPB corridor. To support the attenuation of peak flows, an in-line detention area on the East Side is also proposed between the railroad tracks and Tunnel Road, providing approximately 45.2 acre-feet of storage. The design of the culverts under the railroad tracks and the adjacent detention area will include backflow prevention solutions through natural or mechanical solutions to prevent tidal influence from reaching the West Side and detention area. In addition, the detention area was sized to both replace lost surface storage within the Railyard due to implementation of the Baylands and to reduce the depth and duration of ponding during large storm events at the Bayshore Boulevard Industrial Way intersection. Upon exiting the detention area by flowing through a new bridged or culvert crossing to be constructed as part of The Baylands, under Tunnel Avenue, surface water will continue easterly through Visitacion Creek toward the San Francisco Bay.

Maintenance of the Stormwater Detention Area is focused on preserving the integrity of the ecological focused planting through selective pruning and minimized root system disturbance, maintaining hydraulic capacity, and ensuring side slope stability through non-invasive activities.

6.3.2.7 FRESH WATER WETLANDS

As part of the wetland program, freshwater wetlands are proposed to be hydrologically supported by surface water volume and flows from The Baylands development. Prior to conveyance to freshwater wetlands, runoff is proposed to be treated in compliance with RWACB Municipal Regional Permit Provision C.3 to filter particulates and potential pollutants. Treatment methods are described in Section 7 below and will be chosen based on available space and storm drain depth for drainage area. In addition, energy dissipation, where appropriate, is proposed to be provided upstream of the wetlands to alleviate potential damage to the wetlands from larger storm flows. Refer to the WMP and Figure 6.2 for more detail.

In addition, created wetlands will be planted as part of a cohesive ecological and habitat improvement strategy, while providing slope stability. An impermeable liner is proposed below the channel bottom and side slopes to isolate landfill leachate from the Creek flows.

6.3.2.8 TIDAL WETLANDS

As another component of the wetland program, tidal marsh wetlands are proposed to be established along the intertidal areas of Visitacion Creek. Stormwater flows from the West Side, to an in-line detention area before discharging to the creek. The freshwater wetlands are proposed to release into Visitacion Creek through a seepage berm and weirs during larger storm events.

6.3.2.9 FLEXIBLE STORM DRAIN CONNECTIONS AT BUILDINGS

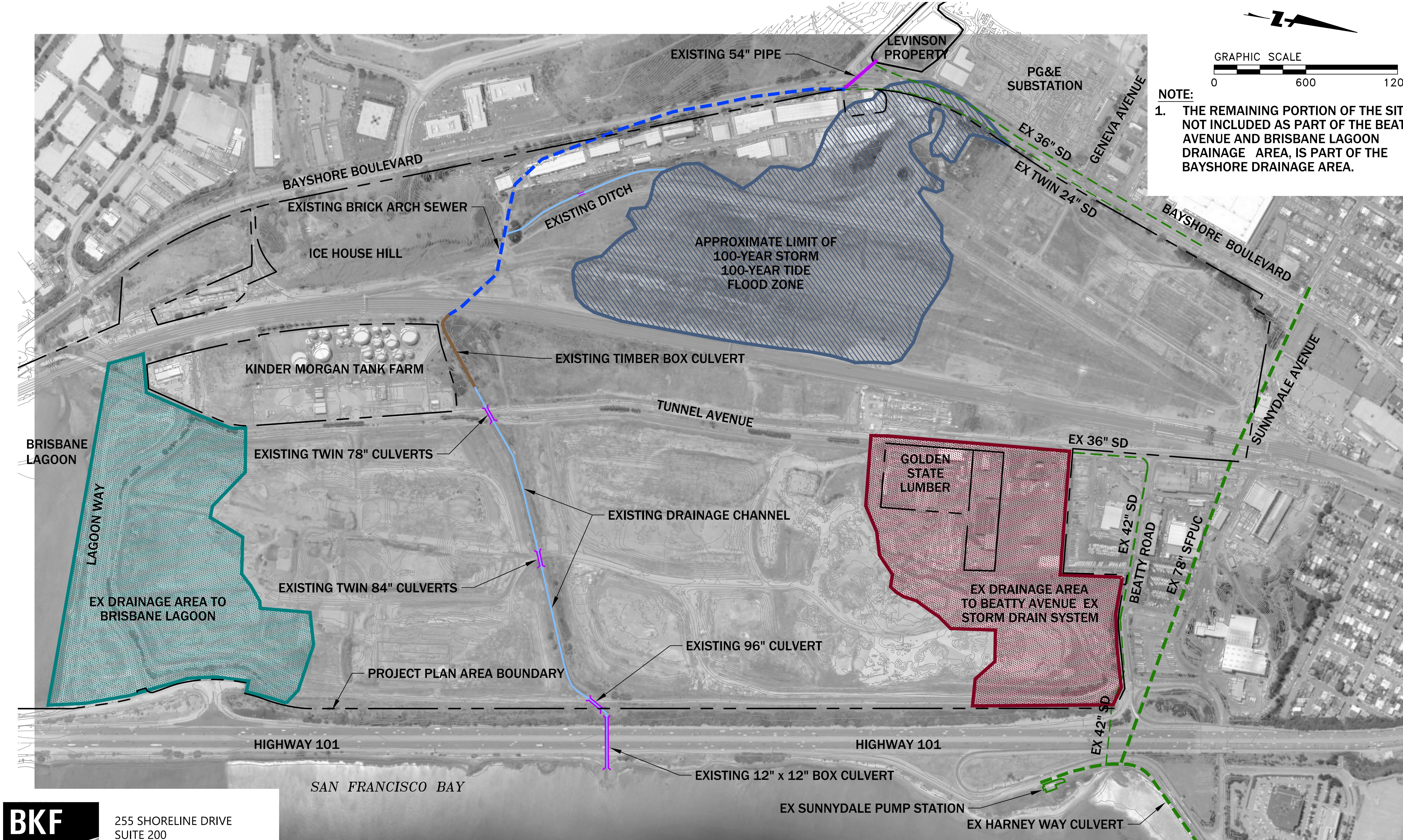
To accommodate hard edge differential settlement at the interface between a proposed structure and a storm drain lateral service connection, flexible connections with settlement vaults may be provided to mitigate shearing of the utility infrastructure, where necessary. Figures 6.3 and 6.4 show a typical settlement vault and flexible storm drain connection, respectively.

6.4 Proposed Phases of Storm Drainage Construction

The replacement of the existing storm drainage system will be completed concurrent with the Building Construction Phases and the replacement of the other utility systems. As much of the existing system as feasible will remain in place as long as possible during the early phases of infrastructure construction in order to maximize the efficiency of construction and to minimize the amount of disruptions to the existing uses.

6.5 Master Utility Plans

A Storm Drainage Master Plan, Storm Water Management Plan (see Section 7) and a SWPPP will be developed in coordination with the City of Brisbane during the development of the design documents. These plans will include a detailed review of the storm water treatment alternatives, hydraulic calculations, BMPs, system layouts, phasing plans, and maintenance requirements.



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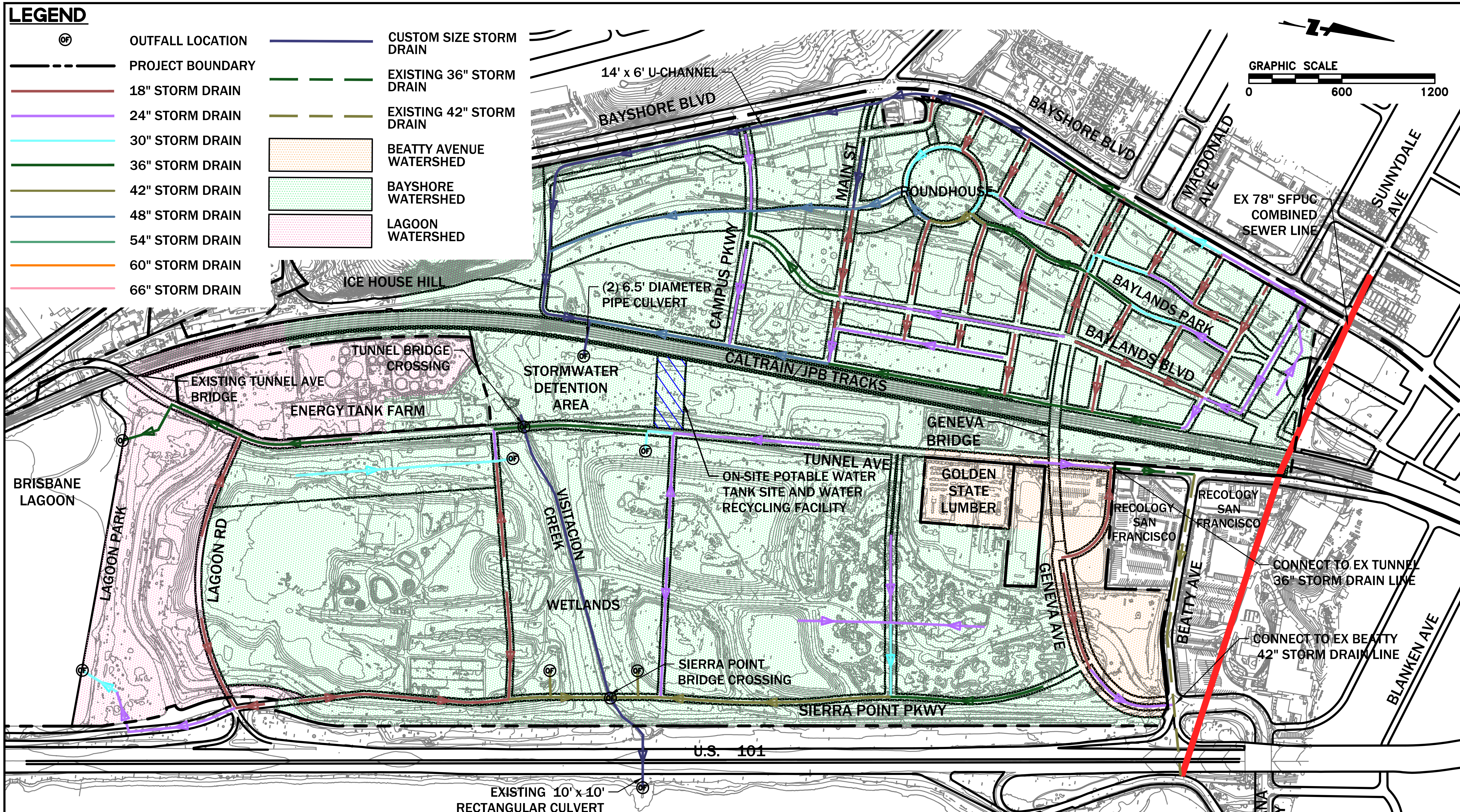
EXISTING STORM DRAINAGE SYSTEM
SCALE: 1"=600'

BRISBANE BAYLANDS
FIGURE 6.1



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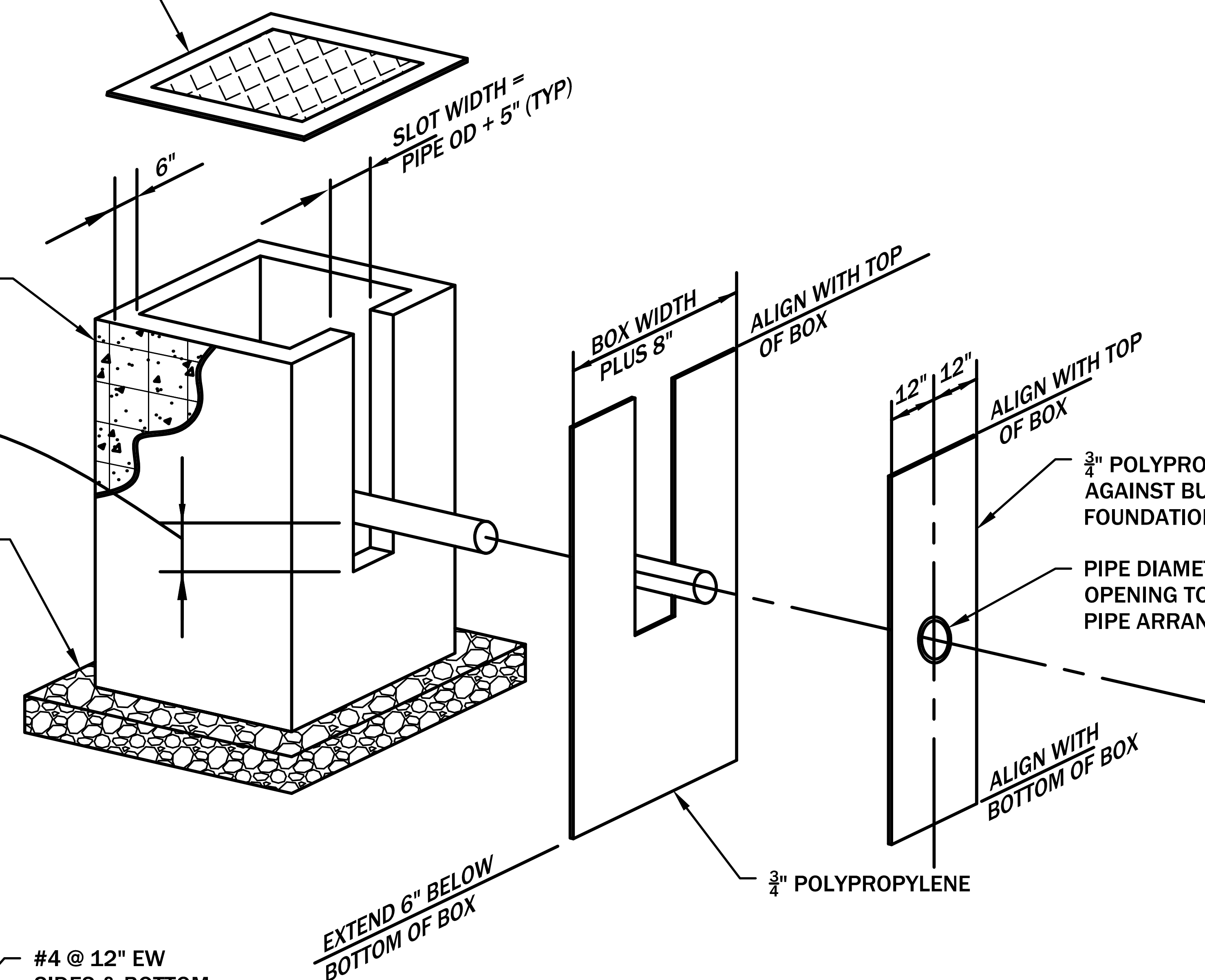
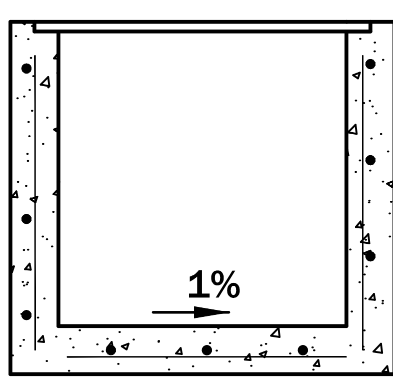
CONCEPTUAL STORM DRAINAGE SYSTEM

SCALE: 1"=600'

BRISBANE BAYLANDS

FIGURE 6.2





SECTION

NOTE:

ALL SETTLEMENT VAULTS SHALL HAVE A STAINLESS STEEL PLACED SECURELY FASTENED WITH THE FOLLOWING WORDING:

CONFINED SPACE - HAZARDOUS AREA
CONTACT BUILDING MAINTENANCE SUPERVISOR PRIOR TO ENTRY
ENTRY BY AUTHORIZED PERSONNEL ONLY

CONTRACTOR SHALL PROVIDE A SUBMITTAL TO THE ENGINEER FOR APPROVAL PRIOR TO PURCHASE AND INSTALLATION.

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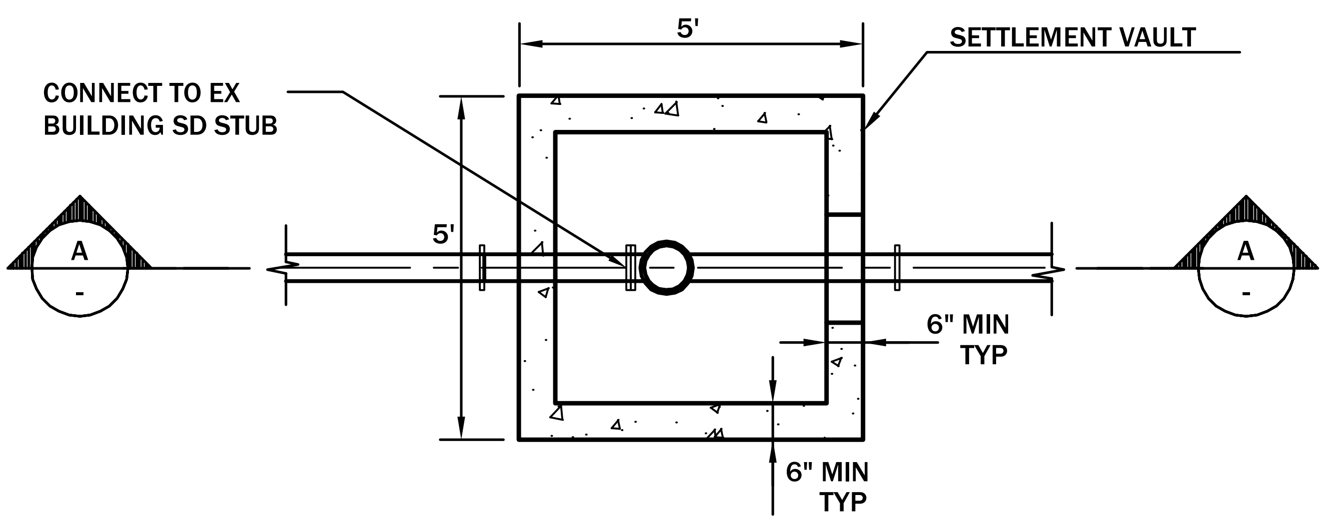
UTILITY SETTLEMENT VAULT

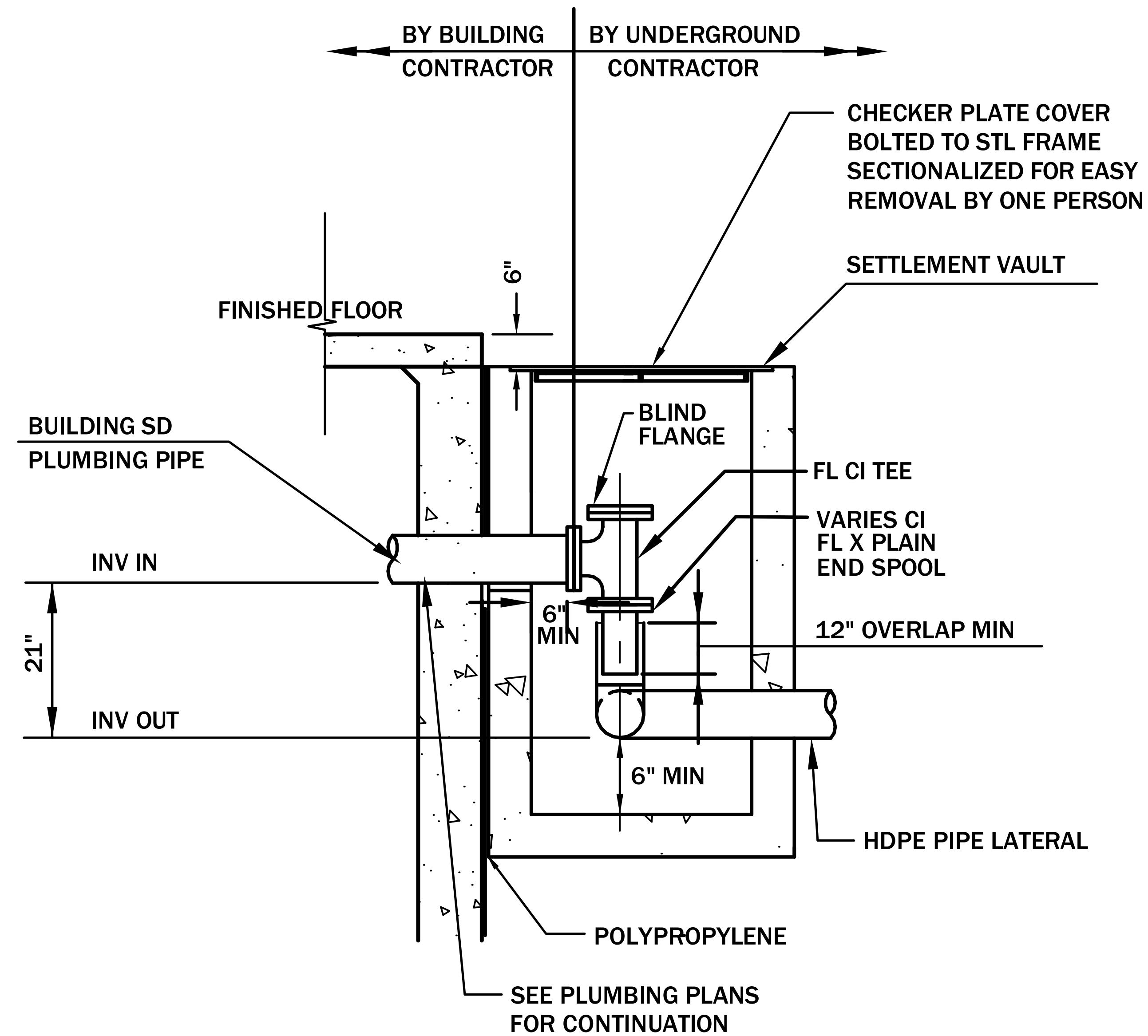
NTS

BRISBANE BAYLANDS

FIGURE 6.3



PLAN



SECTION A-A

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STORM DRAIN FLEXIBLE CONNECTIONS

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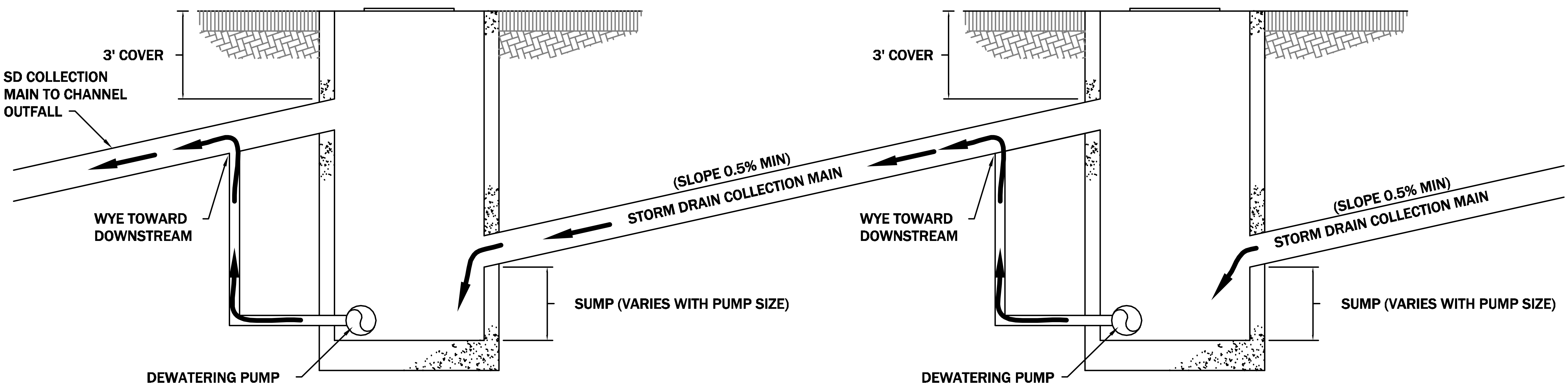
BRISBANE BAYLANDS

FIGURE 6.4



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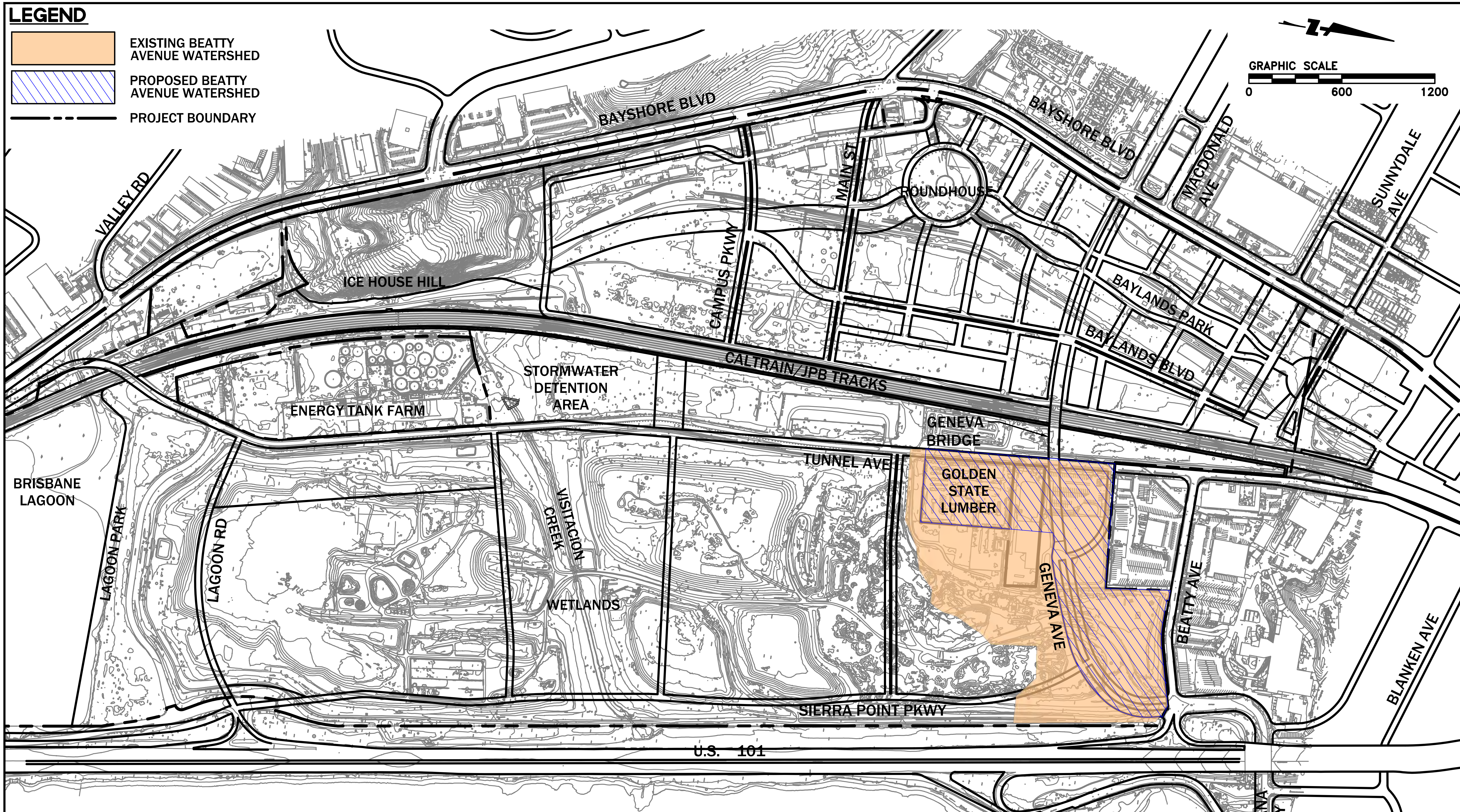
STORM DRAIN MANHOLE WITH PUMP

NTS

BRISBANE BAYLANDS

FIGURE 6.5



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EXISTING AND PROPOSED BEATTY AVENUE WATERSHED
SCALE: 1"=600'

BRISBANE BAYLANDS
FIGURE 6.6

7. STORMWATER TREATMENT

7.1 Regulatory Framework

The San Francisco Bay Region of the California Regional Water Quality Control Board (RWQCB) is responsible for implementing National Pollutant Discharge Elimination System (NPDES) municipal storm water permits throughout the nine counties, including San Mateo County, within its jurisdiction. These permits establish the requirements from storm water treatment prior to discharge into the San Francisco Bay. Since The Baylands disturbs a land area greater than 10,000 square feet, it is considered a Regulated Project and is required to comply with the recently adopted San Francisco Regional Water Quality Control Board Municipal Regional Stormwater Permit Order No. 2015-0049 and as amended by Order No. 2019-0004 Provision C.3 (Provision C.3). Stormwater controls may include a selection of site design and source control measures in combination with stormwater treatment measures required under Provision C.3 to mitigate pollutants post construction.

Provision C.3 recommends that regulated projects evaluate opportunities for incorporating Low Impact Design (LID) strategies, such as stormwater reuse, on-site infiltration, and evapotranspiration as initial stormwater management strategies to reduce water quality impacts. Should these methods prove infeasible at a project site, the RWQCB Provision C.3 permit requires the use of natural, landscape-based stormwater treatment measures as the next preferred means of providing stormwater management and treatment. For The Baylands, the presence of the former Brisbane Landfill that will be closed under Title 27 of the California Code of Regulations, a high groundwater table, and Young Bay Mud limits the site's ability to implement infiltration-based solutions. Where infiltration is limited due to site conditions, stormwater treatment measures will be underlain with perforated storm drain pipe on top of an impermeable liner to prevent both water infiltration into underlying soil and groundwater, and leachate creation.,

As a supplement to Provisions C.3, the San Mateo Countywide Water Pollution Prevention Program C.3 Regulated Project Guide (Guidebook) describes stormwater treatment options, techniques, design, and maintenance requirements. These treatment options vary from "local" improvements at individual building sites to "area wide" concepts such as stormwater treatment ponds and bio-retention areas with large open space areas. Development phasing and site constraints for The Baylands are more suited for local treatment measures, but the development may implement larger area-wide treatment options in open space areas.

7.2 Source Controls and Site Design

While Provision C.3 requirements address treatment of polluted runoff, projects should use site design and planning techniques for pollution prevention and reduction in runoff flows and volumes. This is achieved by minimizing land disturbance and preserving open space, minimizing impervious surfaces, cluster structures, and integrate sustainable landscape designs. Source control measures should also be implemented to limit pollutants from interaction with storm water runoff. Measures can consist of structural features or operational "good housekeeping" practices eliminating or isolating pollutants at their source. Implementation of structural source controls such as roofed trash enclosures, indoor maintenance or equipment areas, and local landscaping or housekeeping measures such as street sweeping, regular storm system or landscaping maintenance, will go a long way to reduce pollutants at their source.

Source controls and site design play an integral part of stormwater control measures to reduce water quality impacts, runoff flows, and volumes created by proposed development.

7.2.1 WETLANDS PROGRAM

In addition to compliance with Provision C.3 and the Guidebook, improved Visitacion Creek and the open space areas will include freshwater wetlands that will receive stormwater runoff from the on-site development. In these areas, a portion of the stormwater runoff generated by on-site development and roadways site will flow to the proposed freshwater wetland mitigation area within Visitacion Creek, which is described in the WMP. Prior to conveyance to the freshwater wetlands, runoff will be treated in compliance with Provision C.3 requirements. The combination of stormwater treatment and the flows routed to the freshwater wetlands will act to improve water quality and to filter particulates and oils.

7.3 Stormwater Treatment Sizing Methods

Based on the Guidebook, stormwater treatment concepts are sized using one of the following methods:

- Flow based sizing
- Volume based sizing
- Combination Flow and Volume based sizing

Treatment concepts are designed to treat storm water runoff to the Maximum Extent Practicable (MEP). As the majority of pollutants are concentrated in the small storms or early stages, known as the first flush of larger storms, Provision C.3 requirements are sized for either the first flush rate or the volume of a small storm. A summary of the treatment sizing methodologies is described as follows:

7.3.1 FLOW-BASED TREATMENT DESIGN CRITERIA

Sizing of flow-based treatment measures is based on the percentile rainfall method. As described in the Guidebook, the percentile rainfall method analyzes data for the hourly depth of rainfall over a long period to determine the 85th percentile hourly rainfall depth. The 85th percentile is then multiplied by two, resulting in a typical Bay Area rainfall intensity value of approximately 0.2 inches per hour (in/hr). As recommended by the guidebook, the 0.2 in/hr rainfall intensity may be used in combination with the rational method to size flow-based treatment measures. When designing flow-based treatment measures, providing a treatment area equivalent to 4% of the total treatment catchment area is an average sizing criterion referenced in the Guidebook for establishing area treatment surface areas.

7.3.2 VOLUME-BASED TREATMENT DESIGN CRITERIA

Volume-based treatment measures are based on an 80 percent or more capture criteria. The 80% runoff capture value is based on the STORM model developed by the Army Corps of Engineers as a method for using continuous simulation to correlate rainfall and runoff with rainfall data. As described in the California Stormwater Quality Association's (CASQA) Stormwater BMP Handbook for New Development and Redevelopment, the 80 percent capture sizing method utilizes drainage area, runoff coefficients, unit storage basin values, and the required capture volume to properly size volume-based treatment measures for compliance with the Guidebook and CRWQCB requirements.

7.3.3 COMBINATION FLOW AND VOLUME TREATMENT DESIGN CRITERIA

Provision C.3 and the Guidebook specify that treatment measures that use a combination of flow and volume capacity shall be sized to treat at least 80 percent of the total runoff over the life of the project. For sites such as The Baylands, where infiltration should be avoided on the East Side, the combination flow and volume design basis may be used for bioretention areas and flow-through planters. In these treatment measures, volume-based treatment is provided when stormwater is stored in the surface ponding area, which generally allows for a reduction in the surface area of the treatment solution from the 4% rule of thumb. The surface ponding area may be sized so that the ponding area functions to retain water before it enters the soil at the design surface loading rate of 5 in/hr required by Provision C.3.

7.4 Stormwater Treatment Solutions

Provision C.3 recommends that projects investigate opportunities to incorporate LID strategies, such as infiltration, stormwater reuse, and evapotranspiration, as primary design strategies. Where these strategies cannot be included in the project stormwater management strategy, such as The Baylands, Provision C.3 allows for the use of natural, landscape-based stormwater treatment measures as the next preferred means of providing stormwater management.

The storm water run-off from The Baylands will be filtered by a combination of treatment measures. Provision C.3-recommended treatment concepts, sized using the flow, volume or the combination-based methodologies, have proven effective stormwater pollutant filtration and reduction on private building sites and public streets. Approaches that The Baylands may include for complying with Provision C.3 include multiple treatment solutions in a treatment train, where water is filtered through a series of treatment options. Where environmentally compatible, the final stormwater treatment concept for The Baylands may include one or a combination of the following treatment options:

- Landscape Dispersion
- Tree Well Filters
- Bio-retention Swale
- Vegetated Buffer Strips
- Flow-through Planter Boxes
- Bioretention Areas and Rain Gardens
- Permeable Pavements
- Interceptor Trees
- Green Roofs (Volume-based)
- Rainwater Harvesting (Volume-based)

Each of the techniques listed above, and others, that may be developed or approved during the course of the project, will have unique aesthetic design issues, space constraints, construction budget implications, environmental and geotechnical constraints, and on-going maintenance commitments. As identified in The Baylands Specific Plan, stormwater runoff within the street cross-sections may be directed to adjacent swales and bio-filtration zones for treatment. Potential treatment locations for street cross-sections shown in Figure 7.2 and additional bio-treatment zones and assumed Parcel treatment area requirements shown in Figure 7.3. Stormwater treatment designs will comply with Provision C.3 such that stormwater runoff is treated prior to discharge to the on-site storm drainage system and Visitacion Creek, which conveys flows to the San Francisco Bay through an existing outfall. Determining which of these techniques, or combination of techniques, is feasible for The Baylands will require a detailed review of the grading concepts, hydrology reports, geotechnical investigations, environmental studies, site plans and architectural concepts for building areas, construction cost analysis for the various techniques, and discussions of maintenance obligations with the City of Brisbane.

7.4.1 CONCEPTUAL TREATMENT OPTIONS

Given the multiple land uses and development phasing, The Baylands may incorporate multiple treatment solutions to achieve the water quality goals of Provision C.3. As shown on Figures 7.1 to 7.3, a conceptual stormwater treatment approach has been developed to identify where potential stormwater treatment measures may be incorporated across the site based on the general use of site areas. In addition, the following discusses treatment measures that The Baylands may incorporate as part of final designs and stormwater treatment strategies:

7.4.1.1 SELF-RETAINING AREAS

Self-retaining areas is a stormwater management concept that involves directing runoff from impervious walkways, pathways and rooftops to adjacent pervious vegetated areas for biological uptake, evapotranspiration, and potentially infiltration. For vegetated areas to provide 80 percent capture of the average annual runoff and thus comply with the Provision C.3 requirements, the vegetated areas must meet the classification of a self-retaining area. Designs of self-retaining areas must comply with the following:

- Surface treatment to include permeable pavement, landscaping or lawn
- Retain the first 1 inch of rainfall without runoff
- Incorporate a maximum impervious to pervious area ratio of 2:1
- Install inlets 3 inches above adjacent grade of the vegetated area
- Grade vegetated areas with perimeter berms or with a concave shape

7.4.1.2 TREE WELL FILTERS

Tree well filters are treatment planter systems integrated with trees typically used to treat smaller areas. These treatment systems can be used in series to treat larger areas and can be integrated into proposed landscaping to provide treatment in constrained urban areas. Runoff is directed from gutter flows into the area between the tree grate and the top of soil media. Then treatment is provided by filtering runoff through an 18-inch subsoil matrix and/or infiltration into the underlying soils. Infiltration through the compacted soil is limited to 5 inches per hour, which limits the available treatment area per tree well. However, tree well filters can be integrated with other treatment systems or larger subsurface areas to increase treatment potential. For areas with high demand for pedestrian space and a landscape planter is not feasible, the tree well filter is a viable alternative.

7.4.1.3 BIO-RETENTION SWALE

Bio-retention swales are open, shallow channels typically in a trapezoidal shape with vegetation on all sides, typically 2 feet deep and 4 feet wide, a minimum of 100 feet in length, and are sized using a combination of flow and volume-based criteria. Swales are easily incorporated into landscaped areas of a site, and provide an aesthetic element to the site in addition to the underlying water quality benefits. Treatment through bio-retention swales is achieved by filtering runoff through the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Bio-retention swales trap particulate pollutants, promote infiltration, and reduce the velocity of stormwater runoff. Generally, runoff is directed to swales via overland flow and drain to the swale through curb openings located approximately every 100 feet. Alternatively, run-off can be pumped into the bio-retention swales where it is impractical for surface water to drain to the swales.

7.4.1.4 FLOW-THRU PLANTER

Sized using combination volume and flow-based calculation methods, flow-thru planters are rectangular in shape with overall depths averaging 3 to 4 feet. Flow-thru planters can be located at ground level, such as within a parking lot, or elevated a few feet against the side of a building to collect drainage from roof water downspouts.

When installed at ground level, the site grades drain directly to the flow-thru planter. However, the treatment flows must be pumped into the treatment planter where site grading constraints prohibit direct gravity flow. Once runoff is discharged to a flow-thru planter, treatment is achieved by allowing biological filtration through the surface vegetation followed by slowly filtering runoff through a bio-retention soil matrix at a rate of approximately 5 inches/hour. The treated runoff is then either collected by a perforated subdrain for discharge to the site storm drainage system and/or infiltrated into the underlying soils. Infiltration is only feasible when permeable silty or sandy soils (Type A or B) are present at the site to permit infiltration and the groundwater table is low enough, typically a minimum at least 10 feet below ground surface, to accept the runoff. The main disadvantage of a ground level planter is that the depth of the subdrain can drive the depth of the entire storm drain system much deeper, resulting in higher construction costs. Given the presence of the landfill cap, Young Bay Mud or a high groundwater table, it is anticipated that infiltration will be limited on-site and treatment facilities will be lined.

7.4.1.5 BIO-RETENTION AREAS AND RAIN GARDENS

A bio-retention area is a large planted, landscaped area used for detaining and treating local runoff. Often viewed as an aesthetic benefit to a site, a bio-retention planter is generally rectangular in shape, yet varying shapes and layouts can be applied to complement proposed landscape designs.

For treatment, the bio-retention area will collect runoff and allow it to infiltrate through the soil matrix to filter out particulate pollutants and debris before collecting in a perforated pipe subdrain and discharging to the storm drain system. Flows may be pumped to the planters where grading constraints do not permit gravity flow. As with the ground level flow-thru planter, the main disadvantage is the depth of the subdrain. For this reason, high ground water can prevent the proper operation of a bio-retention area. If piped drainage enters a bio-retention area by gravity, the subdrain can be very deep and often treatment flows are pumped to avoid this condition. Bio-retention areas can include an impermeable liner where the landfill cap, Young Bay Mud or a high groundwater table prevent water from infiltrating the native soils.

7.4.1.6 PERMEABLE PAVEMENT

Types of permeable pavement include porous Portland Cement Concrete, porous asphalt concrete, porous pavers, and cellular paving grids. Designed using volume-based sizing calculations, permeable pavement areas are installed with relatively flat surface slopes to encourage a greater amount of infiltration while larger flows discharge through an overflow inlet. Site runoff is directed to permeable pavement via overland flow from impervious areas and discharges through openings within the surface to an open-graded subbase or soil matrix below the surface. The permeable pavement collects fine oils, particulate pollution, sediment, and large debris, and traps these pollutants within the pavement and drain rock base. In addition, permeable pavement has been shown to reduce peak flow rates from sites by storing and slowing stormwater runoff as it permeates through its structural section. Where underlying permeable soils and a low groundwater table exist, runoff may be capable of directly infiltrating to the underlying site soils. The permeable pavement section will require an impermeable liner where the landfill cap, Young Bay Mud or a high groundwater table prevent water from infiltrating the native soils. When a line is present, runoff collects through a perforated pipe subdrain that discharges to the storm drain system, and can no longer be considered a treatment measure.

7.4.1.7 INTERCEPTOR TREE CREDITS

Trees within landscaping can help offset 5-10% of the impervious area requiring treatment. Proposed evergreen and deciduous trees can receive credits up to 200 feet and 100 feet of self-treating area, respectively, where placed adjacent to impervious surfaces. In addition, existing trees may receive self-treating area credit up to the area of the tree canopy 4.5 feet above grade. Trees planted for other forms of runoff treatment cannot receive “Interceptor Tree Retention” credits. This treatment measure is typically used to treat small, difficult to treat areas, and is subject to the approval of the municipality. While a difficult treatment method to employ, the credits are invaluable in offsetting treatment for problematic areas.

7.4.1.8 GREEN ROOF

Green roofs are considered “self-treating areas” or “self-retaining areas” and may drain directly to the storm drain. A green roof can be either extensive, with 3 to 7 inches of lightweight substrate and a few types of low profile, low-maintenance plants, or intensive with a thicker 8 to 48-inch substrate. Green roof system planting media should be sufficiently deep to provide capacity within the pore space of the media to capture 80 percent of the average annual runoff.

7.5 Stormwater Treatment Design Considerations

Given the presence of clay soils and a high groundwater table and a landfill cap, opportunities to infiltrate will be severely limited, if not infeasible. In addition, the proposed on-site Wastewater Treatment Plant will provide recycled water for irrigation demands and potentially dual plumbing demands within the proposed buildings, thus the demand for a non-potable water source generated from the treatment of stormwater may be limited. Based on recommendations from the environmental and geotechnical engineers, Non-infiltrating concepts will be used to limit the potential for stormwater runoff to mix with waste materials or other environmentally sensitive areas. Should infiltration-type treatment measures be selected, these facilities will be underlain with a perforated storm drain pipe on top of an impermeable liner to minimize both water infiltration into the Title 27 compliant landfill cap and leachate creation.

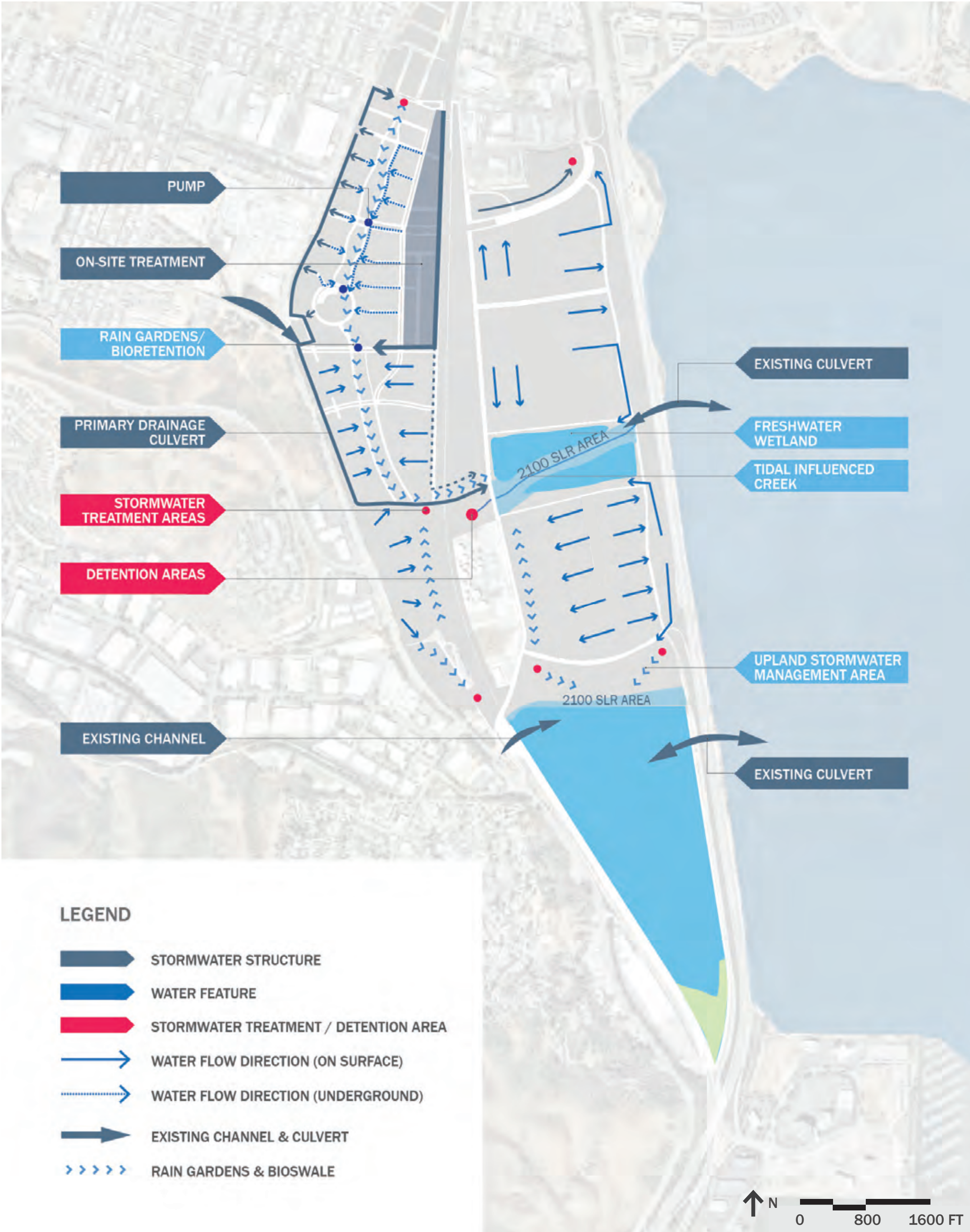
The Baylands will determine the stormwater treatment solution based on drainage area, available treatment area, storm drain depths, and final grading criteria during the design phase. Depending on site specific conditions and locations for The Baylands, the general order of preference for treatment methods would be as follows:

- Landscape Dispersion
- Bioretention Areas and Rain Gardens
- Bio-retention Swale
- Vegetated Buffer Strips
- Flow-through Planter Boxes
- Permeable Pavements
- Green Roofs (Volume-based)
- Rainwater Harvesting (Volume-based)
- Interceptor Trees
- Tree Well Filters

As each method has specific opportunities and constraints the final method will be determined during the design phase.

7.6 Stormwater Control Plan

A conceptual stormwater treatment approach is included as Figure 7.1. Figures 7.2.1 thru 7.2.19 identify locations within the streets that may be programmed with stormwater treatment areas to comply with Provision C.3 and enhance the streetscape. A conceptual stormwater treatment plan with preliminary treatment areas provided is included as Figure 7.3. The selection of stormwater treatment measures and design calculations will be documented and reviewed in detail with the City of Brisbane and County of San Mateo during the construction permitting process to inform the development of the final Stormwater Management Plan (SMP). The SMP will be developed in conjunction with the Storm Drainage Master Plan and construction documents for permitting to ensure that the treatment designs support the hydraulics and hydrology of the proposed storm drainage system. Furthermore, the SMP will act as a guidance mechanism for both construction and post-construction installation and maintenance requirements to promote efficient performance of The Baylands stormwater treatment solutions.



BRISBANE BAYLANDS

FIGURE 7.1 - CONCEPTUAL STORMWATER TREATMENT APPROACH

FIGURE 7.2.1

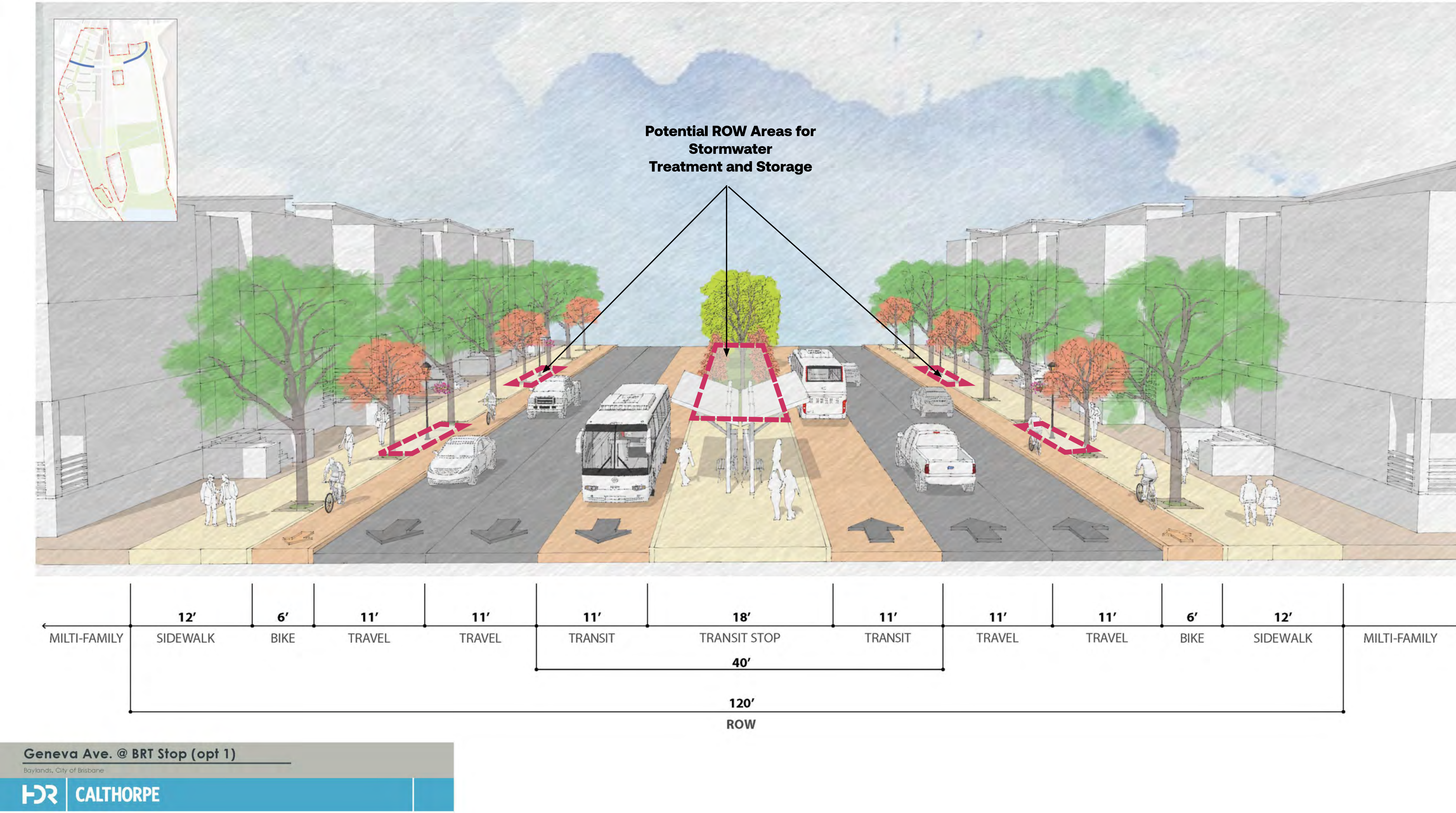
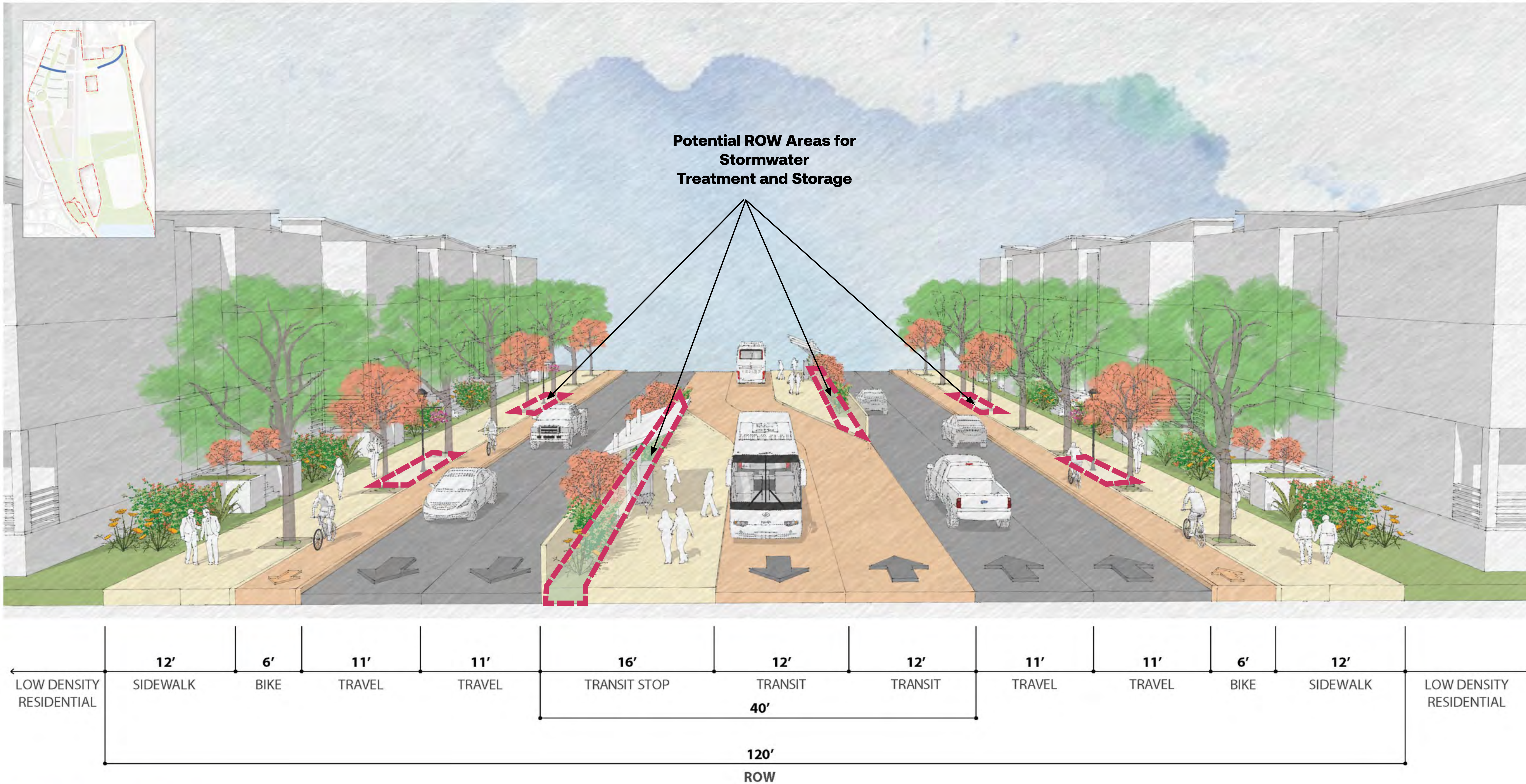

Potential ROW Areas for Stormwater Treatment and Storage
12′
SIDEWALK
6′
BIKE
11′
TRAVEL
11′
TRAVEL
11′
TRANSIT
18′
TRANSIT STOP
11′
TRANSIT
11′
TRAVEL
11′
TRAVEL
6′
BIKE
12′
SIDEWALK
MILTI-FAMILY
MILTI-FAMILY
40′
120′
ROW
Geneva Ave. @ BRT Stop (opt 1)
Baylands, City of Brisbane
HDR
CALTHORPE

FIGURE 7.2.2

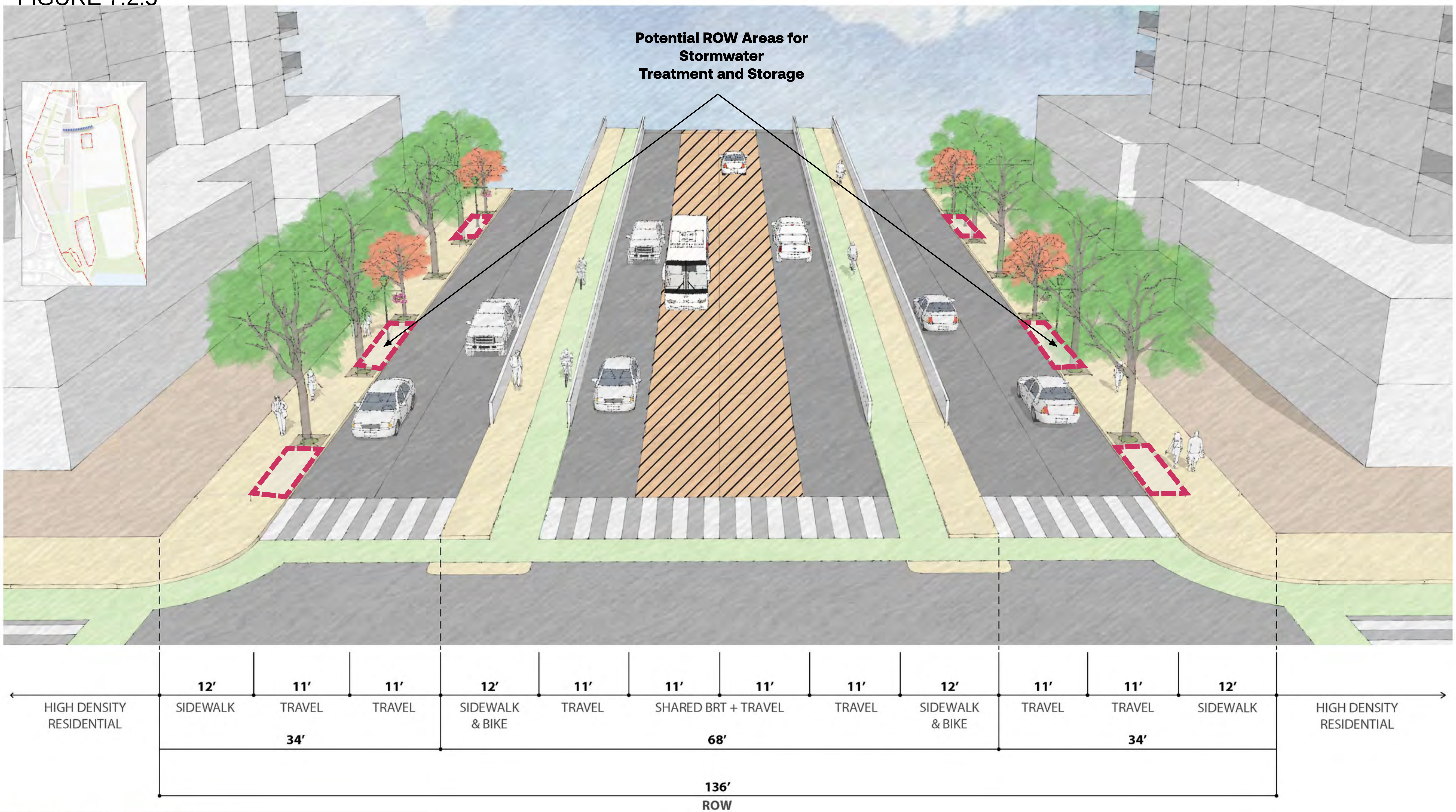


Geneva Ave. @ BRT Stop (opt 1)

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.3

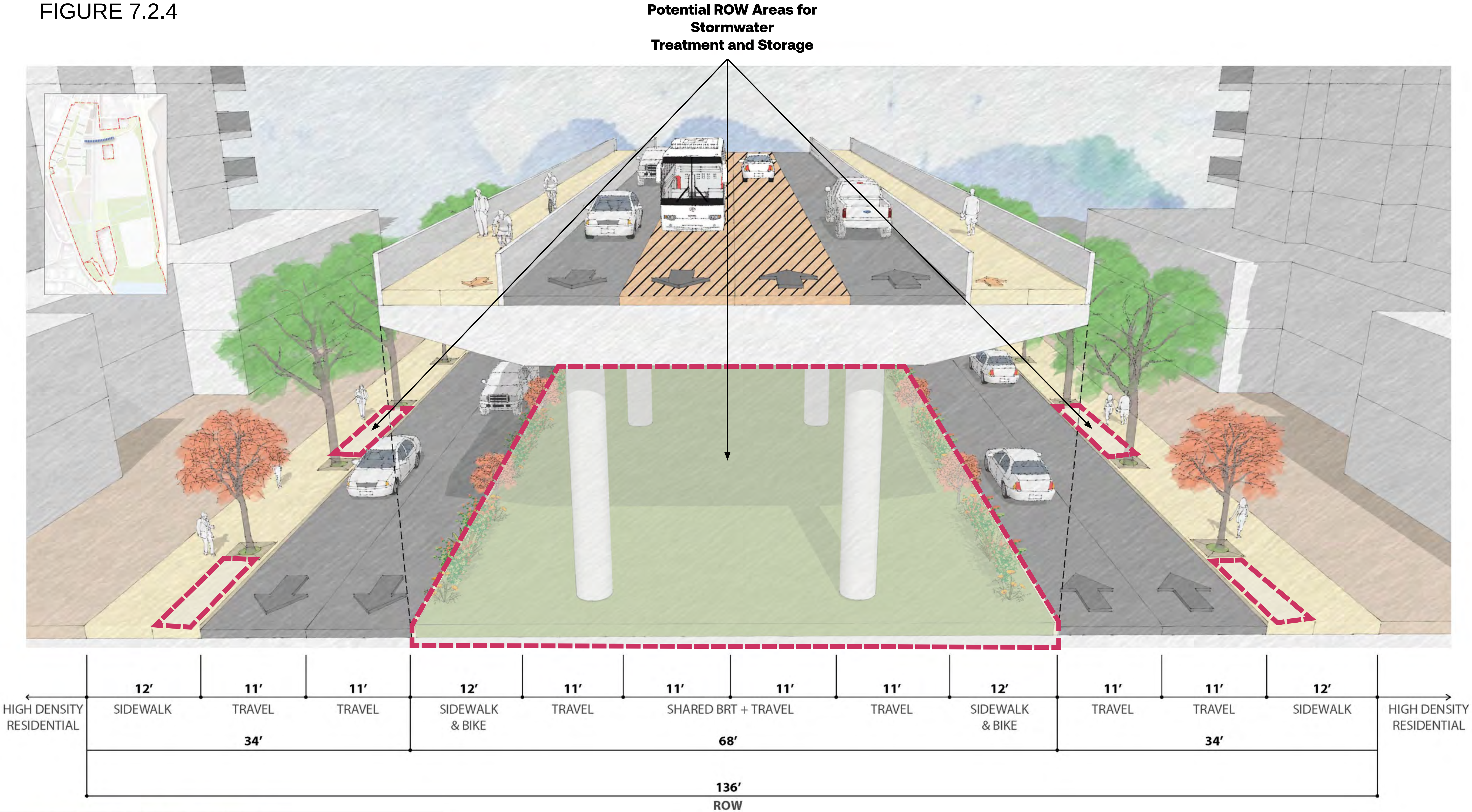


Geneva Ave. @ Baylands Blvd

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.4

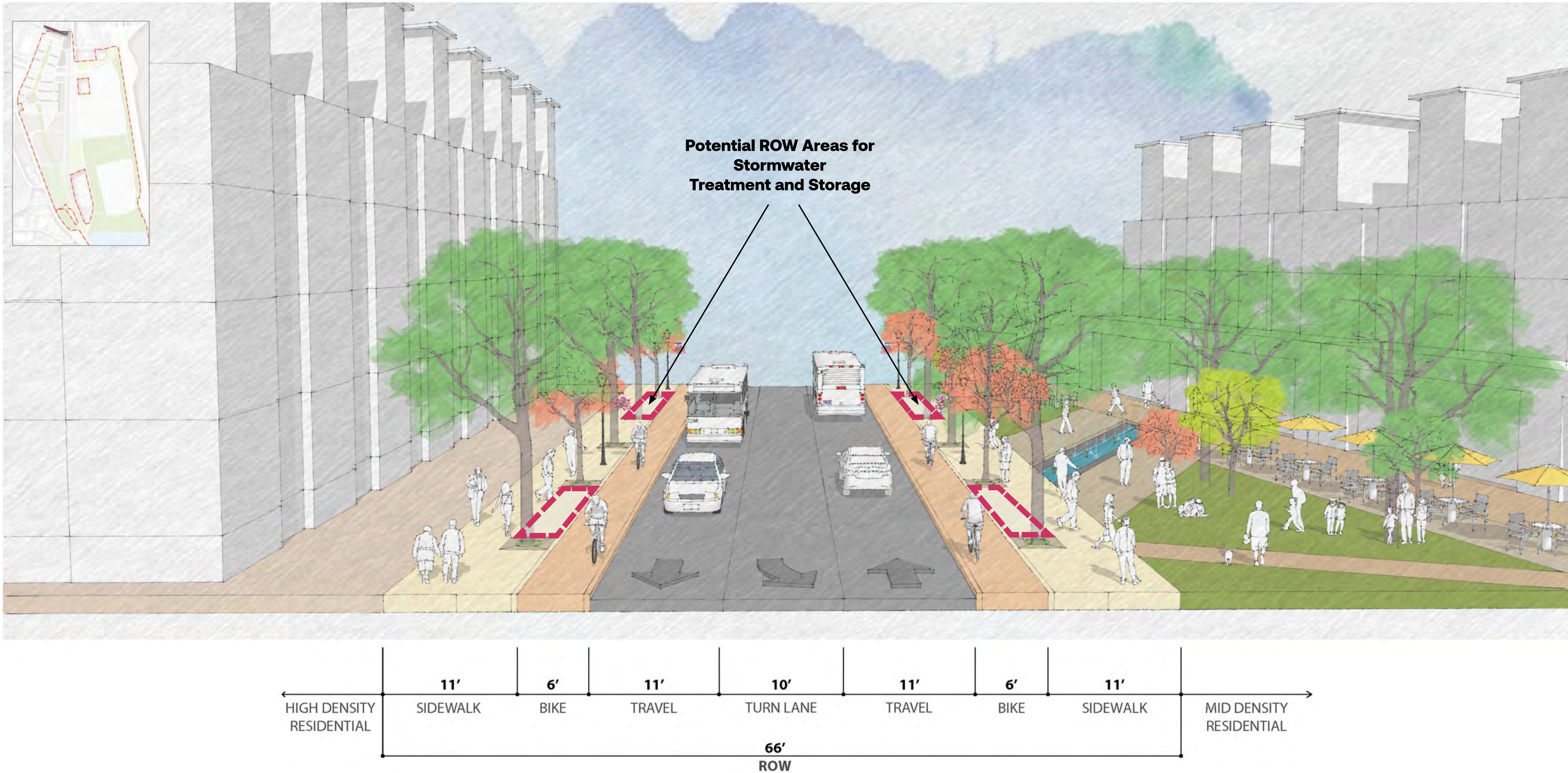


Geneva Ave. @ Bridge over Caltrain

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.5



Sunnydale Ave.

Baylands, City of Brisbane

HDR | CALTHORPE

FIGURE 7.2.6

ROW Area for Stormwater Treatment and Storage Not Identified

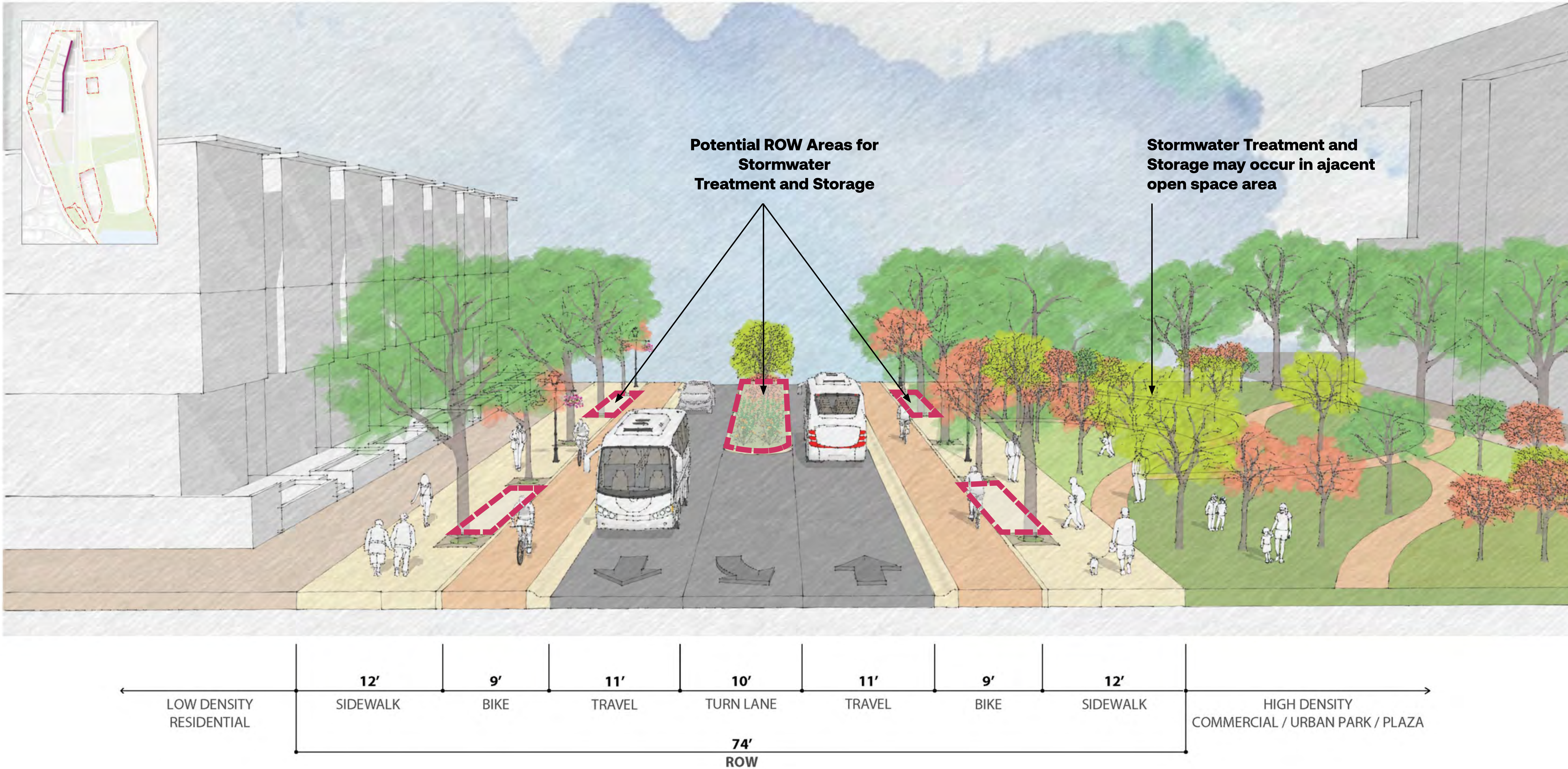


FIGURE 7.2.7

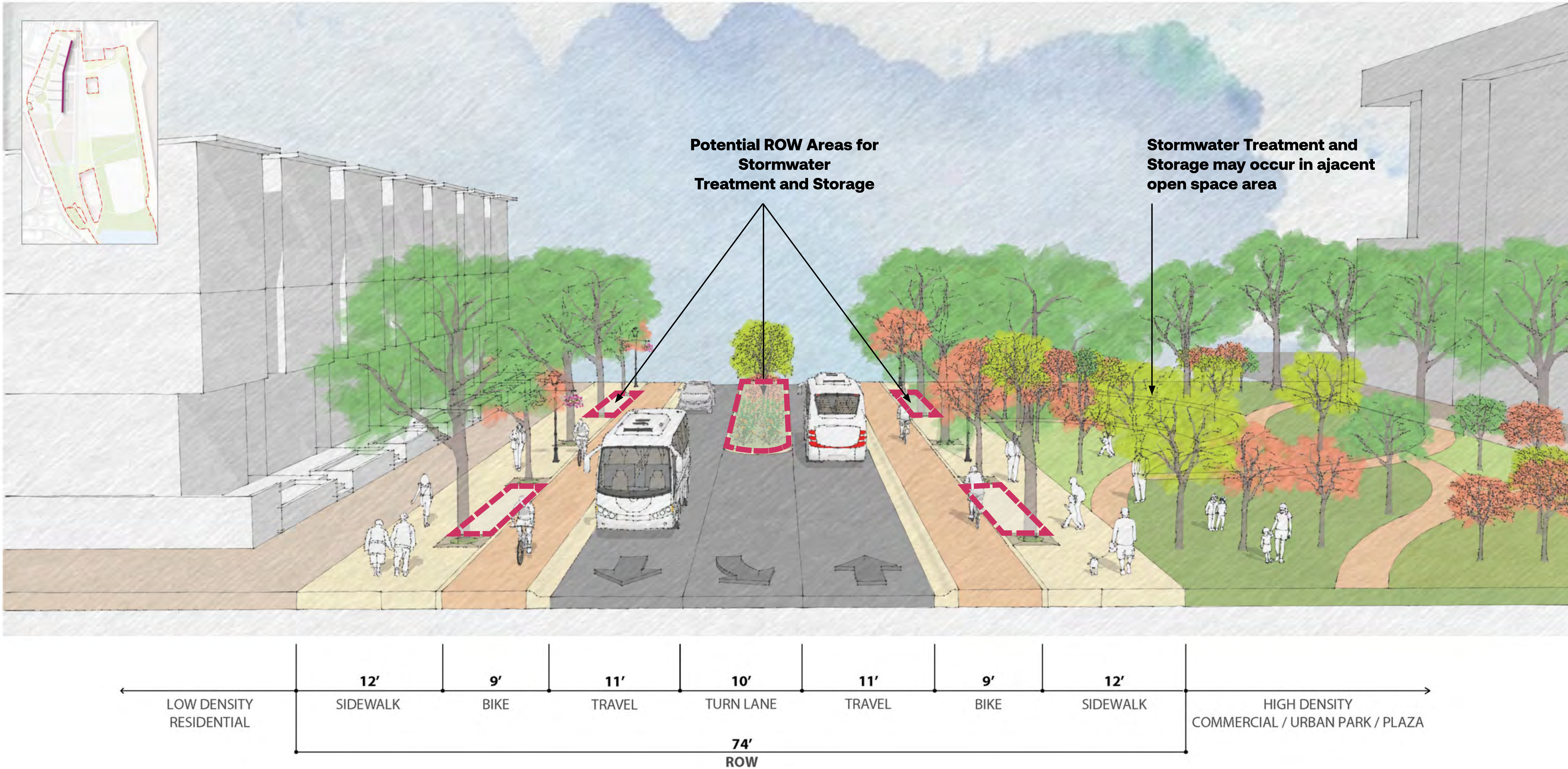
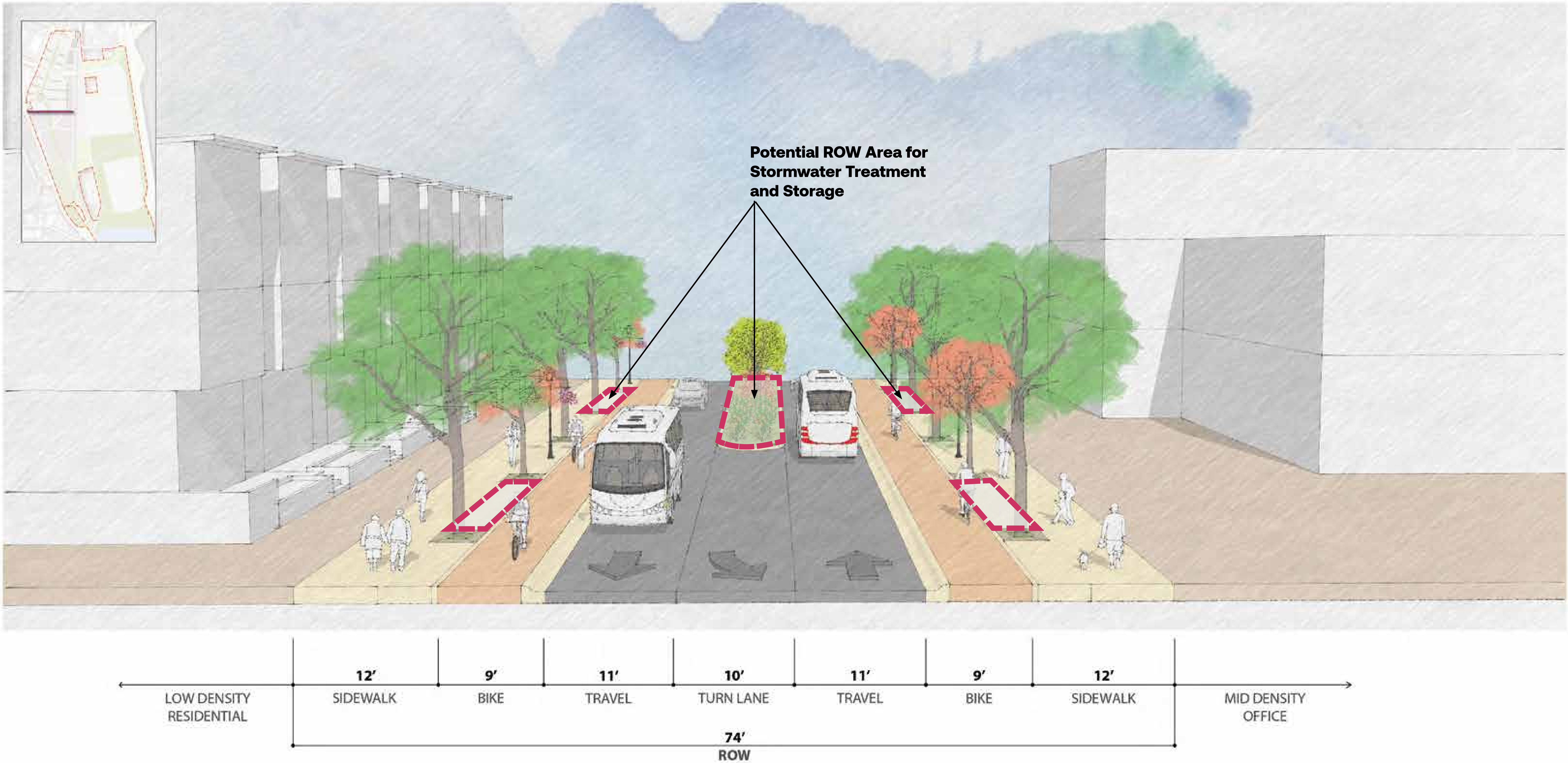

Potential ROW Areas for Stormwater Treatment and Storage
Stormwater Treatment and Storage may occur in ajacent open space area
LOW DENSITY RESIDENTIAL
12' SIDEWALK
9' BIKE
11' TRAVEL
10' TURN LANE
11' TRAVEL
9' BIKE
12' SIDEWALK
HIGH DENSITY COMMERCIAL / URBAN PARK / PLAZA
74' ROW

FIGURE 7.2.8



Main St.

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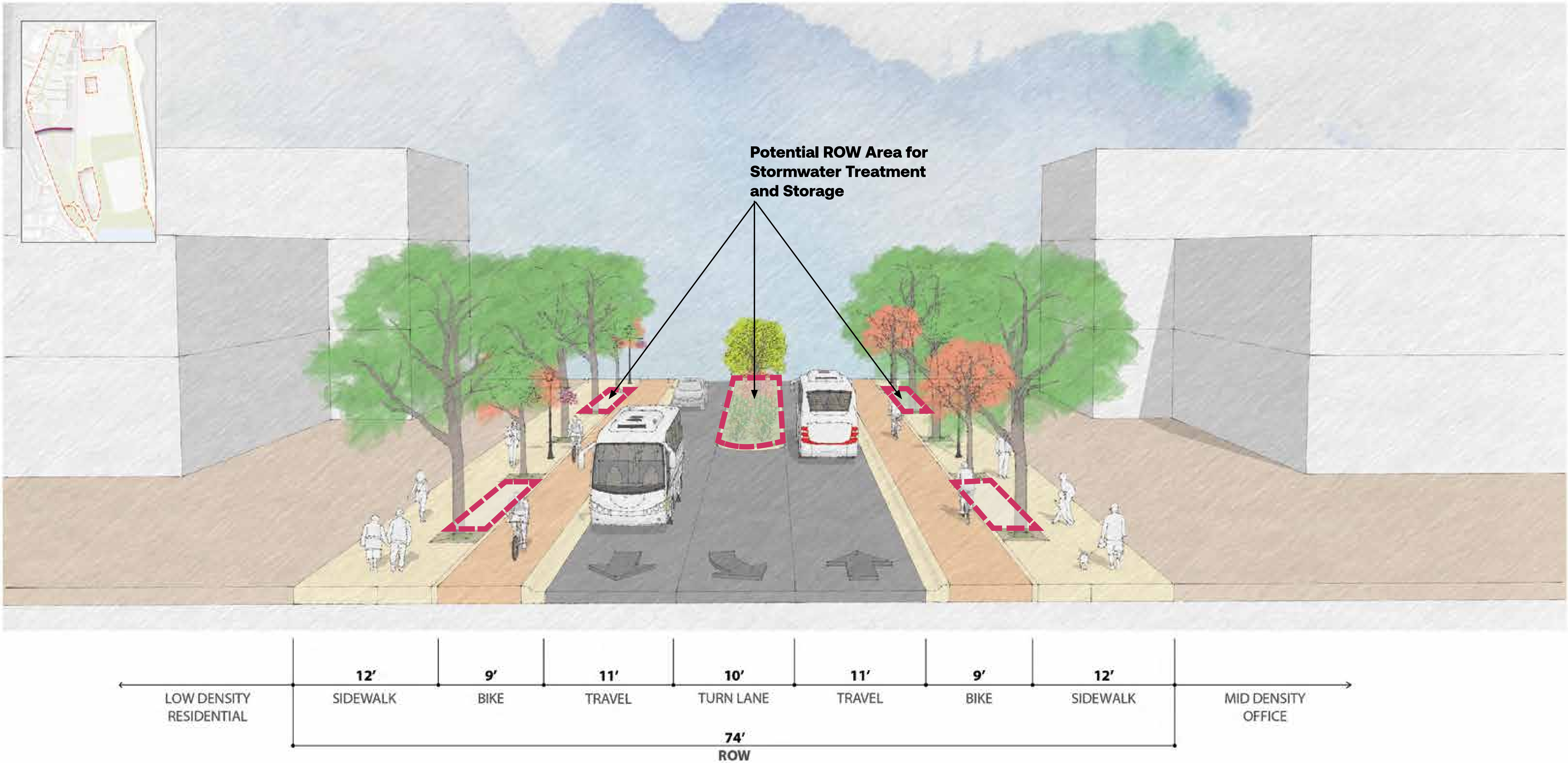
FIGURE 7.2.9



Campus Pky.

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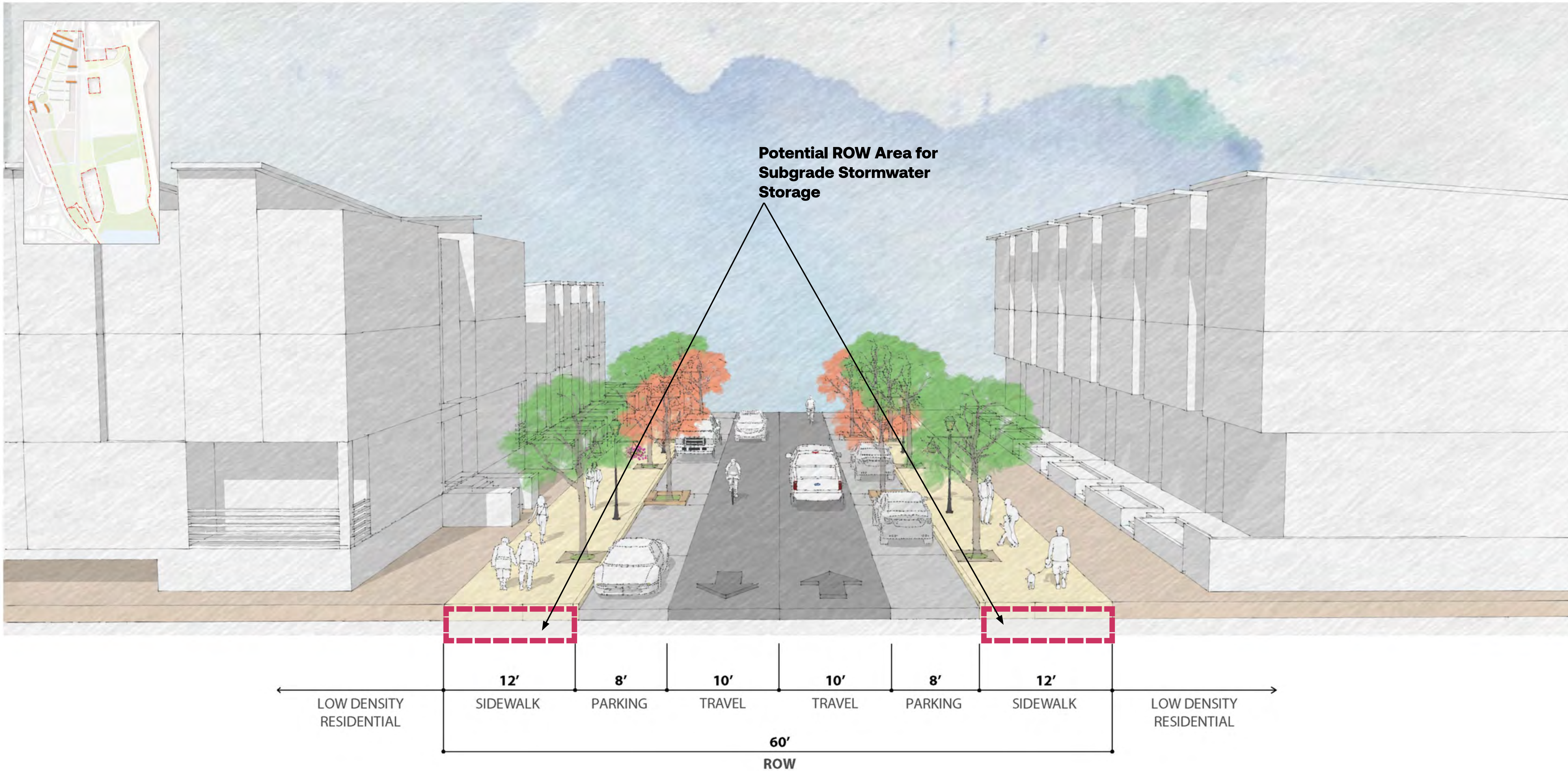
FIGURE 7.2.10

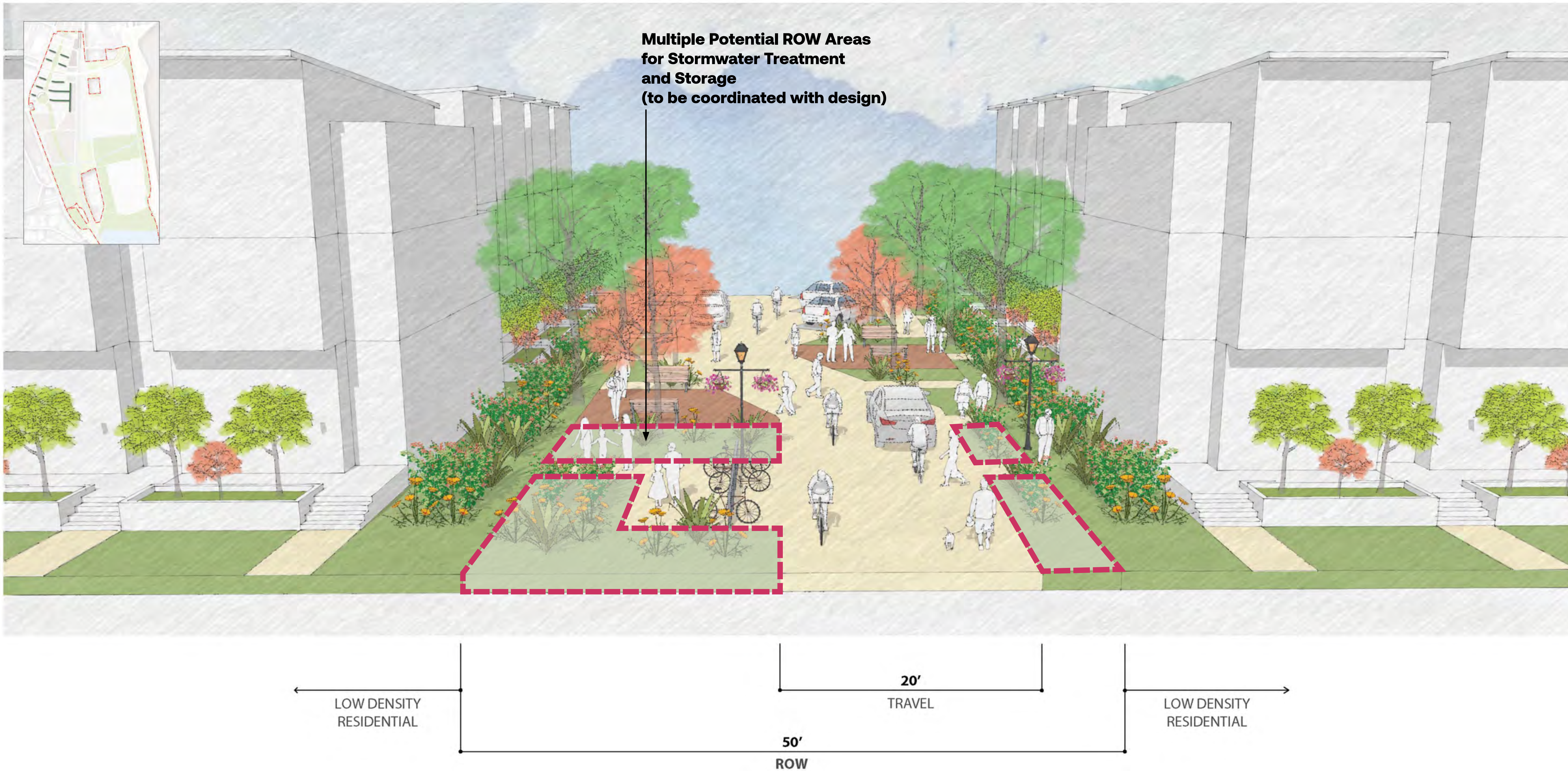


Local Street

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.11

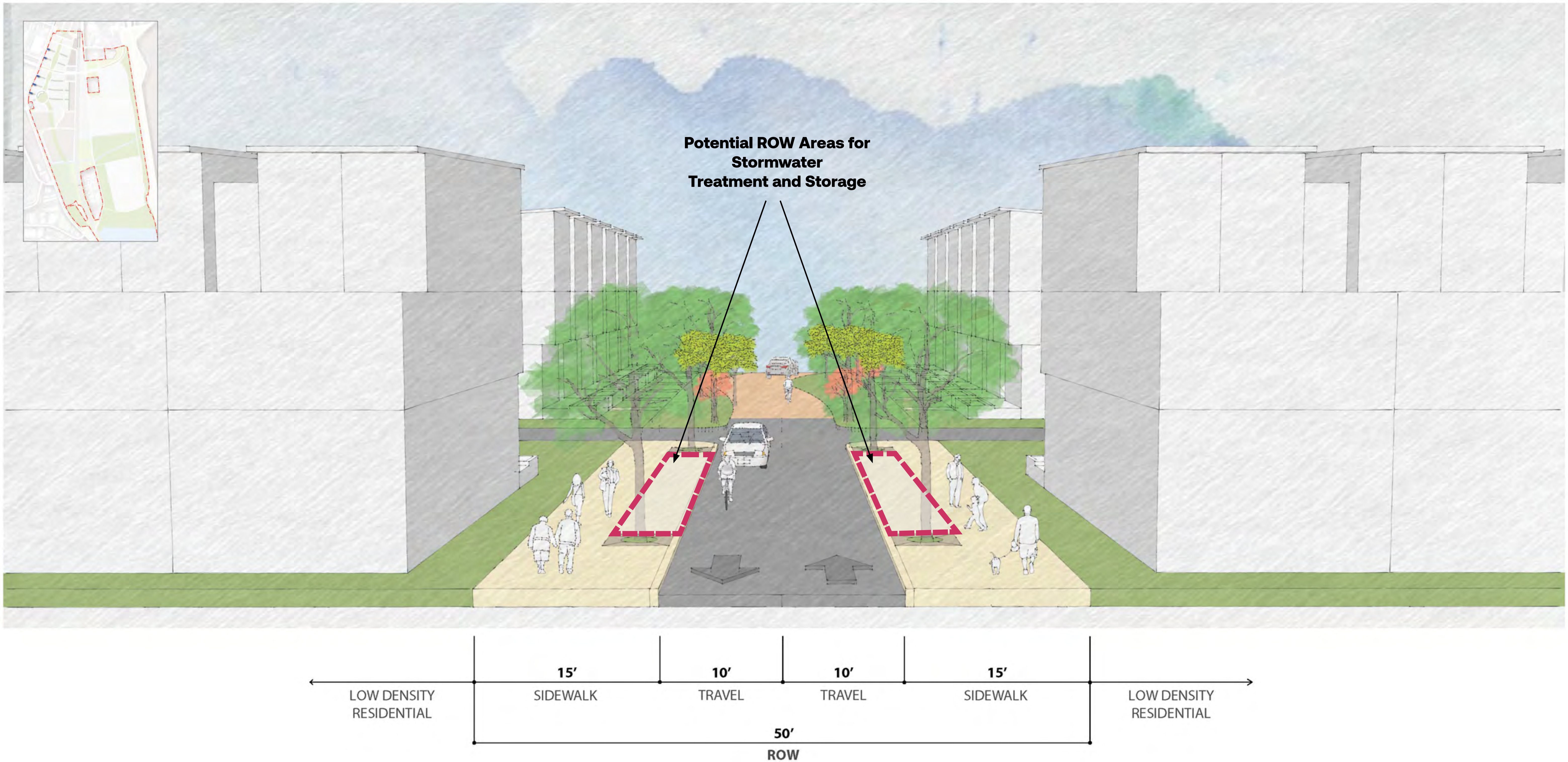


Green Shared Street

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.12



Entrance @ Shared Street on Bayshore Blvd.

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.13

ROW Area for Stormwater Treatment and Storage Not Identified

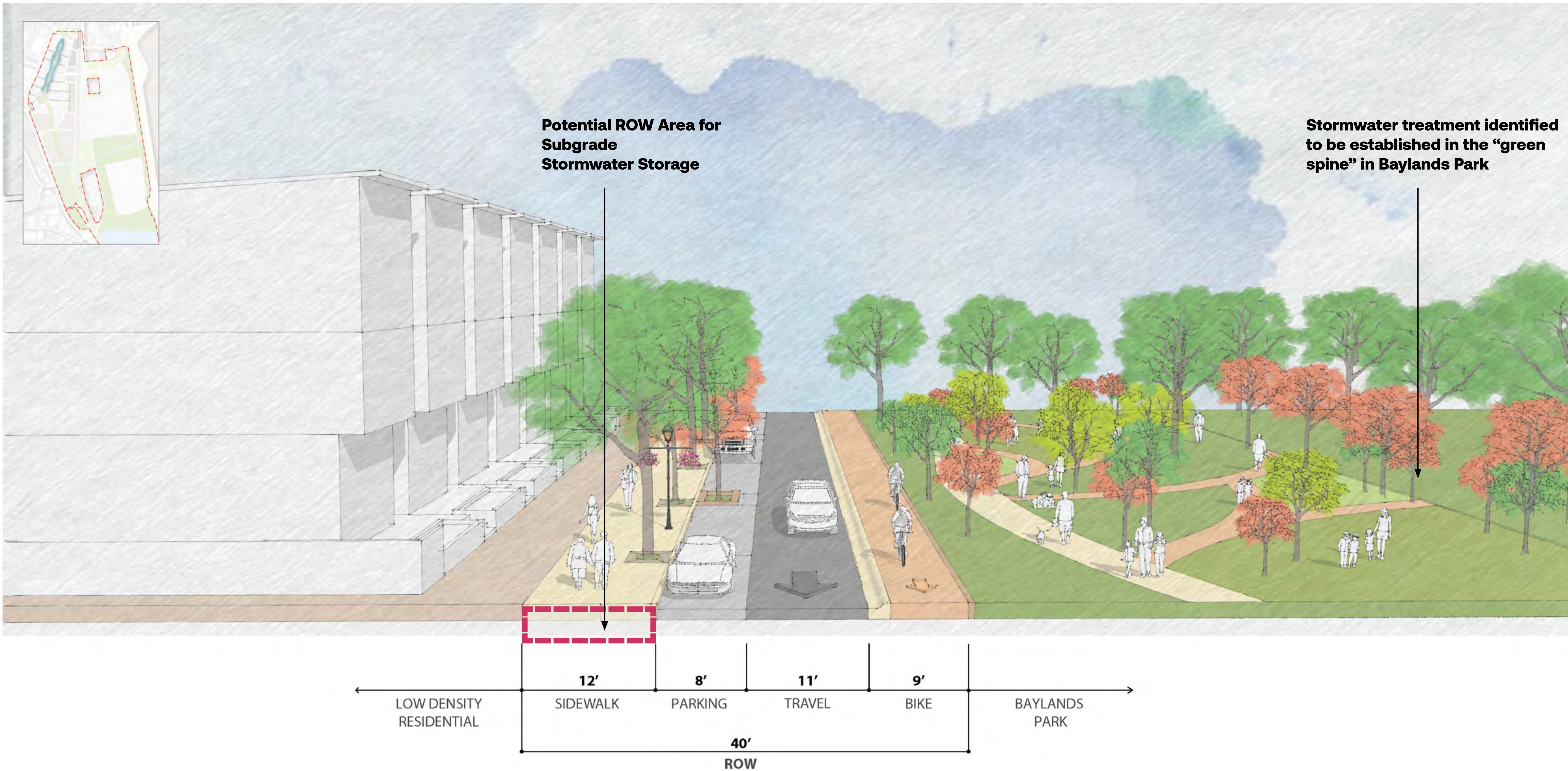
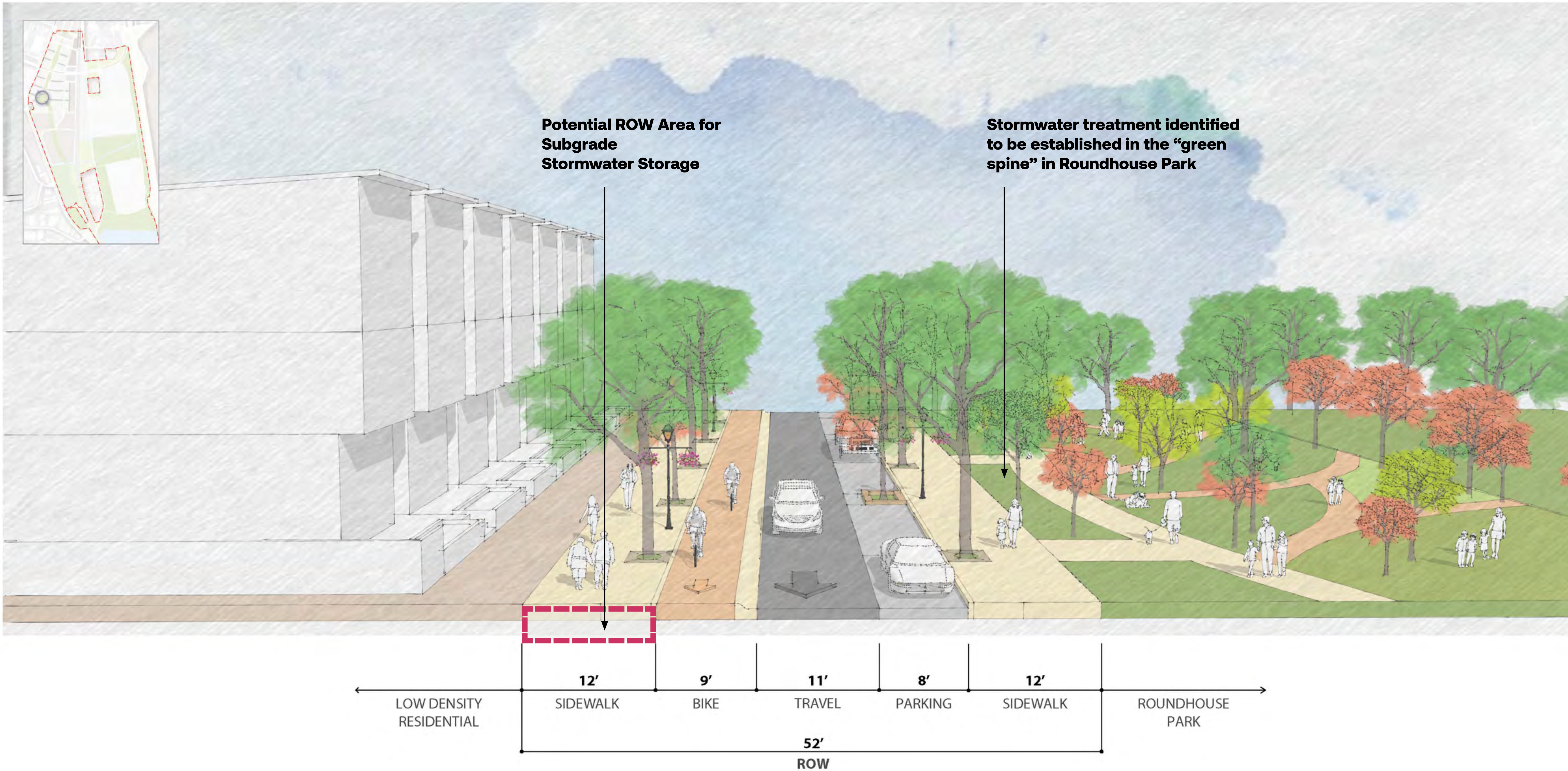


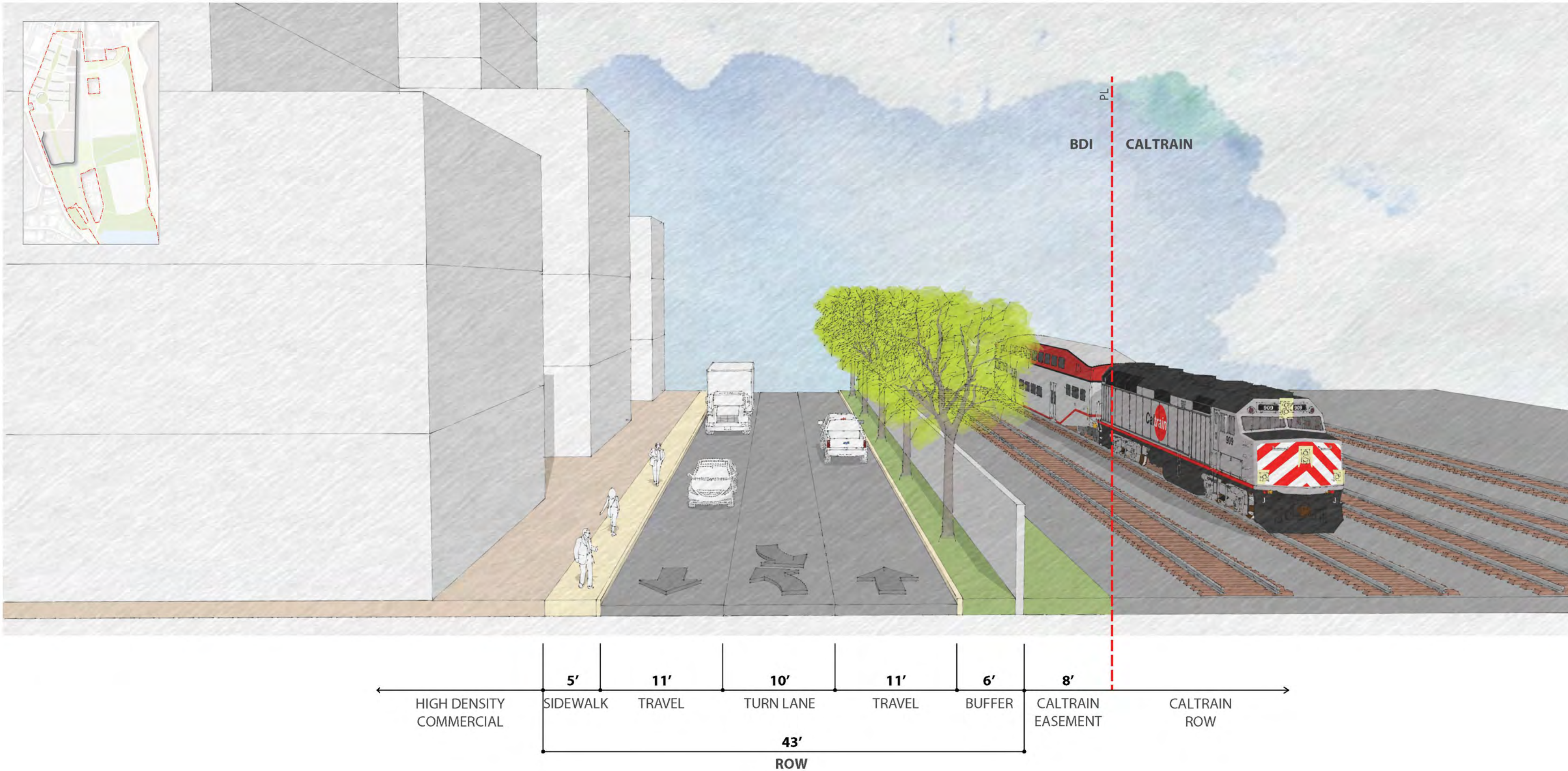
FIGURE 7.2.14



Potential ROW Area for Subgrade Stormwater Storage
Stormwater treatment identified to be established in the "green spine" in Roundhouse Park
12'
SIDEWALK
9'
BIKE
11'
TRAVEL
8'
PARKING
12'
SIDEWALK
LOW DENSITY RESIDENTIAL
ROUNDHOUSE PARK
52'
ROW

FIGURE 7.2.15

ROW Area for Stormwater Treatment and Storage not identified due to need for trees and shrubs in the Caltrain Buffer

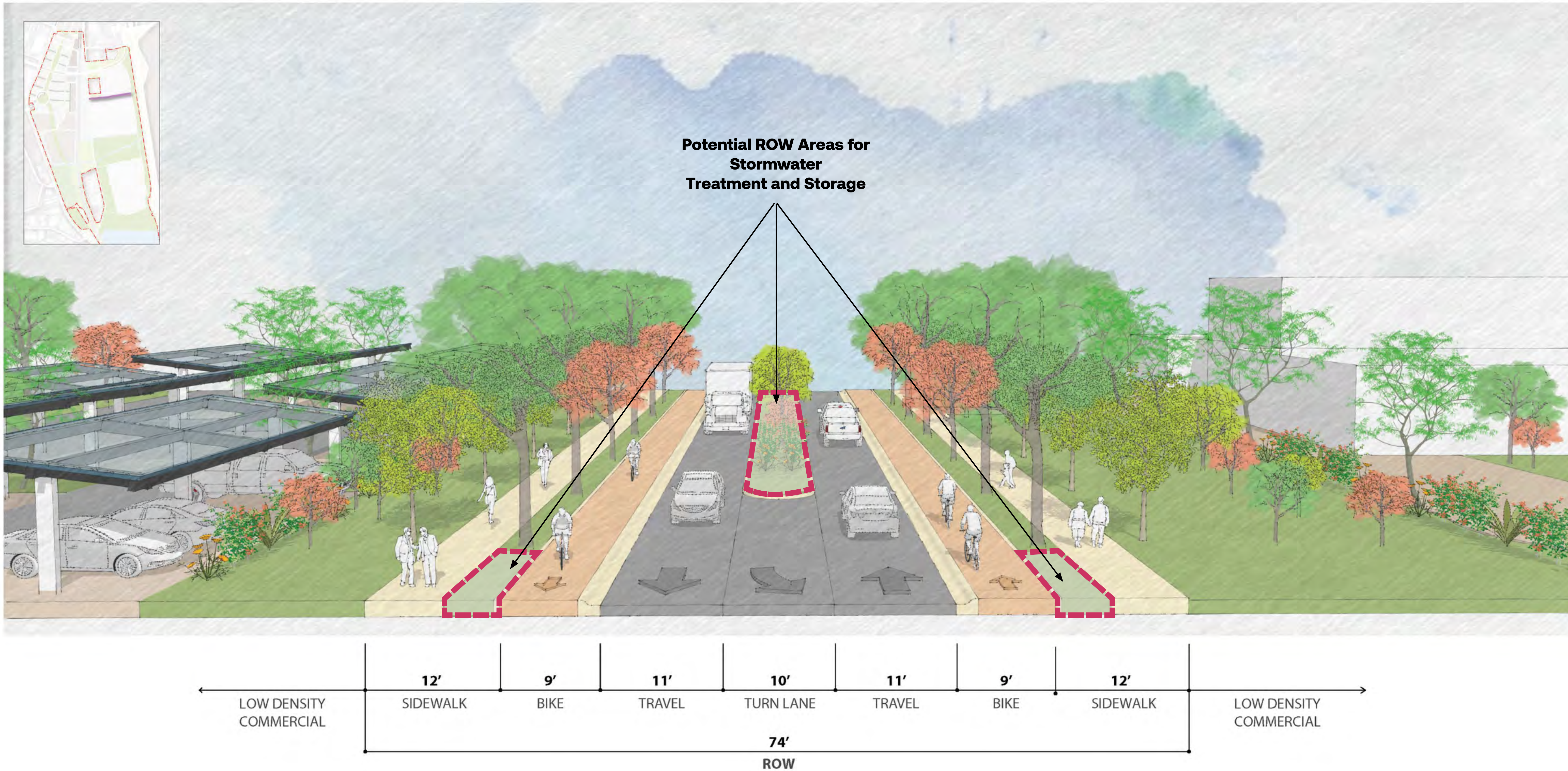


Frontage Street

Baylands, City of Brisbane

HDR | CALTHORPE

FIGURE 7.2.16

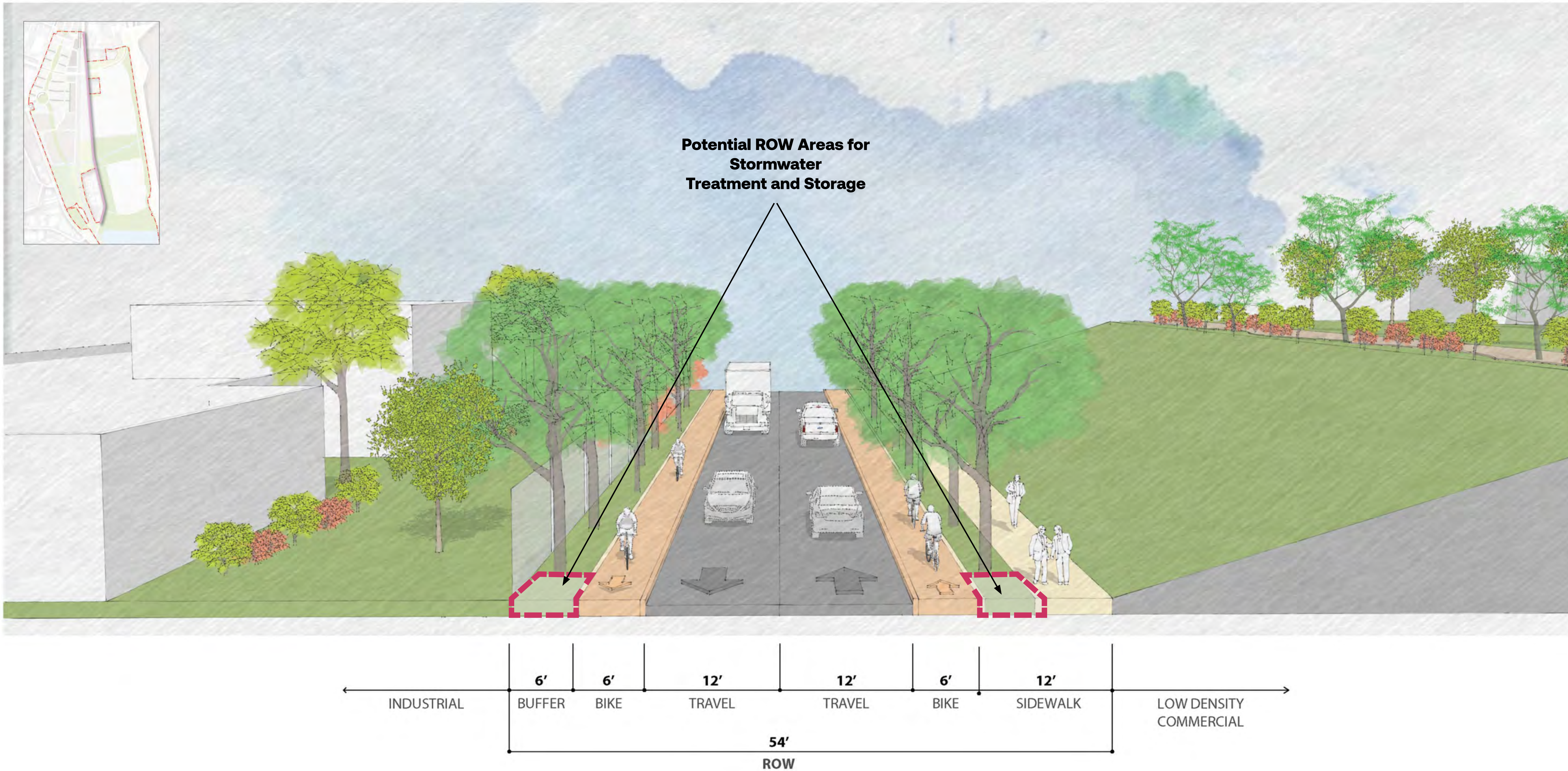


East Campus Rd.

Baylands, City of Brisbane

HDR | CALTHORPE

FIGURE 7.2.17

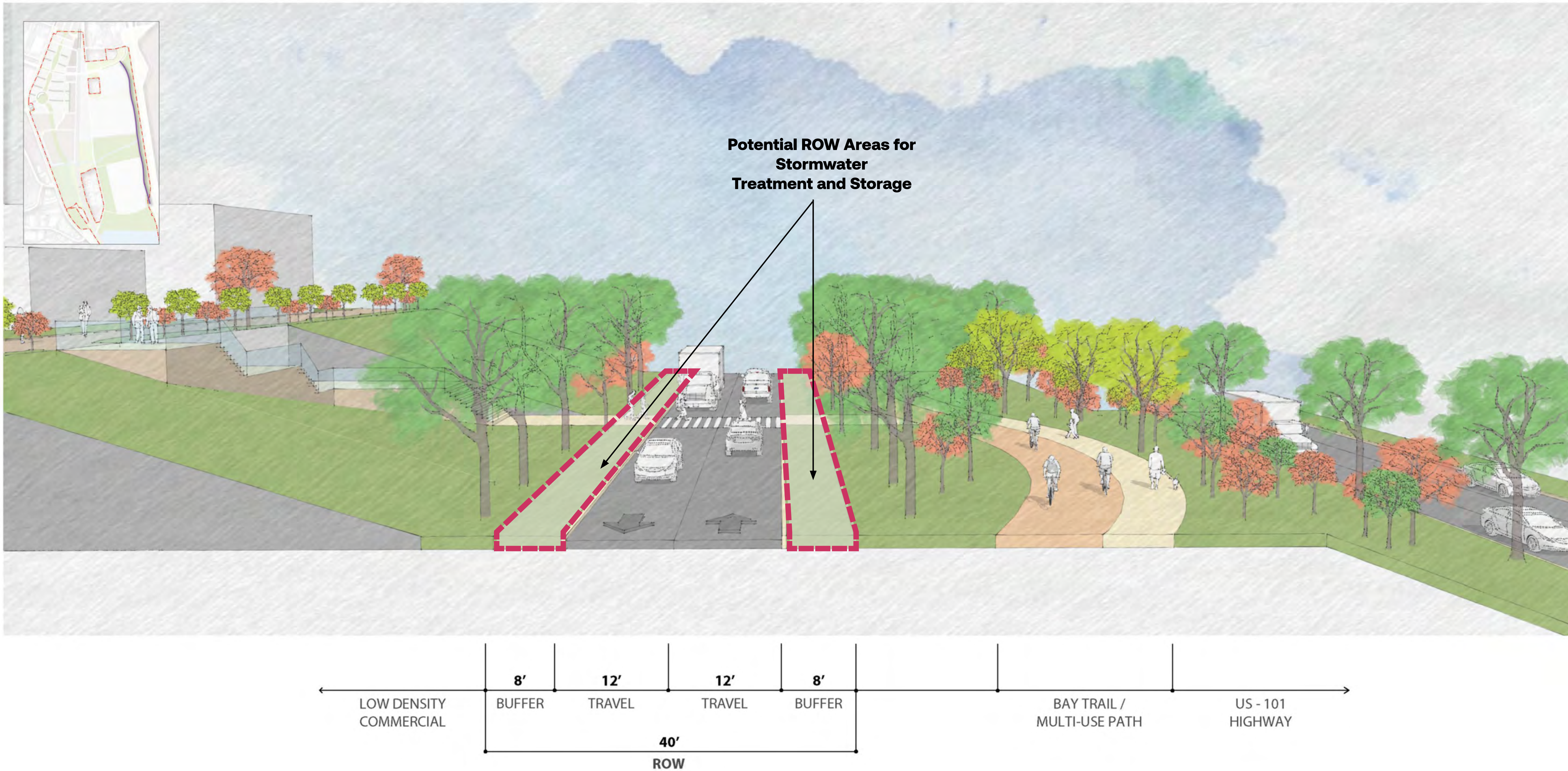


Tunnel Ave.

Baylands, City of Brisbane

HDR CALTHORPE

FIGURE 7.2.18

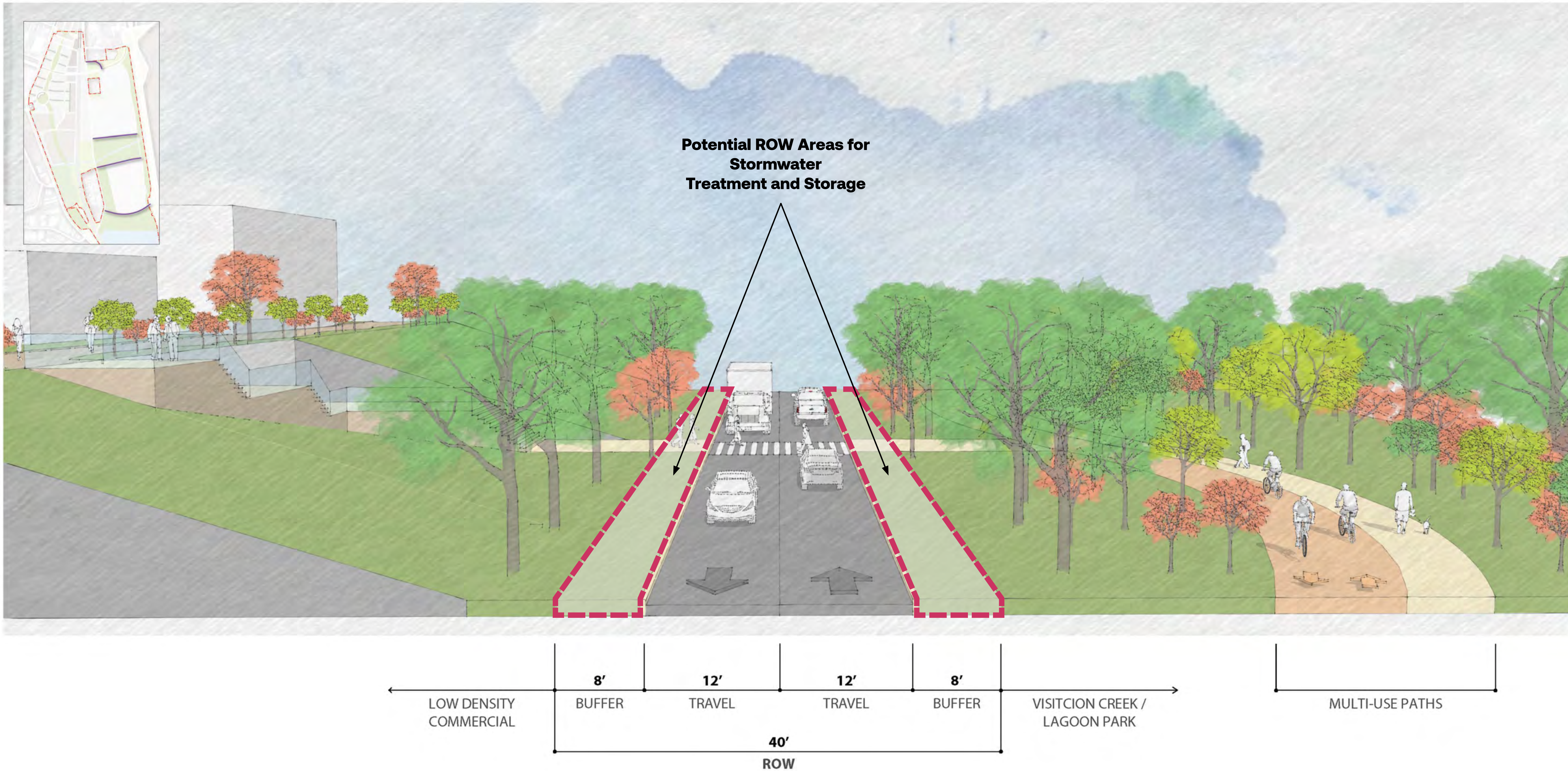


Sierra Point Pky.

Baylands, City of Brisbane

HDR | CALTHORPE

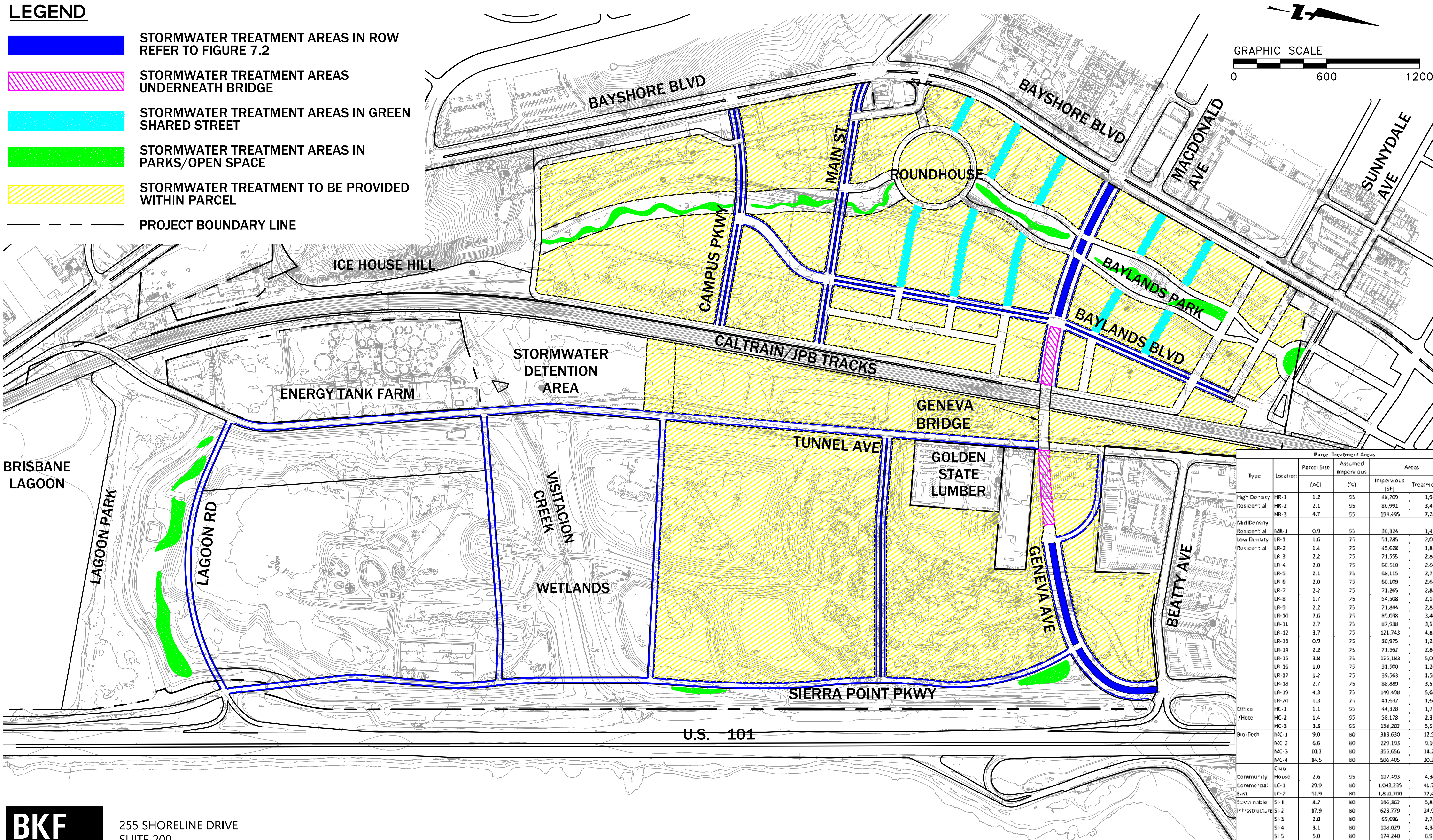
FIGURE 7.2.19



Lagoon Rd. / Visitacion Creek Rd.

Baylands, City of Brisbane

HDR CALTHORPE



Parcel Treatment Areas					
Type	Location	Parcel Size (AC)	Assumed Impervious (%)	Areas: Impervious (SF)	Areas: Treatment (SF)
High Density Residential	HR-1	1.2	95	48,709	1,948
	HR-2	2.1	95	86,991	3,480
	HR-3	4.7	95	194,495	7,780
Mid Density Residential	MR-1	0.9	95	36,324	1,453
Low Density Residential	LR-1	1.6	75	51,785	2,071
	LR-2	1.4	75	45,628	1,825
	LR-3	2.2	75	71,555	2,862
	LR-4	2.0	75	66,518	2,661
	LR-5	2.1	75	68,115	2,725
	LR-6	2.0	75	66,109	2,644
	LR-7	2.2	75	71,265	2,851
	LR-8	1.7	75	54,508	2,180
	LR-9	2.2	75	71,844	2,874
	LR-10	2.6	75	85,038	3,402
	LR-11	2.7	75	87,938	3,518
	LR-12	3.7	75	121,743	4,870
	LR-13	0.9	75	30,975	1,239
	LR-14	2.2	75	71,562	2,862
	LR-15	3.8	75	125,183	5,007
	LR-16	1.0	75	31,500	1,260
	LR-17	1.2	75	39,563	1,583
	LR-18	2.7	75	88,880	3,556
	LR-19	4.3	75	140,498	5,620
	LR-20	1.3	75	41,632	1,665
Office /Hotel	HC-1	1.1	95	44,328	1,773
	HC-2	1.4	95	58,178	2,327
	HC-3	3.3	95	138,202	5,528
Bio-Tech	MC-1	9.0	80	313,630	12,545
	MC-2	6.6	80	229,193	9,168
	MC-3	10.2	80	355,656	14,226
	MC-4	14.5	80	506,405	20,256
Community Commercial East	Club House	2.6	95	107,493	4,300
	LC-1	29.9	80	1,043,235	41,729
	LC-2	51.9	80	1,810,200	72,408
Sustainable Infrastructure	SI-1	4.2	80	146,362	5,854
	SI-2	17.9	80	623,779	24,951
	SI-3	2.0	80	69,696	2,788
	SI-4	3.1	80	108,029	4,321
	SI-5	5.0	80	174,240	6,970
	SI-6	55.0	80	1,916,640	76,666

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CONCEPTUAL STORMWATER TREATMENT
SCALE: 1"=600'

BRISBANE BAYLANDS

FIGURE 7.3

DRAWING NAME: \\bkf-rc\vol4\2019\190615_brisbane_baylands_\ENG\EXHIBITS\2021 Infrastructure plan\plotted_sheets\07_X_FIGURE_SW.dwg
PLOT DATE: 01-27-23 PLOTTED BY: arre

8. DRY UTILITY SYSTEMS

8.1 Electrical System

8.1.1 EXISTING ELECTRICAL SYSTEM

The existing distribution system for The Baylands area is a mix of underground cables and overhead lines managed under the control of Pacific Gas and Electric (PG&E). Existing lines such as those along Tunnel Avenue and Bayshore Blvd where it is necessary to connect to the PG&E grid will be located underground in accordance with PG&E's Rule 20b as part of future development in a manner that allows continued service to existing customers expected to remain in place.

8.1.2 ELECTRICAL POWER DURING CONTSRUCTION

Electrical power for construction is proposed to be provided by Pacific Gas and Electric Company (PG&E) and limit the use of hydrocarbon-based sources on-site but anticipate certain construction operations may require diesel or natural gas based power. Power sources such as solar or other market-available renewable strategies may be used subject to compliance with Brisbane's Use Permit requirements (Brisbane Municipal Code Chapter 17.41).

8.1.3 THE BAYLANDS ELECTRICAL SYSTEM

Electrical utilities in The Baylands will be provided to the site via underground electrical interconnection with PG&E. New development under the Specific Plan is expected to continue to be served by PG&E via the Martin Substation in Daly City, CA. All proposed lines within the Baylands will be located underground within public right-of-way or in dedicated easements in a joint trench with other dry utilities as shown in Figure 7.6.

Significant ground area (Sustainable Infrastructure) and roof top area have been designated as eligible for solar generation. 85,000 MWh is the annual generation requirement from on-site sources with the remaining energy needed to meet energy neutrality (See Chapter 4 – Sustainability Framework) expected to come from off-site renewable sources. Even though the existing and/or upgraded PG&E or equivalent infrastructure will be utilized to provide electricity to the project, off-site clean electricity for future development shall be provided by Peninsula Clean Energy ("PCE") or another provider that sources electricity from 100 percent carbon-free sources.

The Baylands expects to deploy smart grid technology and distributed energy resources ("DERs") to the maximum extent possible to manage energy peaks and respond to fluctuations in electrical demand and supply. The Specific Plan area will also contain a centralized 250 MWs/1 GWh battery-based stationary energy storage intended to serve regional grid-customers. Battery based energy storage is an eligible use in Sustainable Infrastructure areas, as well as within structures in accordance with State and local Codes. In addition to the DER deployment at individual buildings within the development, the 250MW/1GWh of centralized battery and Solar PV facilities will have a transmission level direct connection to PG&E infrastructure. The facilities may be deployed to serve the local Baylands loads and decarbonization goals, and the remainder available for grid services beyond the project boundary.

8.2 Natural Gas System

8.2.1 EXISTING NATURAL GAS SYSTEM

PG&E maintains an existing underground 6-inch gas main in Tunnel Avenue, which begins at the southern edge of the Golden State Lumber Parcel and continues north where it taps into an existing 24-inch PG&E natural gas transmission main in Bayshore Boulevard. The 6-inch gas line currently serves the Golden State lumber property within The Baylands area and other properties to the north. Based on proposed uses and roadway alignments, the Tunnel Avenue gas main is proposed to be relocated to follow the new roadway layout.

8.2.2 PROPOSED NATURAL GAS SYSTEM

Consistent with Chapter 04 Sustainability Framework, the Baylands does not include PG&E natural gas infrastructure to serve proposed uses. Existing natural gas services to the Kinder Morgan Tank Farm property, the City of Brisbane facility of Tunnel Avenue and Golden State Lumber are proposed to be maintained.

8.3 Communications Infrastructure

8.3.1 EXISTING COMMUNICATIONS SYSTEMS

An evaluation of the existing telecommunications facilities within and adjacent to the site will be coordinated with the communications and fiber providers. Removal and replacement of the existing facilities is anticipated as part of the future development and based on demands associated with the phased buildout.

8.3.2 PROPOSED COMMUNICATIONS SYSTEMS

Proposed telecommunications infrastructure, including telephone, cable, broadband, and fiber optics, will be installed in an underground joint trench with proposed electric facilities. Both AT&T and Comcast Cable currently serve the area surrounding The Baylands. Coordination with AT&T, Comcast and other providers to establish service to The Baylands is anticipated during the mapping and permitting process, and based on demands associated with the phased buildout.

No stand-alone telecommunication building facilities are anticipated; instead, telecommunication equipment that is standard for residential and commercial areas will be installed as ancillary equipment for buildings to assure adequate communication and broadband services for the new Baylands community. Specific telecommunication equipment lists and locations are premature, both because these continue to be evolving technologies and because these involve building design specification levels of details that are not part of the entitlement process.

8.4 Kinder Morgan Tank Farm Jet Fuel Infrastructure

8.4.1 EXISTING CONDITIONS

As shown on Figure 8.1, an existing high-pressure liquid gas line conveys jet fuel from the Kinder Morgan Tank Farm to the San Francisco Airport to provide fuel for airplanes. On the East Side, the fuel line runs from the tank farm along an alignment parallel to the Brisbane Lagoon to Highway 101. Adjacency of the Brisbane intertidal mudflats and open water and proximity of Kinder Morgan's buried pipes running from west to east across the northern shoreline of the lagoon currently obliges construction to be conducted with low impact methods.

8.4.2 INTERFACE WITH THE BAYLANDS INFRASTRUCTURE

Soil improvements and construction techniques to support the buried Kinder Morgan pipes shall be evaluated and implemented prior to issuance of grading permits for The Baylands. The soil improvements shall be designed to mitigate potential impacts to the pipelines during landfill closure and construction of the shoreline improvements. Existing infrastructure for the Kinder Morgan tank farm shall be protected in place during grading and construction of The Baylands, consistent with Kinder Morgan requirements and specifications and coordinated with landfill closure activities. A constructability analysis shall determine the feasibility prior to implementation of the soil improvements.

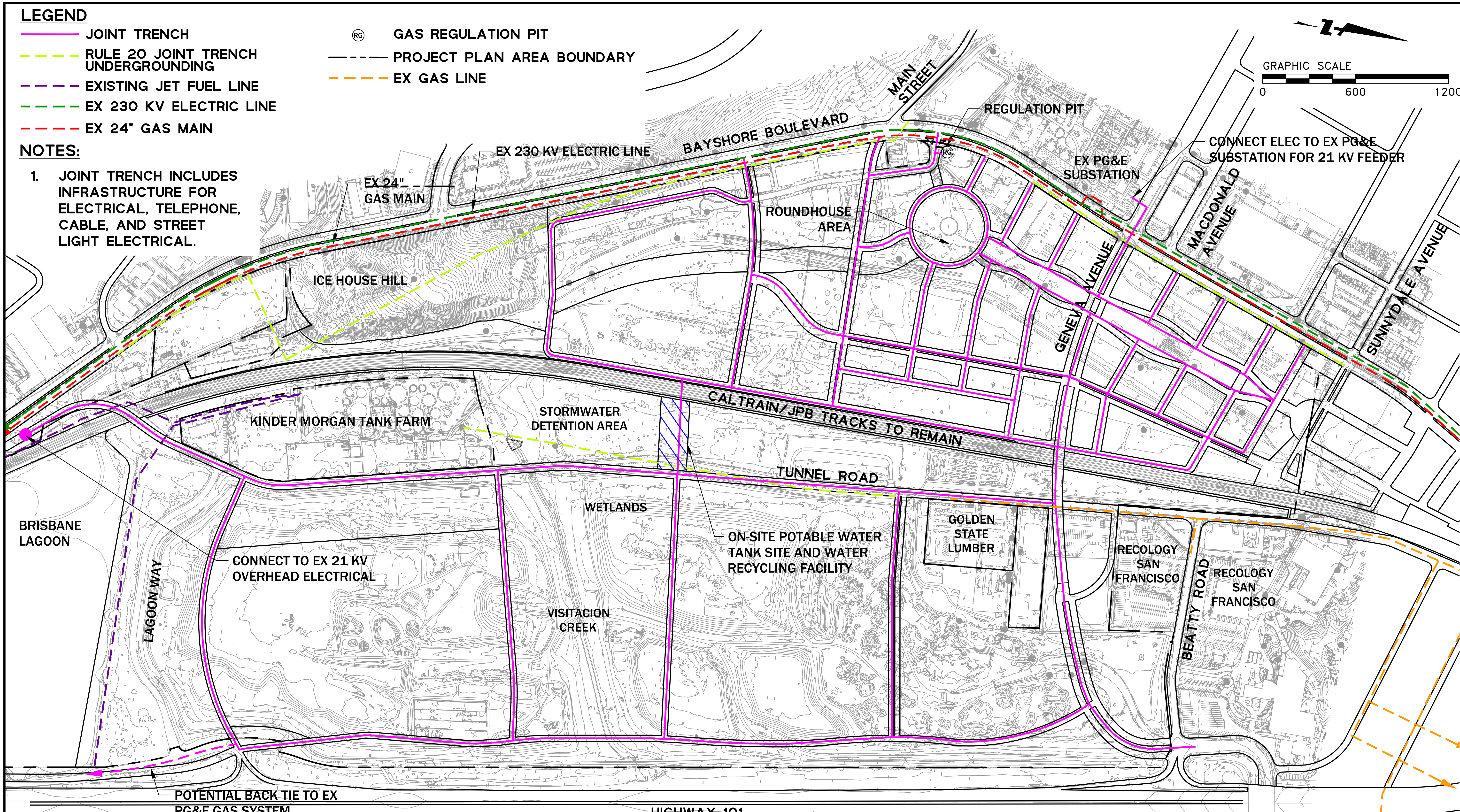
Prior to commencing construction adjacent to the Kinder Morgan easement and infrastructure, a Construction Workplan will be developed with Kinder Morgan to document construction means and methods, including provisions for utility locating and appropriate construction setbacks to minimize impacts on existing facilities, and submitted to reviewing Agencies as part of the permitting process associated with improvements in areas adjacent to the Kinder Morgan facilities.

8.5 Proposed Phases of the Dry Utility Distribution Construction

The replacement of the dry utility systems will be conducted in phases that correspond with the proposed development plan and the other utility system replacement. Much of the existing system will remain in place as long as possible during the early phases of infrastructure construction in order to maximize the efficiency of construction and to minimize the amount of disruptions to the existing uses. Repairs and upgrades to the existing system will be performed as necessary to keep the existing system operational until it is replaced with the new construction.

8.6 Master Utility Plans

As required by the approving Agencies, master utility plans for the electrical system service for The Baylands will be prepared in coordination with the utility providers during the development of the final designs. These plans will include layouts and design requirements for the off-site upgrades and repairs, potential renewable energy generation facilities on The Baylands, coordination with PG&E, and phasing plans for the new systems in The Baylands.



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CONCEPTUAL DRY UTILITY SYSTEMS

SCALE: 1"=600'

BRISBANE BAYLANDS

FIGURE 8.1

APPENDIX A

NOTES

1. THE EXISTING GRADE USED FOR THIS EARTHWORK ANALYSIS IS BASED ON THE AERIAL SURVEY DONE BY BKF ENGINEERS IN 2021.
2. THE EARTHWORK ESTIMATE DOES NOT ACCOUNT FOR COMPACTION, SHRINKAGE, SWELL, LOSS DURING TRANSPORT, SUBSIDENCE, FOUNDATIONS AND BELOW GRADE STRUCTURES.
3. ELEVATIONS SHOWN ARE BASED ON THE NAVD 88 VERTICAL DATUM.

GRAPHIC SCALE

200 0 200 400

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BRISBANE BAYLANDS – RAILYARD PRELIMINARY GRADING – PLAN

BRISBANE, CA

JANUARY 21, 2022

DRAWING NAME: \\Bkf-rc\vol4\2019\190615_Brisbane_Baylands_R\ENG\EXHIBITS\Grading Design\2021 Datum\BBPRSURF-WEST_2021.dwg
PLOT DATE: 01-21-22 PLOTTED BY: chuk

NOTES

1. THE EXISTING GRADE USED FOR THIS EARTHWORK ANALYSIS IS BASED ON THE AERIAL SURVEY DONE BY BKF ENGINEERS IN 2021.
2. THE EARTHWORK ESTIMATE DOES NOT ACCOUNT FOR COMPACTION, SHRINKAGE, SWELL, LOSS DURING TRANSPORT, SUBSIDENCE, FOUNDATIONS AND BELOW GRADE STRUCTURES.
3. ELEVATIONS SHOWN ARE BASED ON THE NAVD 88 VERTICAL DATUM.

DRAWING NAME: \\Bkf-rc\vol4\2019\190615_Brisbane_Baylands_R\ENG\EXHIBITS\Grading Design\2021 Datum\BBPRSURF-EAST_2021.dwg
PLOT DATE: 01-27-23 PLOTTED BY: crui

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BRISBANE BAYLANDS – LANDFILL PRELIMINARY GRADING

BRISBANE, CA

JANUARY 27, 2023

APPENDIX B

NOTES:

1. MAP MUST BE PROPERLY FIELD CHECKED AND VERIFIED BEFORE USE.
2. STRUCTURE OUTLINES INDICATE DRIP LINE, BUT MAY ALSO INCLUDE ELEVATED STAIRS AND MISC. ATTACHMENTS.
3. FEATURES IN SHADOWS, VEGETATION, AND NEAR TALL OBJECTS MAY BE OMITTED FOR CLARITY OR DUE TO BEING OBSCURED, AND/OR MAY NOT MEET MAP ACCURACY STANDARDS DUE TO BEING OBSCURED.
4. MAPPING OUTSIDE OF THE SURVEY CONTROL PERIMETER MAY NOT MEET MAP ACCURACY STANDARDS.
5. PLOTTED CONTROL POINT ELEVATIONS ARE AT GROUND LEVEL UNLESS OTHERWISE INDICATED.
6. IN THE PROCESS OF COMPLETING THE FIELD WORK FOR THE PROJECT SITE CONTROL AND AERIAL TOPOGRAPHIC SURVEY, BKF HAS DETERMINED THAT MUCH OF PRIOR RECOVERED MONUMENTATION SHOWN ON PREVIOUS SURVEYS HAS NOW BEEN DESTROYED. FOR THIS REASON, ABOVE ANY OTHER, IT IS STRONGLY RECOMMENDED THAT A CURRENT BOUNDARY SURVEY BE COMPLETED FOR THE PURPOSE OF REESTABLISHING AND MONUMENTING THE SUBJECT BOUNDARIES. ADDITIONALLY, BY OBTAINING OUR OWN MEASUREMENTS ON MONUMENTS UTILIZED BY PRIOR SURVEYS, BKF WILL BE ABLE TO ADEQUATELY DETERMINE AND ACCOUNT FOR THE TRANSFORMATIONAL PARAMETERS BETWEEN THE DIFFERENT REFERENCE FRAMES.
7. AERIAL IMAGERY AND TOPOGRAPHIC INFORMATION SHOWN HEREON WAS PERFORMED BY VERTICAL MAPPING RESOURCES IN MARCH, 2021 UNDER COMMISSION BY BKF ENGINEERS.

GRAPHIC SCALE
200 0 200 400

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BRISBANE BAYLANDS - EXISTING TOPOGRAPHY

BRISBANE, CA

MARCH 2021

APPENDIX C

ELEVATION TABLE

LOWER LIMIT	UPPER LIMIT	COLOR
−60	−50	
−50	−40	
−40	−30	
−30	−20	
−20	−15	
−15	−10	
−10	−5	
−5	0	
0	5	
5	10	
10	15	
15	20	
20	25	
25	30	
30	35	

NOTES

1. THE EXISTING GRADE USED FOR THIS EARTHWORK ANALYSIS IS BASED ON THE AERIAL SURVEY DONE BY BKF ENGINEERS IN 2021.
2. THE EARTHWORK ESTIMATE DOES NOT ACCOUNT FOR COMPACTION, SHRINKAGE, SWELL, LOSS DURING TRANSPORT, SUBSIDENCE, FOUNDATIONS AND BELOW GRADE STRUCTURES.
3. ELEVATIONS SHOWN ARE BASED ON THE NAVD 88 VERTICAL DATUM.

AREA 1 EARTHWORK ESTIMATE

AREA	116.8 AC
CUT	2,255,861 CY
FILL	246,518 CY
NET	2,009,343 CY (EXPORT)

AREA 2 EARTHWORK ESTIMATE

AREA	62.0 AC
CUT	1,294,005 CY
FILL	106,544 CY
NET	1,187,461 CY (EXPORT)

AREA 3 EARTHWORK ESTIMATE

AREA	153.8 AC
CUT	721,819 CY
FILL	1,448,614 CY
NET	726,795 CY (IMPORT)

AREAS 1, 2 AND 3 EARTHWORK ESTIMATE

AREA	332.6 AC
CUT	4,271,685 CY
FILL	1,801,676 CY
NET	2,470,009 CY (EXPORT)

GRAPHIC SCALE
200 0 200 400

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BRISBANE BAYLANDS – LANDFILL PRELIMINARY GRADING (CUT FILL MAP)

BRISBANE, CA

JANUARY 21, 2022

DRAWING NAME: \\Bkf-rc\vol4\2019\190615_Brisbane_Baylands_R\ENG\EXHIBITS\Grading Design\2021 Datum\BBPRSURF-EAST_2021.dwg
PLOT DATE: 01-20-22 PLOTTED BY: chuk

ELEVATION TABLE

LOWER LIMIT	UPPER LIMIT	COLOR
-60	-50	
-50	-40	
-40	-30	
-30	-20	
-20	-15	
-15	-10	
-10	-5	
-5	0	
0	5	
5	10	
10	15	
15	20	
20	25	
25	30	
30	35	

NOTES

1. THE EXISTING GRADE USED FOR THIS EARTHWORK ANALYSIS IS BASED ON THE AERIAL SURVEY DONE BY BKF ENGINEERS IN 2021.
2. THE EARTHWORK ESTIMATE DOES NOT ACCOUNT FOR COMPACTION, SHRINKAGE, SWELL, LOSS DURING TRANSPORT, SUBSIDENCE, FOUNDATIONS AND BELOW GRADE STRUCTURES.
3. ELEVATIONS SHOWN ARE BASED ON THE NAVD 88 VERTICAL DATUM.

AREA 4.1 EARTHWORK ESTIMATE

AREA	61.0 AC
CUT	424 CY
FILL	1,079,429 CY
NET	1,079,005 CY (IMPORT)

AREA 4.2 EARTHWORK ESTIMATE

AREA	59.4 AC
CUT	7,568 CY
FILL	840,618 CY
NET	833,050 CY (IMPORT)

AREA 4.3 EARTHWORK ESTIMATE

AREA	41.1 AC
CUT	1,773 CY
FILL	539,453 CY
NET	537,680 CY (IMPORT)

AREA 4 TOTAL EARTHWORK ESTIMATE

AREA	161.5 AC
CUT	9,765 CY
FILL	2,459,500 CY
NET	2,449,735 CY (IMPORT)

GRAPHIC SCALE

200 0 200 400

DRAWING NAME: \\Bkf-rc\vol4\2019\190615_Brisbane_Baylands_R\ENG\EXHIBITS\Grading Design\2021 Datum\BBPRSURF-WEST_2021.dwg
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BRISBANE BAYLANDS - RAILYARD PRELIMINARY GRADING (CUT FILL MAP)

BRISBANE, CA

JANUARY 21, 2022