STEVENS CREEK SHORELINE NATURE STUDY AREA RESTORATION FEASIBILITY STUDY

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CONTENTS

1. INTRODUCTION

The Stevens Creek Shoreline Nature Study Area (SCSNSA) is an approximately 50-acre parcel that lies adjacent to the Whisman Slough reach of Stevens Creek (Figure 1.1). The parcel is managed by the Midpeninsula Regional Open Space District (MROSD) and is currently used for retention of stormwater runoff. Levees and berms separate the SCSNSA from Whisman Slough to the west, from the Western Diked Marsh to the south, and from former salt production ponds to the north, although the parcel itself was never used as a salt pond. The San Francisco Bay Trail runs along the top of the northern and western levees and connects to the nearby Stevens Creek Trail. Along the eastern boundary of the parcel, contaminated debris from the construction of facilities at NASA's Ames Research Center was discarded and built up over time to form a peninsula. The peninsula was cleaned up in 2018: a process that involved removing contaminated soils, grading, removing upland invasive plants, and establishing native species.

Figure 1.1. Stevens Creek Shoreline Nature Study Area and surroundings. Note that a berm separates the Central Basin from the Northeast Basin; the orange dotted line between the SCSNSA and the Central Basin is a property boundary rather than a berm.

The SCSNSA parcel is a part of, and hydraulically connected to, the larger 213-acre Moffett Field Storm Water Retention Pond (SWRP), managed by NASA. NASA uses the SCSNSA parcel for stormwater runoff and retention under a long-standing agreement with MROSD. The SCSNSA parcel provides approximately 200 acre-feet of storage, about 22% of the SWRP capacity. The SWRP has no functional connection to Stevens Creek or the Bay. The SWRP, including the SNSNSA parcel, fills with stormwater runoff over the wet season (winter and early spring) and then empties, primarily by evaporation, during the dry season (summer and fall). The SWRP is also known as Crittenden Marsh, and the SCSNSA parcel as Crittenden Marsh West.

The history of diking, the placement of fill, and the present stormwater function are reflected in a diverse array of habitats: non-tidal open water, diked salt marsh, salt marsh/freshwater seasonal wetland transition, salt panne, and peripheral halophyte. A previous restoration study, the *Feasibility Study of the NASA Retention Basin,* examined four alternatives with varying degrees of tidal restoration for the SWRP, including the SCSNSA parcel (Brown and Caldwell, 2005). The recent clean-up of contaminated soils, the planned restoration of the salt ponds to the north by the South Bay Salt Pond Restoration Project (SBSPRP), potential changes to the stormwater management of Moffett Airfield, the US Army Corps of Engineers (USACE) Shoreline Study levee, and growing interest in the shoreline in general bought on by both climate change and development pressures, indicate that this is an opportune time for MROSD to reevaluate management options at the SCSNSA parcel.

Purpose of this memo

This document assesses the feasibility of various management options for MROSD's SCSNSA parcel, building on existing information about the site and previous restoration planning for both the site and the larger area. In developing potential management options we consider opportunities and constraints for restoration and management of the parcel in both the short and long term. We consider the landscape context of the parcel in relation to 1) NASA's future management of the SWRP; 2) the adjacent Stevens Creek mitigation marsh; 3) the planned restoration and management of Ponds A2W, AB1 and A2E; and 4) proposed alignments of the USACE Shoreline Study levee to protect the area landward of the SCSNSA parcel, which are currently being developed collaboratively through the Sunnyvale Shoreline Resilience Vision process. We also consider target species for protection, integration with adjacent habitats and planned nearby projects, and opportunities to enhance ecosystem services such as flood risk management, carbon sequestration, and public recreation.

We provide a stakeholder engagement plan that can help MROSD develop partnerships and collaborations in the restoration process. The shoreline has many stakeholders and it will be necessary to work with them to achieve meaningful habitat restoration. Relevant stakeholders to engage with include NASA, the Santa Clara Valley Water District (Valley Water), the US Fish and Wildlife Service (USFWS), and the South Bay Salt Pond Restoration Project (SBSPRP), among others.

Management goals

MROSD is exploring management options for the Stevens Creek Shoreline Nature Study Area (SCSNSA) that will improve habitat quality and make the site more resilient to climate change. MROSD would like to leverage this small but strategically-located site for the larger benefit of the region. We used the following goals to guide the development of management options presented in this report:

1. Promote the growth and resilience of populations and habitats of native species.
2. Increase connectivity of water, sediment, and species with adjacent habitat.
3. Do not increase flooding in adjacent properties.
4. Allow for continued public access via the Bay Trail.
5. Be adaptable enough to allow for future management changes in response to shifting habitat needs and environmental conditions.
6. Contribute to regional habitat goals and South Bay sea-level rise adaptation planning efforts.

Outline of memo

This technical memo begins with a discussion of existing conditions at the SCSNSA, including historical changes that led to the development of the current landscape. Following the description of habitats in Chapter 2 is a discussion of projected future changes in environmental conditions in Chapter 3. Chapter 4 is a brief description of considerations to take into account when assessing the feasibility of various management options. The central feature of this memo is Chapter 5, with maps and descriptions of various potential management options for the site. These are followed in Chapter 6 by a discussion of the feasibility of implementing these various options. The memo concludes with suggested next steps and a proposed stakeholder engagement plan (Chapter 7).

2. SETTING

Historical habitats and land use

Historically, the parcel was part of a larger tidal marsh complex that drained westward to Permanente Creek. Most of the site was covered by tidal salt marsh. Marshes were bordered on the terrestrial edge with wet/alkali meadow habitat and on the bayward edge by extensive tidal flats/mudflats representative of historical South Bay habitats (Collins and Grossinger 2004; Goals Project 2015) (Figure 2.1). These marshes supported extensive channel systems and tidal pannes. Construction of levees for salt production in the late 1800's and early 1900's dissected this broad marsh area into managed ponds for salt production. The construction of the ponds to the north of the site removed it from tidal action.

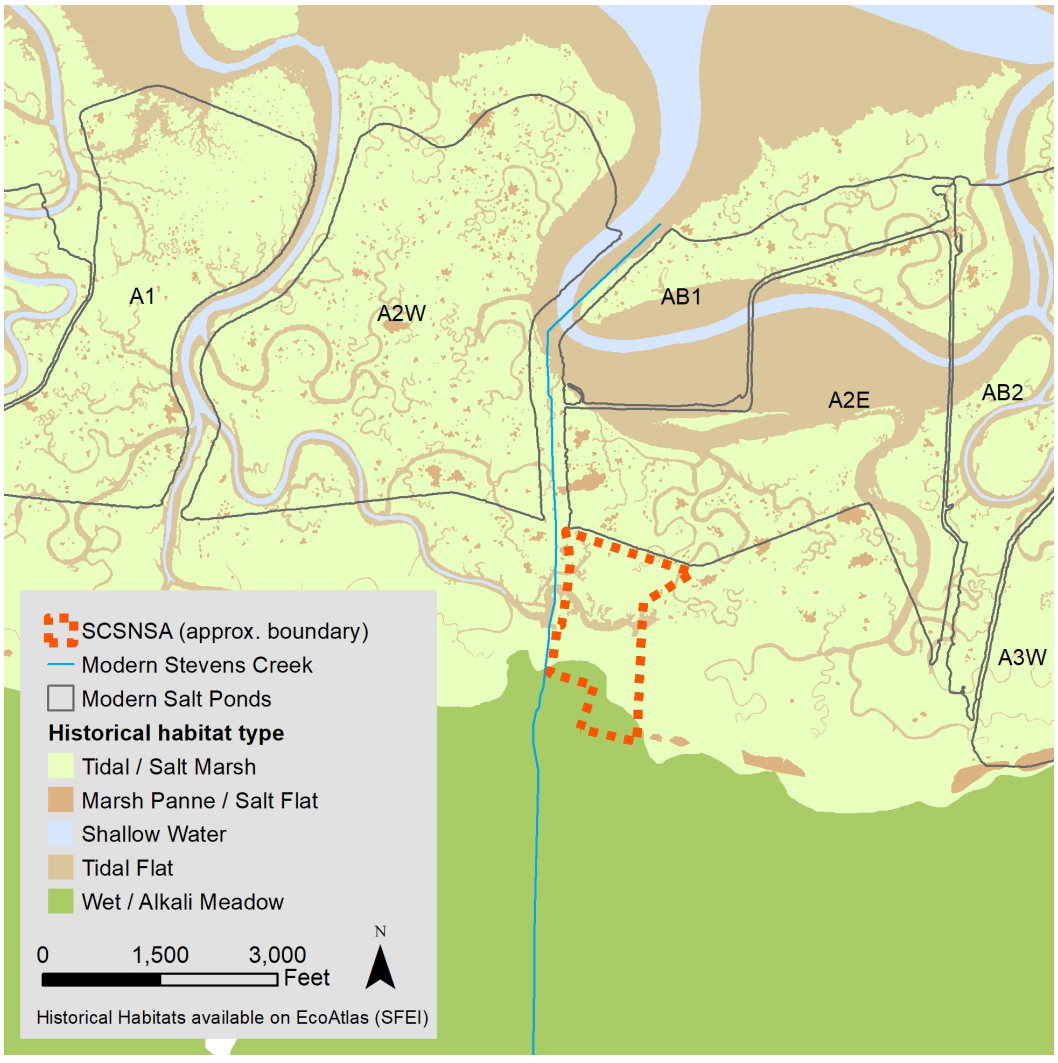

Figure 2.1. Historical habitats at the SCSNSA, prior to diking, draining, and channelizing of Stevens Creek.

Prior to channelization, Stevens Creek terminated in a distributary fan far inland from where it now drains to the Bay, spreading into a wet meadow habitat before it reached the baylands. In the 1870s, the channel was straightened and extended. In Figure 2.2 below (adapted from Collins and Grossinger 2004), a remnant of the distributary alluvial fan can be seen in the 1897 image. By 1948, berms for draining agricultural land and creating salt ponds had separated the SCSNSA parcel from the tidal marshes of the Bay. In the 1960s, high flows from Permanente Creek were diverted to a newly constructed flood control channel that extended Stevens Creek to the Bay along Whisman Slough. Levees separated the flood control channel from the floodplain and tidal marsh, effectively blocking all tidal flow to the SCSNSA. Between 1850 and today, habitat shifted from a tidal salt marsh to a seasonal wetland as the hydrologic connections to the Bay were reduced and eventually blocked.

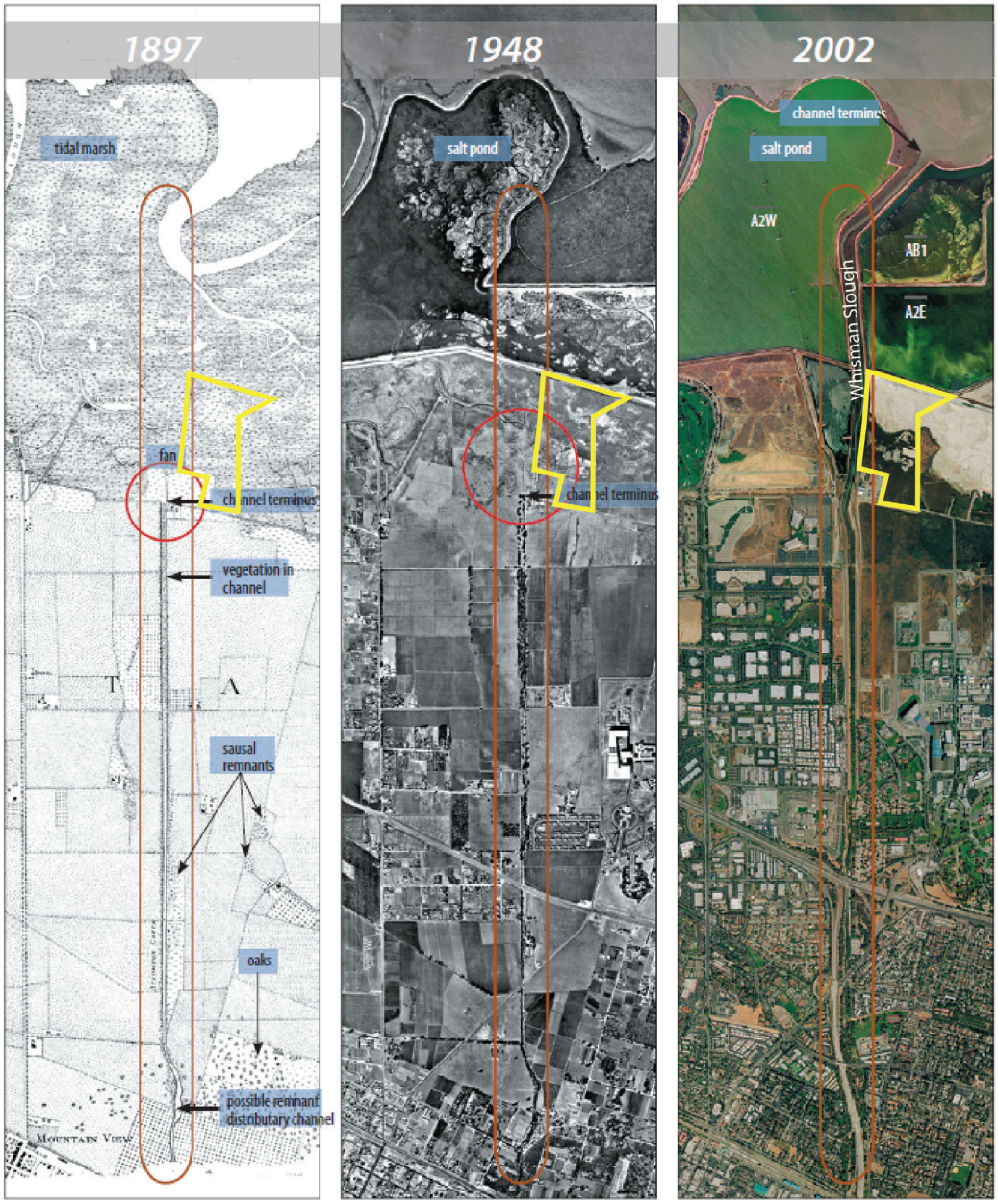

Figure 2.2. (adapted from Collins and Grossinger 2004, figure by Grossinger and Askevold 2004). The yellow boundary shows the approximate extent of the current SCSNSA. The sequence of maps shows the former distributary fan at the mouth of Stevens Creek in 1897 (post channel extension) and the later extension of the channel beyond the newly created salt ponds in the 1948 and 2002 images.

Legacy impacts and contamination

Prior to cleanup in 2018, a peninsula of artificial fill extended into the SWRP along the boundary with the SCSNSA (Figure 2.3). This peninsula was composed of soil and construction debris from construction at the NASA Ames Research Center. Contaminants of concern included PCBs, lead, and DDT. The removal action was undertaken to prevent erosion and contamination of adjacent wetlands. Other remedial actions had been undertaken previously, but the removal of the approximately 65,000 cubic yards of contaminated material in 2018 is considered the final cleanup action. The former peninsula was upland habitat dominated by nonnative weeds. Impacts to pickleweed around the edges of the peninsula during construction and removal of fill were mitigated at a 3:1 ratio (in terms of area) on the former peninsula site after re-grading (Tetra Tech, 2017).

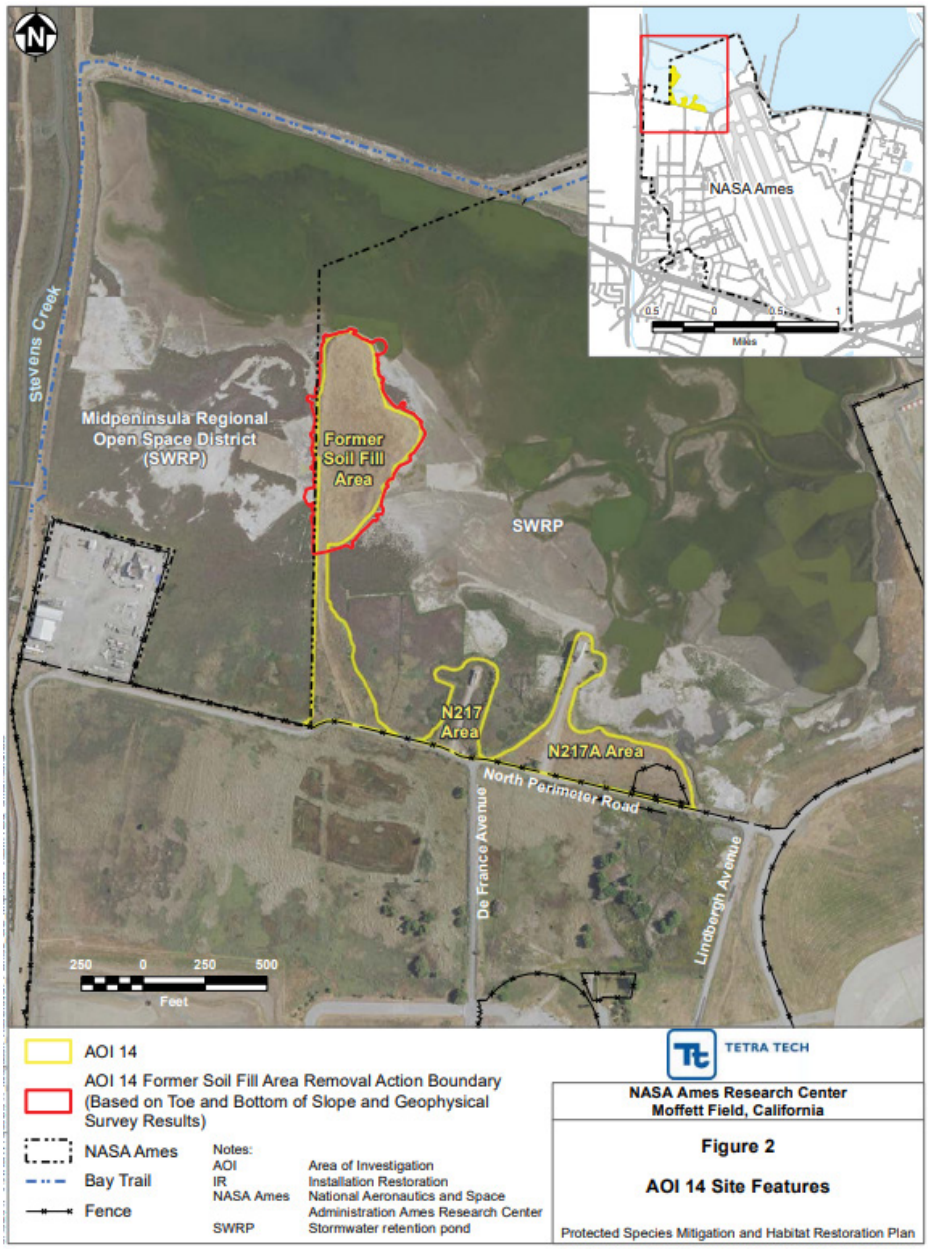

Figure 2.3. Peninsula of artificial fill removed in 2018 remediation action. Figure 2 from Protected Species Mitigation and Habitat Restoration Plan (Tetra Tech, 2017).

Topography

The SCSNSA is a subsided basin surrounded by levees that protect the site from flooding from Stevens Creek and Pond A2E. Like many other diked baylands in the San Francisco Bay Area isolated from tidal action, the SCSNSA has subsided due to compaction and oxidation of organic soils. The site has subsided much below the level of the adjacent marsh in the Stevens Creek channel. The lowest part of the site is in the northeast corner, where ground level is below mean lower low water (MLLW). The highest point on the parcel is in the southwest corner near the emergency preparedness area, at just above mean sea level (MSL) (Figure 2.4). The low elevations in the site mean that even if tidal action was restored to the site today, it would take time for the site to reach elevations sufficient for marsh colonization. Initially, the site would be primarily mudflat. Most of the Moffett Field site falls within the tidal range in terms of elevation, so berms would be required to protect Moffett Field from flooding should tidal action be reintroduced.

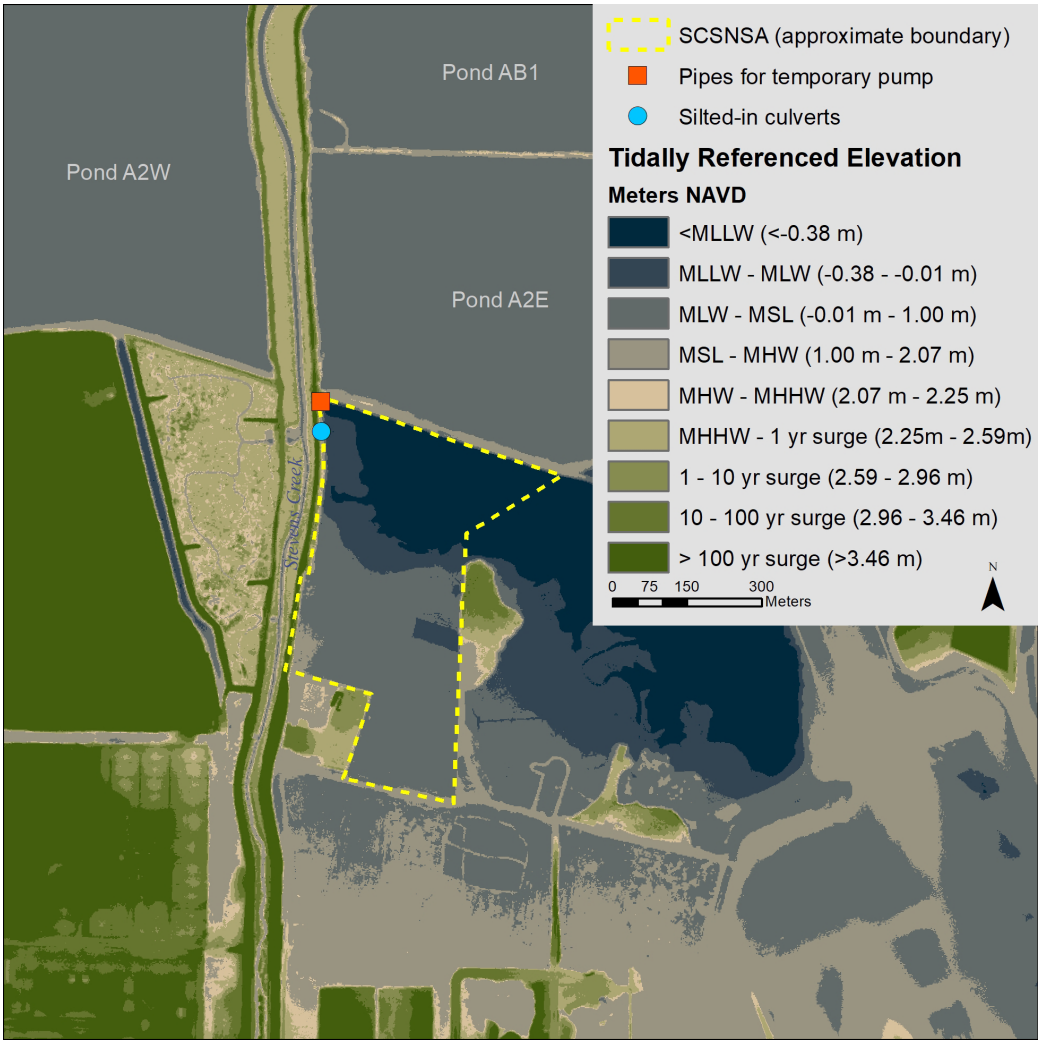

Figure 2.4. Tidally-referenced elevation at the SCSNSA. The site and the rest of the adjacent NASA stormwater retention pond are subsided below sea level. The high-elevation peninsula to the east of the site was removed in 2018 (the LiDAR used to create the digital elevation model shown here was collected for the SBSPRP circa 2010). Note that the bathymetry for Ponds A2W, AB1, and A2E is uncertain; the elevations from the LiDAR are more likely water surface rather than ground surface elevations.

Hydrology

The site is a seasonal stormwater basin with limited hydrologic connections except to the rest of the NASA stormwater retention pond (SWRP) system; there is, at present, no hydrologic barrier between the SCSNSA and the rest of the SWRP. Water from the NASA Ames Research Center watershed's Western Drainage Basin drains to the SWRP via the Eastern and Western Diked marshes through three 48" culverts (Brown and Caldwell 2005, Figure 2.5). The westernmost stormwater culvert (from the Western Diked Marsh) discharges into the NASA central basin, which is hydraulically connected to the SCSNSA (Brown and Caldwell, 2005). The entire SWRP drains an area of approximately 1000 acres and provides about 900 acre-ft of stormwater storage, 200 acre-ft of which is on MROSD property (Brown and Caldwell, 2005). These volume calculations are based on a water surface elevation of 4' (1.2m), the lowest point in the SWRP levees according to Brown and Caldwell (2005).

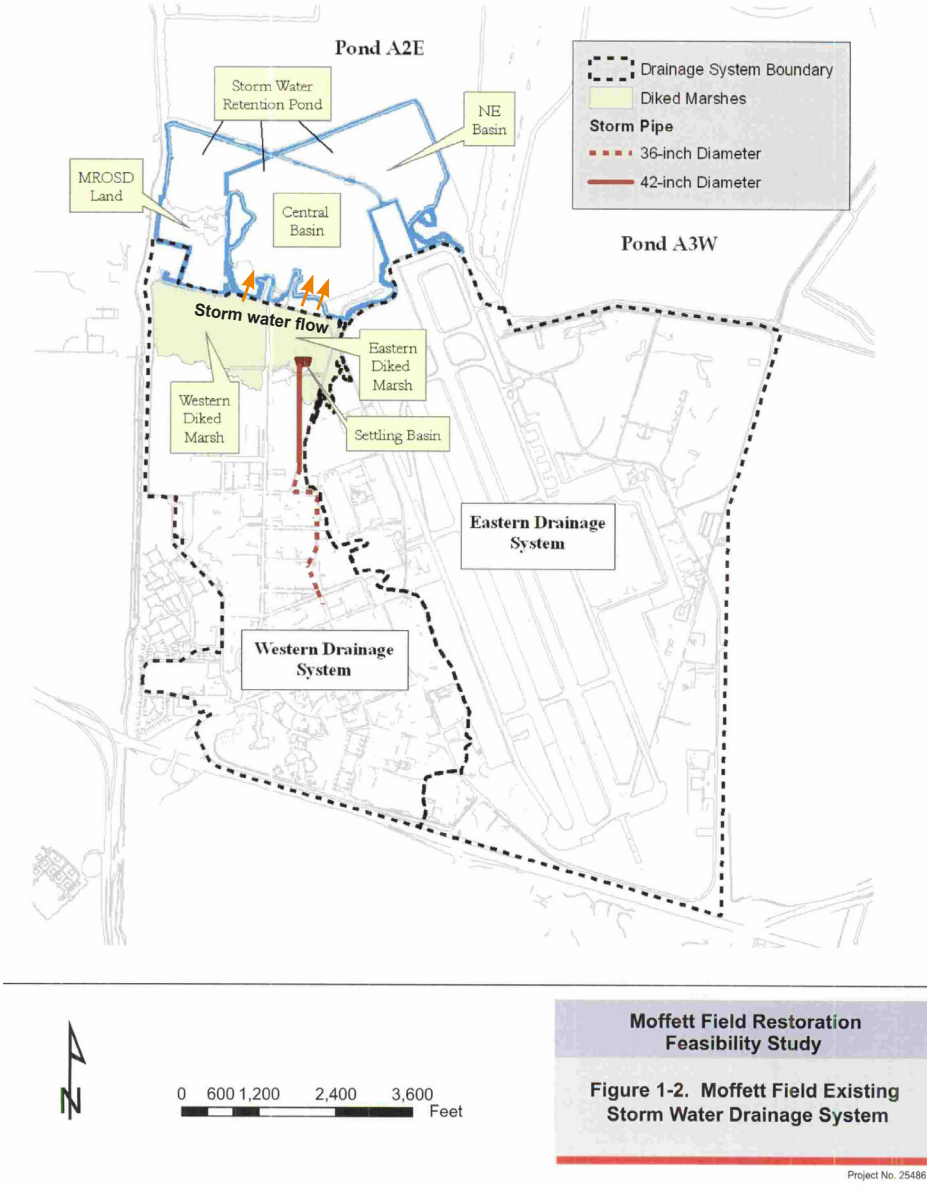

Figure 2.5 (Figure 1-2 from Brown and Caldwell 2005), showing Moffett Field and associated stormwater management system. Stormwater flow arrows (shown in Figure 4-4 in Brown and Caldwell 2005) have been added here (in orange) to indicate where stormwater from the Western and Eastern Diked marshes discharges to the SWRP.

Most stormwater detained in the SWRP evaporates. According to Brown and Caldwell (2005), water is pumped, with agreement from MROSD, from the northwest corner of the SCSNSA to Stevens Creek during very wet years when the pond's storage capacity is reached (see temporary pump location in Figure 2.4). Historically, pumping from the SWRP to Stevens Creek has been an infrequent occurrence. According to MROSD comments on the draft EIS for the NASA Ames Development Plan (2002), MROSD's stormwater agreement with NASA is a verbal license only with no guarantee of continuation.

Pumping location at the northwest corner of the SCSNSA.

Levee seepage may contribute additional water from A2E and Stevens Creek to the site (Brown and Caldwell, 2005). Culverts formerly connected the parcel to Stevens Creek but these have silted in over time and no longer provide a functional connection between the site and the creek channel (Figure 2.4).

Silted-in culverts near the northwest corner of the SCSNSA.

The water table is within 1-2' of ground level in the SWRP (Brown and Caldwell, 2005). According to monitoring of groundwater levels in the SWRP (there are no wells within the SCSNSA), groundwater fluctuates seasonally and is close to the current ground elevation of the SWRP bed. As would be expected, monitoring results showed that groundwater flows toward the Bay (Brown and Caldwell, 2005).

The nearest tide station to Stevens Creek is the Palo Alto Yacht Harbor. Tidal elevations shown in Table 2.1 give a rough idea of the tidal range that would be expected in the SCSNSA if tidal action is restored to the site.

Table 2.1. Tidal elevations relative to MLLW from the Palo Alto Yacht Harbor (NOAA Tides and Currents Station 9414525).

Tidal datum	Ft (m) above MLLW
Mean Higher High Water (MHHW)	7.61 (2.32)
Mean High Water (MHW)	6.99 (2.13)
Mean Tide Level (MTL)	3.88 (1.18)
Mean Low Water (MLW)	0.77 (0.23)
Mean Lower Low Water (MLLW)	0.00 (0.00)

Existing habitats

According to a survey conducted by Brown and Caldwell (2005), habitat types in the SCSNSA include non-tidal open water (seasonal stormwater pond in northern part of site); diked salt marsh (pickleweed-dominated area in southern part of site), salt panne (salt crusts with little to no vegetation), peripheral halophyte (saline vegetation along levees, high water refuge for marsh wildlife), non-native herbaceous vegetation (weedy ruderal species on levees), and salt marsh/freshwater seasonal wetland transition habitat (higher-elevation area, less salt-tolerant plants interspersed with pickleweed) (Figure 2.6). While these habitats have shifted in location and extent since 2005 in response to precipitation patterns, the same basic types of habitat exist on the parcel today: low-quality non-native herbaceous vegetation on the levees, and diked wetlands with seasonal wetland and salt panne habitats across most of the site.

The SCSNSA and surrounding SWRP provide important breeding habitat for waterfowl. According to the South Bay Salt Pond Existing Conditions Report, this is one of a few areas in the South Bay with the combination of freshwater/brackish seasonal wetland, grassy/ruderal vegetation for nesting, and low-salinity ponds and marshes for brooding of young birds that is required for waterfowl breeding habitat (H.T. Harvey & Associates, 2005). The area also provides shorebird roosting and foraging habitat (H.T. Harvey & Associates, 2005)

More detailed information on habitats and species of the SCSNSA/Crittenden Marsh/NASA Stormwater Retention Pond is available in Brown and Caldwell, 2005.

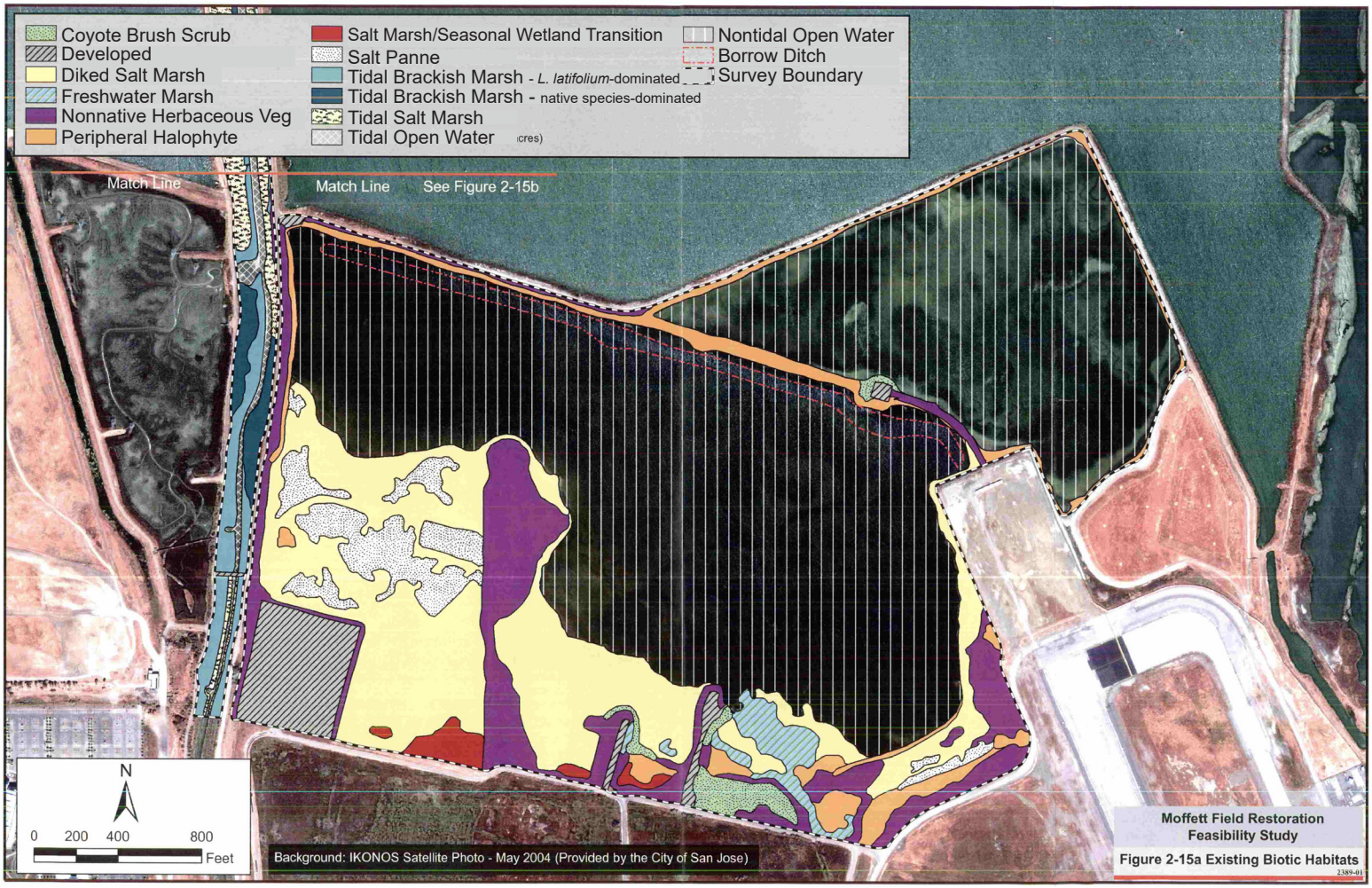

Figure 2.6. Habitats at the SCSNSA. Figure 2-15a from Moffett Field Restoration Feasibility Study (Brown and Caldwell, 2005).

Flora and fauna

Literature reviews and research were conducted to identify known occurrences of special-status wildlife species and sensitive plant communities in the vicinity of the SCSNSA.

Listed wildlife species

Salt marsh harvest mouse *(Reithrodontomys raviventris)*

The salt marsh harvest mouse, listed as endangered at both the state and federal levels, has been documented on site. According to MROSD records, salt marsh harvest mice were documented at Crittenden Marsh in 1985 and 1994. There is one CNDDB listing for the site; trapping grids were set in 1991 (two of three on MROSD property) and one mouse was captured. While pickleweed is typically considered the primary habitat of salt marsh harvest mouse, researchers have recently found that the mice also use other non-tidal land cover types (Smith & Kelt, 2019). Restoration activities should take into account the potential for adverse impacts to habitats that may benefit this species.

Western snowy plover *(Charadrius nivosus nivosus)*

Western snowy plovers (federally threatened) in the Bay Area typically nest in dry salt panne/pond habitat, as well as on levees and berms or other dry, degraded habitats. Western snowy plover populations are threatened by habitat loss and predation. Predators include natural predators such as falcons, gulls, and raccoons, and human-mediated predators such as crows, ravens, and domestic dogs and cats. The western snowy plover intermittently uses the SCSNSA as a nesting site when the site is not ponded. Activity seems to be dependent on weather patterns, with more use in dry years (SFBBO, 2019).

Breeding activity has been documented since 2003. Five nests were monitored in 2018, with three of them hatching successfully and one additional brood sighted using the pond (SFBBO, 2019). This use in 2018 and a sighting of a brood on salt flat in 2019 (R. Phillips, MROSD records) indicates frequent use of the site by western snowy plover in recent years. During the 2020 breeding season at least three nests were monitored on the SCSNSA property with two additional nests either on or adjacent to the SCSNSA property (B. Pearl, personal communication, August 20, 2020).

California black rail *(Laterallus jamaicensis coturniculus)*

The California black rail is listed as threatened at the state level. Black rail are primarily found in the South Bay during non-breeding season in tidal marshes and are only rarely seen at the edges of marshes during high tides (Goals Project, 1999). They have been documented at the SCSNSA in multiple years according to CNDDB records. In 2011 black rail were seen near the "remediation site" (presumably the peninsula that was removed in 2018) in pickleweed and cattails; in 2012 they were sighted in shallow water in diked sedge/cattail marsh; and in 2013 they were seen in the "stormwater retention pond."

California least tern *(Sternula antillarum browni)*

The California least tern is listed as endangered at both the state and federal level. Least terns typically breed in lagoons and sandy beaches, but have adapted in San Francisco Bay to breed in former salt ponds and habitats similar to those used by the western snowy plover. In fact, monitoring by the San Francisco Bay Bird Observatory indicates that snowy plover nesting may benefit from the presence of nearby nesting California least terns due to the defense strategies the terns use to deter avian predators. While least terns have not been documented breeding in Santa Clara County, they have been observed recently at the SCSNSA, with a sighting of two adults flying over ponded areas at the site in 2019 (Ryan Phillips, MROSD database). California least terns have been known to stage at Pond A2E each fall (B. Pearl, personal communication, November 23, 2020). Forster's terns breed in Pond A2E, and gulls, pelicans, herons, and cormorants also feed there, so it may be assumed that there are foraging opportunities in the area.

California Ridgway's rail *(Rallus obsoletus obsoletus)*

The California Ridgway's rail is listed as endangered at both the state and federal level. Ridgway's rails can be found within brackish and salt marshes of San Francisco Bay. They typically use marshes dominated by Pacific cordgrass (*Spartina foliosa*) and pickleweed, foraging along tidal channels and mudflats near the edge of marshes. Ridgway's rails are present in the Stevens Creek channel and at adjacent Stevens Creek Marsh (Olofson Environmental, Inc., 2018). While a few eBird records (not

formal surveys) report Ridgway's rail in Crittenden Marsh (SCSNSA), the primary habitat occurs in the adjacent tidally-connected marshes, not within the SCSNSA itself.

Steelhead trout *(Oncorhynchus mykiss)*

The steelhead trout is listed as threatened at the federal level. Though a barrier to fish passage exists at the Stevens Creek Dam, reducing available habitat in the channel to about half of its historical length, Stevens Creek continues to support a steelhead run and is designated as critical habitat for the central California coast steelhead trout (SCVWD, 2018). Changes to management of the SCSNSA could affect steelhead habitat in lower Stevens Creek.

Other species of interest observed on site or nearby

- **Loggerhead shrike (*Lanius ludovicianus*)** is a California state-listed Species of Special Concern and was documented on site in 1994 by V. Layne (SFBBO, per MROSD database).
- **Western burrowing owl (*Athene cunicularia hypugaea*)** have been declining across their range and are listed as a Species of Concern in California. Burrowing owls have multiple nesting locations nearby, including at the NASA emergency preparedness site adjacent to the property, at the landfill west of Stevens Creek Marsh, and on levees at Pond A2E (CNDDB). Steep embankments, grassland, airfields, golf courses, roadside embankments, and road edges tend to be colonized in this area by burrowing owls. The vegetation in these areas is often nonnative grasses, ruderal species, and/or urban landscaping (CNDDB).
- **Saltmarsh common yellowthroat (*Geothlypis trichas sinuosa*)** have declined throughout their range in California and are considered a Bird Species of Special Concern (Goals Report 1999). They have been documented nearby on NASA property near the airfield. Three breeding pairs were seen in 1985 in the diked freshwater marsh in this area.
- **American avocet (*Recurvirostra americana*)** are protected under the Migratory Bird Treaty Act. They typically use open water habitat and ponds for breeding and have been observed nesting at Ponds AB2 and A2E (SFBBO 2014, 2018).
- **Double-crested cormorant (*Phalacrocorax auritus*)** are widespread within San Francisco Bay, with populations recovering since declines in the 1960s and 1970s. Double-crested cormorants are protected under the Migratory Bird Treaty Act (Goals Report 1999). They have been observed nesting at ponds AB2 and A2E (SFFBO 2014, 2017, 2018).
- **Forster's tern (*Sterna forsteri*)** populations have been decreasing in South San Francisco Bay since they were first observed nesting in 1948, possibly due to predation. They are protected under the Migratory Bird Treaty Act and have been observed nesting at ponds AB2 and A2E (SFBBO 2014, 2017).
- **California gull (*Larus californicus*)** first nested in San Francisco Bay in 1980 and since then their population has continued to increase (Goals Report 1999). Their nesting colonies can have a detrimental impact on populations of other waterbirds. 33 nests were removed from Pond AB2 by USFWS in 2018 (SFBBO 2018).

Rare plants

Congdon's tarplant (*Hemizonia parryi ssp. congdonii*), a rare but not listed annual species endemic to California, has been documented in the gravel road on top of the levee adjacent to Stevens Creek (CNDDB). It was a component of the alkali meadows which formerly existed at the site landward of the tidal wetlands (Beller et al., 2013).

Other vegetation

The vegetated areas of the SCNSA are primarily salt marsh, with the area along the levee characterized by weedy species (Figure 2.7). Dominant species in the salt marsh area include pickleweed (*Salicornia pacifica*), alkali heath (*Frankenia salina*) and saltgrass (*Distichlis spicata*) (Tetra Tech 2017). Similar to many levees around the Bay margins, the adjacent levee to the west of the SCSNSA is primarily vegetated by weedy, ruderal species such as cheeseweed (*Malva parviflora*), mustard (*Brassica* sp.), radish (*Raphanus* sp.), milk thistle (*Silybum marianum*), and non-native grasses.

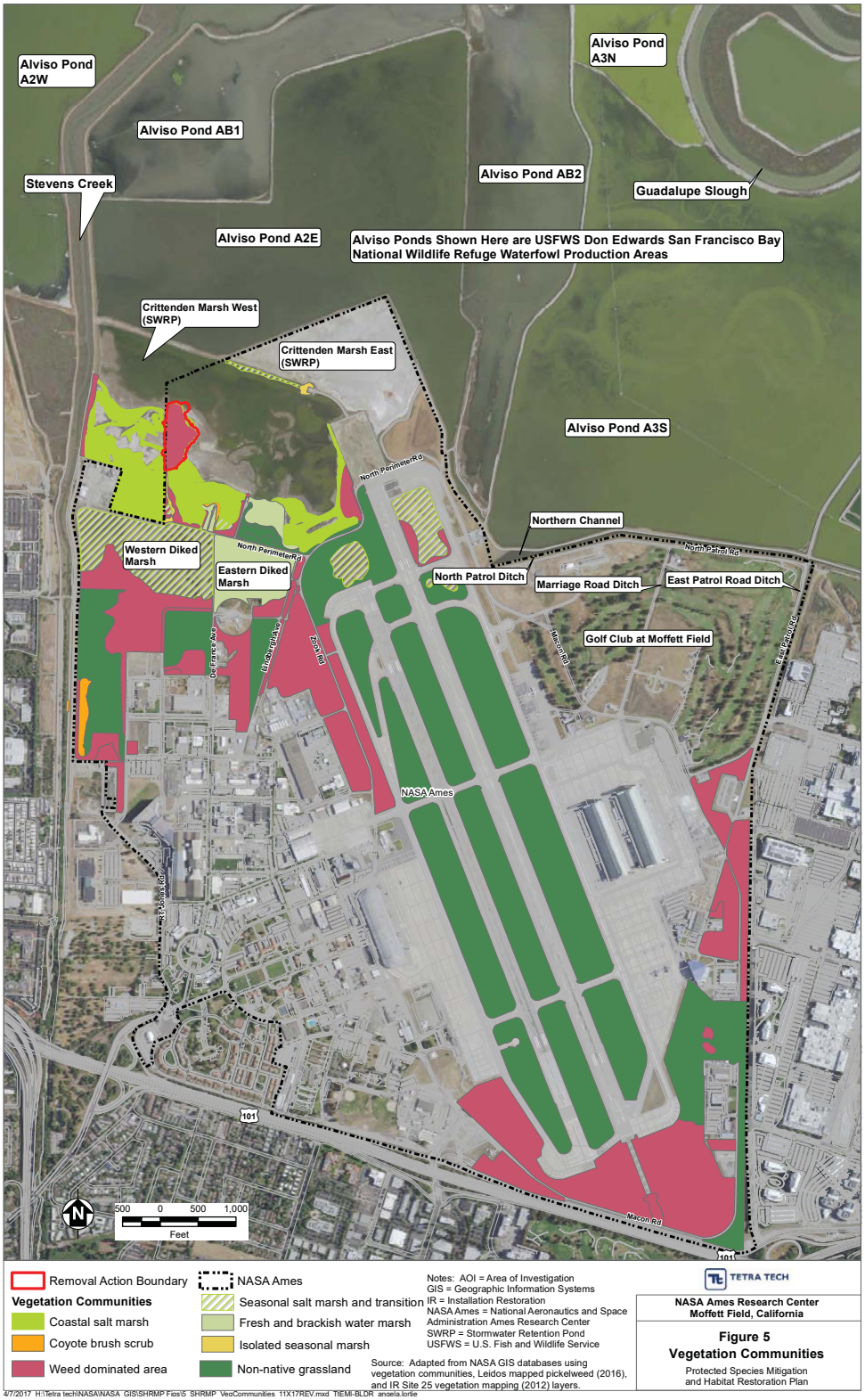

Figure 2.7. Vegetation communities (Figure 5 from Tetra Tech 2017).

Habitat quality assessment

The current mosaic of habitats, both spatial and temporal, includes pickleweed-dominated marsh, open water, mudflat, salt pannes, and vegetated levee slopes. Habitat conditions in the SCSNSA are dependent on hydrologic conditions; the area of pickleweed marsh varies year to year depending on precipitation. While it provides some habitat benefits for the salt marsh harvest mouse it is generally not high-quality salt marsh habitat that can support large numbers of marsh-dependent species. Because there is no control of hydrologic conditions, in drought years the site is completely dry, while in wet years there is significant standing water in the winter and early spring, with the site drying due to evaporation in the summer. These dry periods also provide habitat for some nesting bird species. However, because of the lack of hydrologic control, this habitat can be intermittent between years. The vegetated levees may provide some habitat benefit, but the quality of this habitat for wildlife is generally low as these areas are primarily vegetated by non-native plant species.

Surrounding habitats

South Bay

Historical South Bay habitats included extensive salt marsh, wet meadows, and grassland. These areas no longer exist in abundance in the South Bay and much of the South Bay is now highly urbanized and developed. The SCSNSA is located adjacent and to the south of a large area of former salt evaporation ponds previously owned by Cargill and now owned by the Don Edwards National Wildlife Refuge (USFWS) and managed as part of the South Bay Salt Pond Restoration Project (SBSPRP). These ponds were diked in the early 1900s and returned to public ownership in 2003. The ponds are part of the larger SBSPRP to restore and enhance 15,100 acres of former salt ponds as wetlands at three former salt production complexes owned and managed both by the USFWS (Ravenswood, Alviso) and CDFW (Eden Landing).The goals of the project are to restore and enhance wetlands, provide for flood risk management, and provide wildlife-oriented public access and recreation.

The managed ponds near the SCSNSA currently provide habitat benefits for a number of bird species. Most of these ponds are slated for tidal marsh restoration over the course of the 50-year SBSPR Project, so the opportunity exists to restore some of the large swaths of marshes and associated habitats historically found in the South Bay. Currently, sedimentation rates are generally high enough for marsh establishment in the South Bay, but the use of supplemental sediment from beneficial reuse to raise initial marsh plain elevations may help achieve marsh restoration goals more quickly, especially in light of rapid SLR projections.

There is currently little transition zone habitat in the South Bay in general. Transition zone habitat is proposed as part of the restoration of several SBSPRP ponds and restoring this habitat type within the SCSNSA would be consistent with the SBSPRP goals as well as regional recommendations to restore historic habitats to address climate change (Goals Project 2015).

Neighboring parcels

The SCSNSA is bordered by parcels owned by NASA, USFWS, and Valley Water (Figure 2.8). Information about the surrounding parcels and their associated habitats is detailed in the following pages.

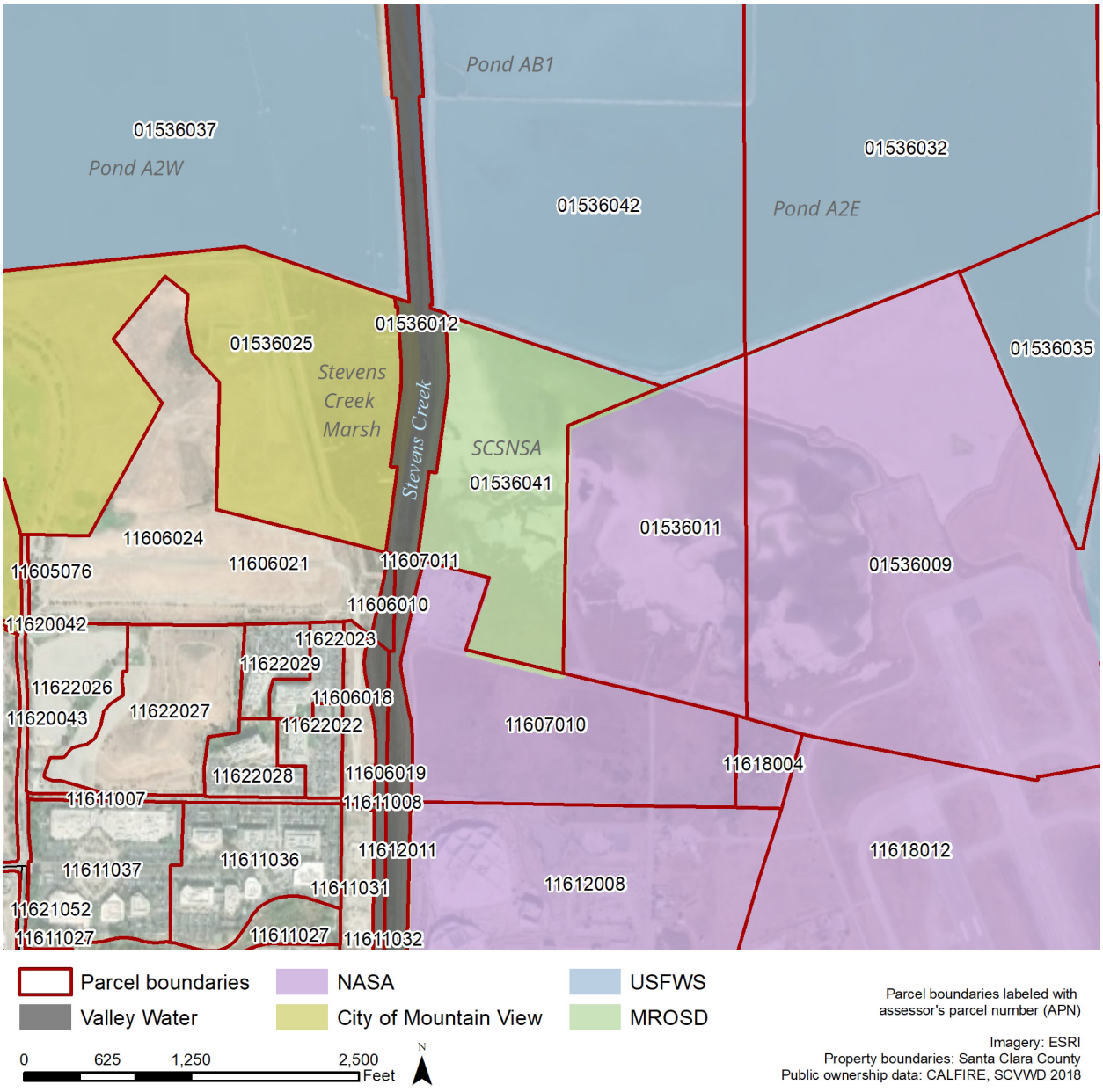

Figure 2.8. Parcels neighboring the SCSNSA. Parcels are labeled with assessor's parcel numbers, and public ownership is identified where known. Ownership data is not publicly available from Santa Clara County.

Managed Ponds near the SCSNSA (Salt Ponds A2W, AB1, A2E)

The diked Pond A2E is located directly adjacent to the SCSNSA and is part of a cluster of managed ponds that also includes Ponds AB1, AB2, A3W, and A3N. The Alviso A3W Pond System is part of the SBSPR Project and is owned and managed by the USFWS as part of the Don Edwards San Francisco Bay National Wildlife Refuge. These ponds are not currently slated for restoration as part of Phase 2 of the SBSPR Project. However, two ponds to the west of this A3W Pond System (Ponds A1 and A2W) will be restored to tidal marsh as part of Phase 2. The USFWS currently manages Pond A2E and other nearby ponds to maintain full tidal circulation in order to maintain discharge salinities to less than 40 ppt and to provide habitat for waterfowl. Management also includes maintaining lower water surface levels in winter to reduce overtopping of levees adjacent to Moffett Field, while also accommodating waterfowl hunting from mid-October to mid-January. Waterfowl hunting is allowed as part of the Refuge's Priority Refuge Public Use Activities (USFWS 2017).

Stevens Creek channel

Stevens Creek begins in the Santa Cruz Mountains, is approximately 22 miles in length, and drains 46 square miles (Stevens Creek and Permanente drainages). Stevens Creek historically drained to marshes in the area before it was straightened and confined to a channel between earthen levees in the Whisman Slough reach adjacent to the SCSNSA. The creek is tidally influenced from the Bay upstream to Highway 101 (SCVWD, 2018). While the channel empties into the Bay, levees isolate the creek from the adjacent salt ponds slated for restoration. 10 miles upstream of the mouth is Valley Water's Stevens Creek Dam and reservoir, which limits the volume of flow to the Bay. The channel and levee are also managed by Valley Water.

The Stevens Creek watershed has a relatively continuous riparian corridor, and watershed restoration activities to benefit conditions for steelhead along all reaches of Stevens Creek are a priority (SCVWD 2018).

NASA

The SCSNSA is adjacent to the extensive NASA Ames Research Center/Moffett Field property (Figure 2.8). East of the SCSNSA are the other parts of the NASA Storm Water Retention Pond (SWRP) (Figure 2.5). The SWRP is a designated Superfund Site due to contamination with PCBs, lead, zinc, and DDT (Brown and Caldwell, 2005). The Navy is responsible for the cleanup. Habitat conditions in the rest of the SWRP are similar to the SCSNSA, though flow toward the northwest (lowest elevation) means the MROSD area is the wettest part of the SWRP. The Northeast Basin has little vegetation or wildlife relative to the Central Basin and the SCSNSA. South of the SCSNSA are the Eastern and Western diked marshes. Due to a freshwater outfall, the Eastern Diked Marsh is a freshwater marsh with some riparian habitat. The Western Diked Marsh is dominated by invasive pepperweed. These areas support more terrestrial species than the SWRP (Brown and Caldwell, 2005). Southwest of the MROSD property is a disaster preparedness training ground for emergency responders owned by NASA Ames.

Stevens Creek Marsh

Stevens Creek Marsh is a 30-acre wetland restored in the 1990s as a requirement for the creation of Shoreline at Mountain View (Philip Williams & Associates, Ltd., 2002). The diked wetland was restored by removing soil and restoring tidal action via culverts connected to Stevens Creek. The wetland is currently constrained on all sides by levees, with tidal flow dependent on the culverts. It is currently considered a muted-tidal brackish marsh and is dominated by alkali bulrush (*Bolboschoenus maritimus*) with areas of cordgrass (*Spartina* sp.) and pickleweed (*Salicornia pacifica*).

A sea-level rise (SLR) vulnerability study for the City of Mountain View noted that SLR will increase the depth and duration of inundation in Stevens Creek Marsh and that the reduced tidal exchange in the marsh due to use of culverts will increase vulnerability to SLR, particularly because sediment delivery to the marsh is reduced by lack of sheet flow over the marsh. As sea level rises, more sediment may be deposited outboard of the culvert, reducing efficiency of tidal exchange (ESA PWA, 2012).

High-voltage PG&E power lines run through Stevens Creek Marsh

3. PROJECTED FUTURE CHANGE

Regional habitat and adaptation goals

The 2015 Baylands Goals Update lists restoration opportunities for each segment of the shoreline. For the Mountain View segment, where the SCSNSA is located, unique opportunities include enlarging existing marshes, providing dispersal corridors from the eastern to the western portion of the South Bay tidal marshes, enhancing and managing ponds for snowy plover, least tern, and other waterfowl and shorebirds, and enhancing tributary riparian areas (Goals Project, 2015). High suspended-sediment concentrations in the South Bay may make this area a good target for tidal restoration, as sediment can accrete faster in restored marshes to keep pace with sea-level rise (SLR). While managed ponds provide important habitat for waterbirds, the ponds will be more difficult to maintain (both in terms of water level and salinity) as sea levels rise.

The Baylands Goals Update recommends restoring a continuous corridor of tidal marsh in this area prior to 2030. For those ponds not restored, the Goals Update recommends modifying management to benefit waterbirds, "warping" (periodically letting tidal flows in and letting the sediment settle out) to raise the elevation of diked ponds, and adapting management to rising sea level.

The strategic location of the SCSNSA along the back edge of the diked ponds and along Stevens Creek provides a unique opportunity to contribute to the goals of enhancing transition zone habitat and riparian corridors. By coordinating with the SBSPRP and Valley Water, it may be possible to leverage the parcel to improve habitat connectivity from the baylands to inland areas along this riparian corridor. Connecting the parcel to Stevens Creek and the Bay could create a more natural creek mouth for the artificial channel, which currently bypasses the baylands and delivers freshwater and sediment directly to the Bay. Restoring better connectivity to the baylands could help recreate a more natural fresh-to-brackish-to-saltwater gradient that historically existed in this area, where creek mouths, freshwater seeps, and wet meadows abutted the bayward edges of salt marsh in the South Bay (Collins & Grossinger, 2004; Beller et al., 2013). It could also enhance sediment delivery to the baylands and improve geomorphic processes in the channel (SCVWD, 2018). A reconnected creek mouth could also benefit fish passage for migratory species including steelhead trout. The location of the parcel at the back of the diked baylands provides an opportunity for transition zone restoration; depending on the location of future flood risk management levees, ecotone slopes could be constructed to provide high-tide refuge, marsh migration space, and transition zone habitat.

However, the nature of the existing habitat in the parcel suggests there is an opportunity to contribute some of the habitat functions of diked ponds and baylands listed in the 2015 Goals Update, supporting species like snowy plover. To best contribute to regional habitat goals, MROSD may need to work with other scientists and land managers to determine what habitat types are most needed in the short term and are most resilient to climate change in the long term. For example, it may be most feasible to implement tidal restoration in tandem with neighboring SBSPRP ponds, when current levees are no longer sufficient to protect the site, and/or when a flood risk management levee is built to protect inland areas. Therefore, near-term restoration targets may

be aimed at improving habitat quality for listed species that currently use the site, involving more enhancement than overhaul.

Changes in neighboring land uses/habitat

South Bay Salt Pond Restoration Project (SBSPRP)

The SBSPRP is operating with a phased approach and an adaptive management strategy whereby each phase is evaluated based on lessons learned in order to plan next phases of the project. The Programmatic EIR lays out alternatives that may be adopted as the project moves through phases depending on various factors, such as wildlife needs, SLR, and sediment supply. The 90:10 Alternative at Year 50 assumes a mixture of 90% tidal marsh restoration and 10% managed pond restoration. Under the 90:10 Alternative, Ponds AB1, A2E, and AB2 will be restored to tidal marsh (Figure 3.1). The 50:50 Alternative assumes a mixture of 50% tidal marshes and 50% managed ponds. Under the 50:50 Alternative, the same ponds would be restored to tidal marsh as under the 90:10 Alternative, with the exception of Pond A2E which would be maintained as a managed pond (Figure 3.2).

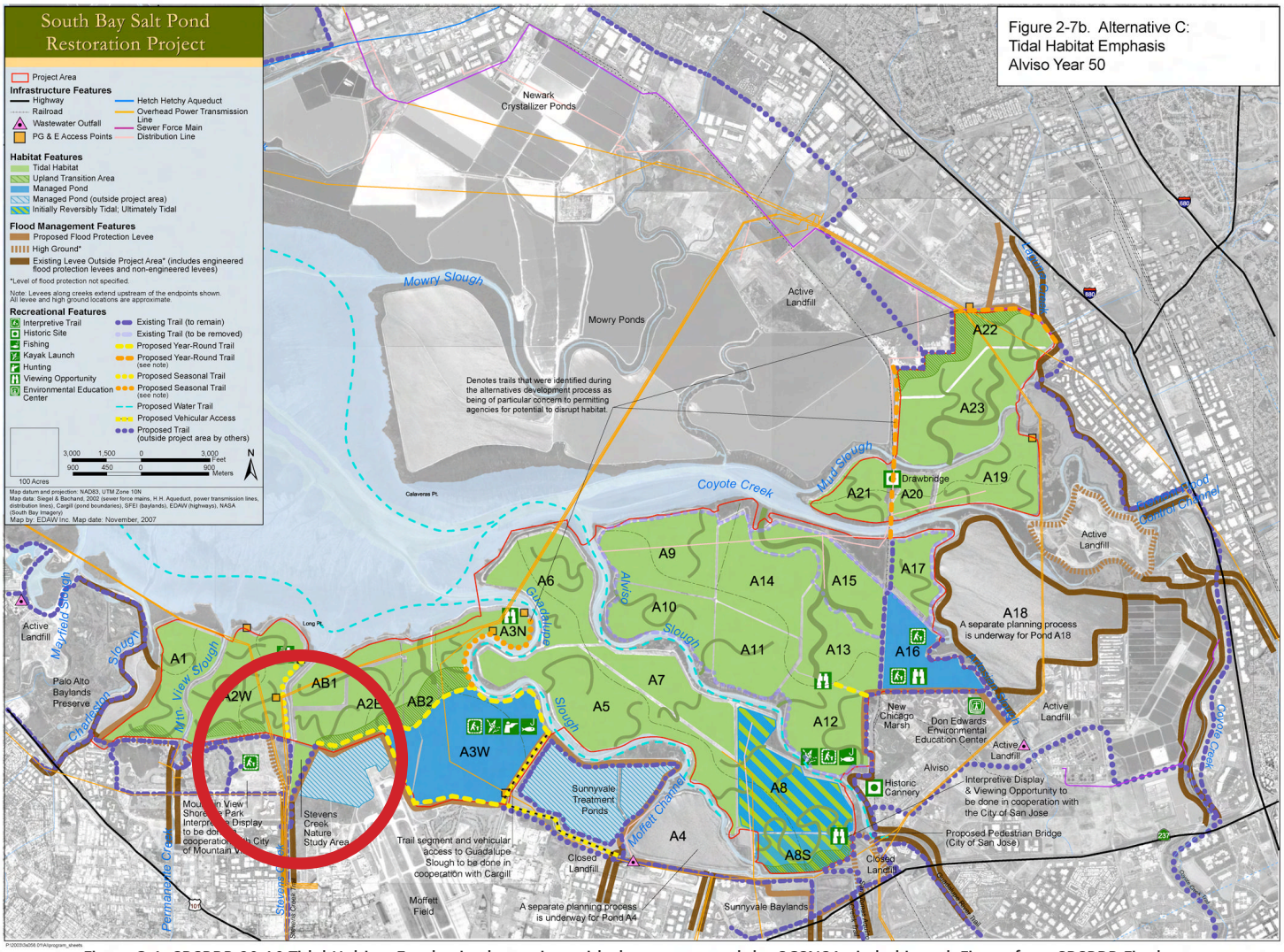

Figure 3.1. SBSPRP 90:10 Tidal Habitat Emphasis alternative, with the area around the SCSNSA circled in red. Figure from SBSPRP Final EIS/R (2007)

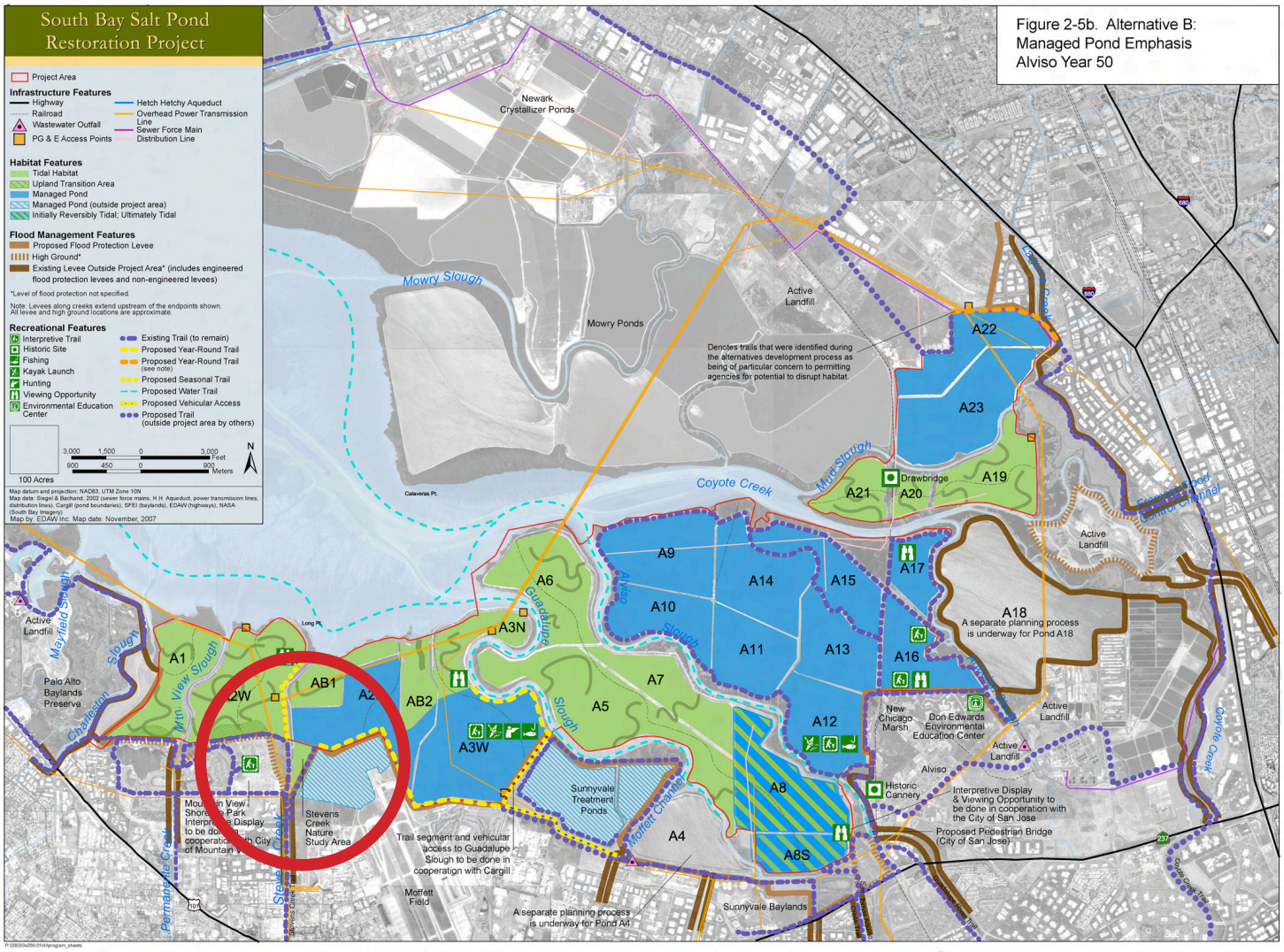

Figure 3.2. SBSPRP 50:50 Managed Pond Emphasis alternative. Figure from SBSPRP Final EIS/R (2007)

U.S. Fish and Wildlife Service

In the near term, the USFWS is planning to maintain and reinforce the outer berms of Ponds AB1, AB2, A3N and A3W, thereby reducing the possibility of berm failures and overtopping. To reduce maintenance costs for degraded internal berms and maintain water quality, the USFWS will be replacing a water control structure with a breach between Ponds AB1 and A2E and lowering internal levees to provide increased waterbird habitat. After work is complete, Ponds AB1, A2E and AB2 will function as one pond system and A3N and A3W will be maintained as a separate pond system.

City of Mountain View

A 2012 report prepared for the City of Mountain View (ESA PWA, 2012) provides detailed information about the impacts of sea level rise in the general vicinity of the SCSNSA (the SCSNSA is not included in the modeled area, as Stevens Creek is the eastern boundary of the Shoreline Community which was studied). Though a recent project provided FEMA-certified 1% flood protection upstream of Crittenden Lane, the modeling effort undertaken for the sea-level rise study found that the levee

along lower Stevens Creek (west of the creek) is vulnerable to a 1% flood under existing conditions. Improvements to the levee along lower Stevens Creek north of Crittenden Lane (south of Stevens Creek Marsh) were recommended in the report. To meet FEMA certification standards along this reach, the report recommends improving levee stability, slightly raising existing crest elevations, and adding a short section of new levee with drainage culverts at the southern end of the drainage channel adjacent to Stevens Creek Marsh. The Santa Clara Valley Water District (Valley Water) manages flood protection in the Santa Clara County.

Shoreline Study

The South San Francisco Bay Shoreline Study ("Shoreline Study") is a Congressionally-authorized study by the United States Army Corps of Engineers (USACE), in collaboration with Valley Water and the State Coastal Conservancy. The goal of the study is to identify projects promoting flood risk management, ecological restoration, and public access in the South San Francisco Bay area that should receive federal funds. Phase I of the Shoreline Study covered the Alviso area. The Alviso Shoreline Project was approved in 2016, funds were authorized in 2018, and construction began in 2019. Phase II covers Palo Alto and is currently underway. Partners participating in the Sunnyvale Shoreline Resilience Vision process (see Chapter 7 for more information) are helping develop alternative alignments, costs, and benefits for the Sunnyvale shoreline to present to USACE for a potential Phase III starting sometime after October 2021. There are opportunities for MROSD to participate in collaborative efforts with other stakeholders in preparation for Phase III.

NASA

Given projected sea-level rise and other environmental shifts due to climate change, management adjustments to the NASA stormwater system will likely be required, necessitating collaboration to achieve stormwater management goals and promote the resilience of habitats and species. Specific impacts and potential changes to the NASA stormwater system have not been assessed for this report. As changes in development and stormwater management on NASA property could cause shifts in habitat in the SCSNSA and surrounding areas, coordination with NASA will be an important next step in the planning process (see Chapter 7).

Watershed

Development upstream could change runoff patterns and increase freshwater flows in Stevens Creek. More freshwater from the watershed could cause overtopping in vulnerable areas of levees and impact habitat conditions in areas receiving inputs from Stevens Creek (e.g. Stevens Creek Marsh).

Climate change and sea-level rise

State sea-level rise guidance (CA Ocean Protection Council, 2018) provides sea-level rise projections for San Francisco Bay. The guidance provides probabilistic decadal projections of sea-level rise, with respect to a baseline of the year 2000, based on high and low emission scenarios, and location on the California coast. The recommended projections for San Francisco are shown in Figure 3.3 below. For a medium-high risk aversion planning purpose, these projections are 1.9′ (0.6 m) by 2050 and 6.9′ (2.1 m) by 2100. The crest elevation of flood risk management levees also needs to take account of increased storm surge water surface elevations and wave run-up. The location of the parcel adjacent to Stevens Creek means that there could be elevated water levels due to the combination of both high Bay water levels and high fluvial discharges if they are coincident during a storm event.

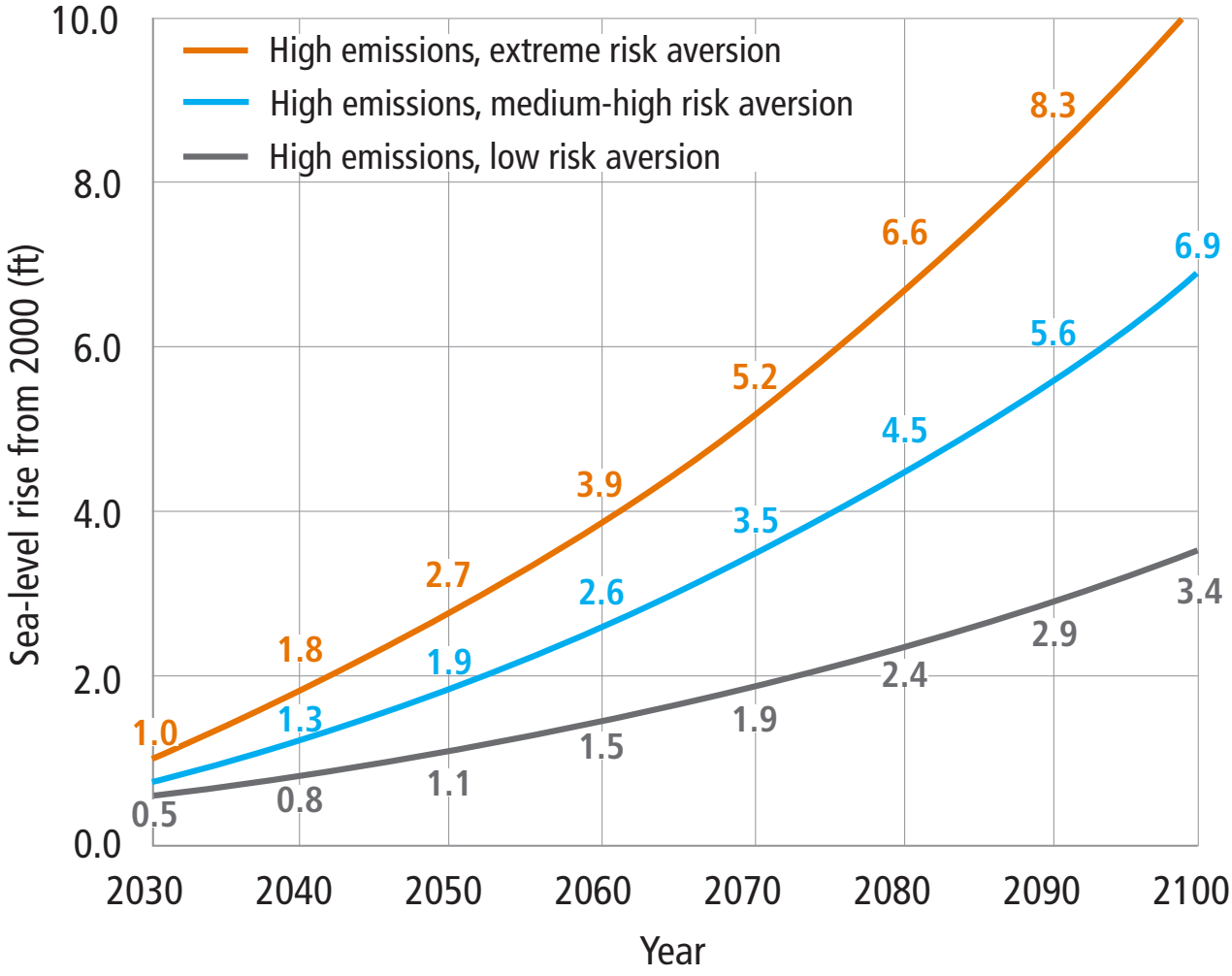

Figure 3.3. Projected sea-level rise (in feet) for San Francisco (adapted from Table 1, CA Ocean Protection Council 2018). All three curves shown on the chart are for a high-emissions scenario. The blue line shows the 0.5% probability SLR curve, which is recommended for medium-high risk aversion planning purposes.

Where shallow aquifers are unconfined (i.e., have a direct interface to the ocean and are not overlain with a solid, impermeable layer), groundwater will rise as sea levels rise (Bjerklie et al., 2012). Even if shoreline levees are raised to prevent inundation from the Bay or Stevens Creek, rising groundwater may emerge above the ground surface and reduce the stormwater storage capacity of the SWRP. Given that the water table is already at about ground surface in the SWRP, rising groundwater is likely to affect hydrologic conditions in the site regardless of which management option is pursued. Both sea level rise and rising groundwater should be accounted for in the design of any management strategy for the SCSNSA.

Downscaled climate projections for this area predict that by the end of the century (2070-2099), average temperatures will be about 4 degrees Fahrenheit higher than 1961-1990. Though the trends are less clear than they are for temperature, average annual precipitation is projected to increase slightly by the end of the century relative to historical conditions, with more precipitation falling in extreme events (Cal-Adapt).

Stevens Creek

4. FEASIBILITY CONSIDERATIONS

In this section, considerations relevant to the development of management options are discussed. The information in this section is broadly applicable to multiple (or in some cases, all) of the management options. The Feasibility Analysis section (Chapter 6), which follows the description of management options, describes the differences and tradeoffs between the management options presented.

Stormwater management

Most management options presented here assume a discontinuation of management of NASA stormwater on MROSD property. A record of a MROSD comment on the NASA Ames Development Plan EIS (2002) notes that the stormwater agreement is verbal and that there is no guarantee that NASA's use of the SCSNSA for stormwater storage must continue, whether or not tidal restoration is undertaken at the site. According to NASA's 2005 restoration feasibility study, "NASA has agreed to discontinue use of the MROSD parcel for storm water retention in the future if levee were to be constructed by MROSD or the US Army Corps of Engineers as part of the SBSPRP, to isolate the MROSD parcel from the SWRP" (Brown and Caldwell 2005, page 4-1).

Implementation of any of the management options (with the exception of maintaining existing conditions) could impact the functioning of the SWRP by reducing the storage capacity of the SWRP and inhibiting the pumping of water from the SWRP into Stevens Creek. Close coordination with NASA will be required to determine impacts to the stormwater management system and potential habitat implications of separating the MROSD parcel from the rest of the basin.

Bird strike

Due to potential bird strike hazards, large water features (including wetlands) are a concern near airport runways. Coordination with NASA Ames will be required to determine how changes in habitat may affect bird populations and associated bird strike hazard within airport safety zones at Moffett Field.

Public access

The San Francisco Bay Trail (Bay Trail), which provides walking, biking, and wildlife viewing access to the SCSNSA and surrounding area, is located on top of the levees to the north and west of the SCSNSA along Ponds A2E and Stevens Creek (Figure 4.1). The Bay Trail connects to the nearby Stevens Creek Trail, which runs south from the SCSNSA alongside the creek channel. Management options that involve changes to these levees should consider alternate alignments to allow continued public access along the Bay Trail on this part of the shoreline. Close coordination with the Bay Trail and the City of Mountain View will be required to determine how to facilitate continued access both

during and after construction. While many members of the public use the trail for recreation, there are also many commuters who rely on the Bay Trail to get to work each day.

A recent resurfacing effort paid for by Google resurfaced four miles of the Bay Trail from Stevens Creek east to Carl Road in Sunnyvale (Mountain View Voice, 2016). Similar standards to those used for this previous project may apply for any trail changes related to restoration at the SCSNSA.

Another public access consideration is waterfowl hunting, which is currently allowed on Refuge managed ponds. Management options that blur the boundary between MROSD and USFWS property will need to consider how to reconcile this priority public use activity for the Refuge with MROSD regulations prohibiting carrying of firearms. MROSD could consider granting land use and/or management permissions to USFWS, depending on which management option is pursued. This could help clarify the boundaries of allowed firearm carry and hunting and lessen management requirements for MROSD staff. MROSD board reports from as early as 1990 indicate interest in pursuing a joint or outside management agreement with USFWS.

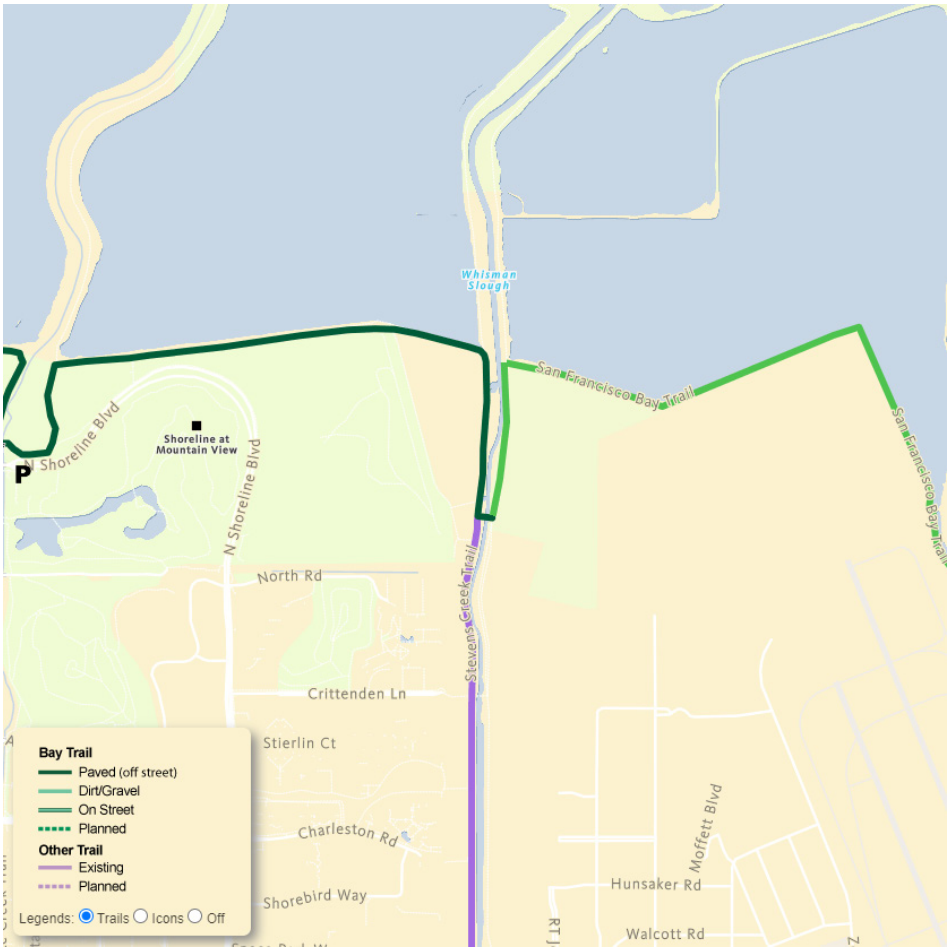

Figure 4.1. Bay Trail alignment (figure from San Francisco Bay Trail webmap). The Stevens Creek Trail is shown in purple.

Transition zone habitat

For management options that restore tidal flows to the site, planning for upland transition zone habitat is an important consideration. Estuarine-terrestrial transition zones are ecotones that provide a link between terrestrial areas and tidal marsh habitats. Though they were historically common, transition zone habitat today is fragmented or completely absent in most parts of the Lower South Bay (Beller et al., 2013; Nur et al., 2018). Planning for transition zone habitat is increasingly important in the context of climate change because it provides critical high tide refuge for marsh species and migration space for marshes to move upward as sea level rises.

Two potential options for incorporating transition zone habitat into tidal marsh restoration designs are ecotone levees and marsh mounds. Ecotone levees are gentle slopes (with a length to height ratio of 20:1 or gentler) bayward of flood risk management levees. They connect the levee crest to the marsh surface, and can provide transition zone habitat when properly vegetated with native grasses, rushes, and sedges (SFEI & SPUR, 2019). Marsh mounds (in the middle of the marsh plain rather than at the edge) enhance marsh structural heterogeneity, increase plant species diversity within the marsh, provide barriers to wind-driven waves that can cause erosion, and provide high-tide refugia for wildlife (Goals Project, 2015). Either of these two options (ecotone levee or marsh mounds) could be implemented for any of the tidally connected management options. Marsh mounds require considerably less material and therefore are less costly than ecotone levees; however, they do not provide the same marsh migration space and wave damping functions at the back edge of the marsh.

Adjacent habitat, levees, and nesting birds

Habitat complexity and the uses of adjacent areas are important considerations in determining the best ecological value of the site. This part of the South Bay contains some abrupt transitions between habitat types, and wildlife species have been known to utilize the modified landscape in sometimes unexpected ways. Therefore it is important to understand the management implications of an action in the context of adjacent uses. For example, if tidal action is restored to the site, levee maintenance could be complicated by adjacent uses that attract protected wildlife. For instance, snowy plovers have been known to nest on levee tops. Therefore, long-term operations and management of any proposed facilities need to be assessed in the context of restrictions that will likely be present due to the sensitive nature of adjacent habitat.

Management requirements

In assessing management options, the limited capacity of MROSD to actively manage the site needs to be taken into account. The set of management options outlined in Chapter 5 includes a range of management requirements. As mentioned in the Public Access section above, one potential option if future changes to the SCSNSA increase maintenance responsibilities is to explore a joint or outside management partnership with USFWS.

The management options presented need not be considered discrete. A combination of these options could be selected as part of a phased or adaptive management approach, as 1) management capacity changes; 2) the site evolves in response to future conditions, or 3) habitat plans for adjacent parcels become more fully developed.

Berm/Levee alignment

Another consideration in the development of management options is cost limitations. While most cost considerations are discussed in the feasibility and implementation section (Chapter 6), one key decision point is the alignment and, therefore, the length of a berm or levee north of the Western Diked Marsh. A berm or levee will be required for all alternatives except Option 1. The longer alignment (dashed yellow line) shown in Figure 4.2 below is approximately 1,880 linear feet, while the shorter alignment (solid yellow line) is 590 linear feet. Management of the approximately 9-acre area at the back of the SCSNSA will be affected by the alignment; with the longer alignment it would remain hydraulically connected to the rest of the parcel, while with the shorter alignment it would be disconnected.

Figure 4.2. Potential levee alignments north of the Western Diked Marsh. The large white arrow indicates the 9-acre area that will be affected by the alignment decision.

If the shorter alignment is selected, management options for the hydraulically disconnected square 9-acre area include the following:

1) a detention basin to collect water that formerly flowed to the SCSNSA. Pumps and pipes could be installed to discharge to Stevens Creek to prevent overflow.

2) a seasonal wetland that would be inundated in the winter/early spring and mostly dry the rest of the year, depending on rainfall.

3) an area managed for upland species similar to the Western Diked Marsh.

4) a managed pond for snowy plover and/or California least tern habitat, similar to what is described for Option 2 below.

5) a seasonal wetland with surrounding berms enhanced for nesting plover and/or California least tern by spreading rock or gravel and creating a gentler slope from the berm to the marsh. Human disturbance would need to be reduced on these stretches of berm during nesting season.

5. MANAGEMENT OPTIONS

Seven management options are described in the following section. They vary by inundation regime:

- Options 1 and 2 are disconnected from the Bay's tides and have seasonal ponding. Option 1 maintains the existing habitat; Option 2 is focused on Snowy Plover habitat and has tidal gates that limit the high tide elevation within the site.
- Options 3 and 4 are focused on muted or fully tidal marsh. Both have sub-options with different amounts of grading and fill to accelerate the evolution of tidal marsh and with different amounts of connectivity to adjacent parcels.

A discussion of the permitting process that would be required to implement a new management strategy at the SCSNSA is provided in Chapter 7.

Existing conditions at the SCSNSA (March 2020)

Option 1: Maintain existing diked marsh/stormwater pond

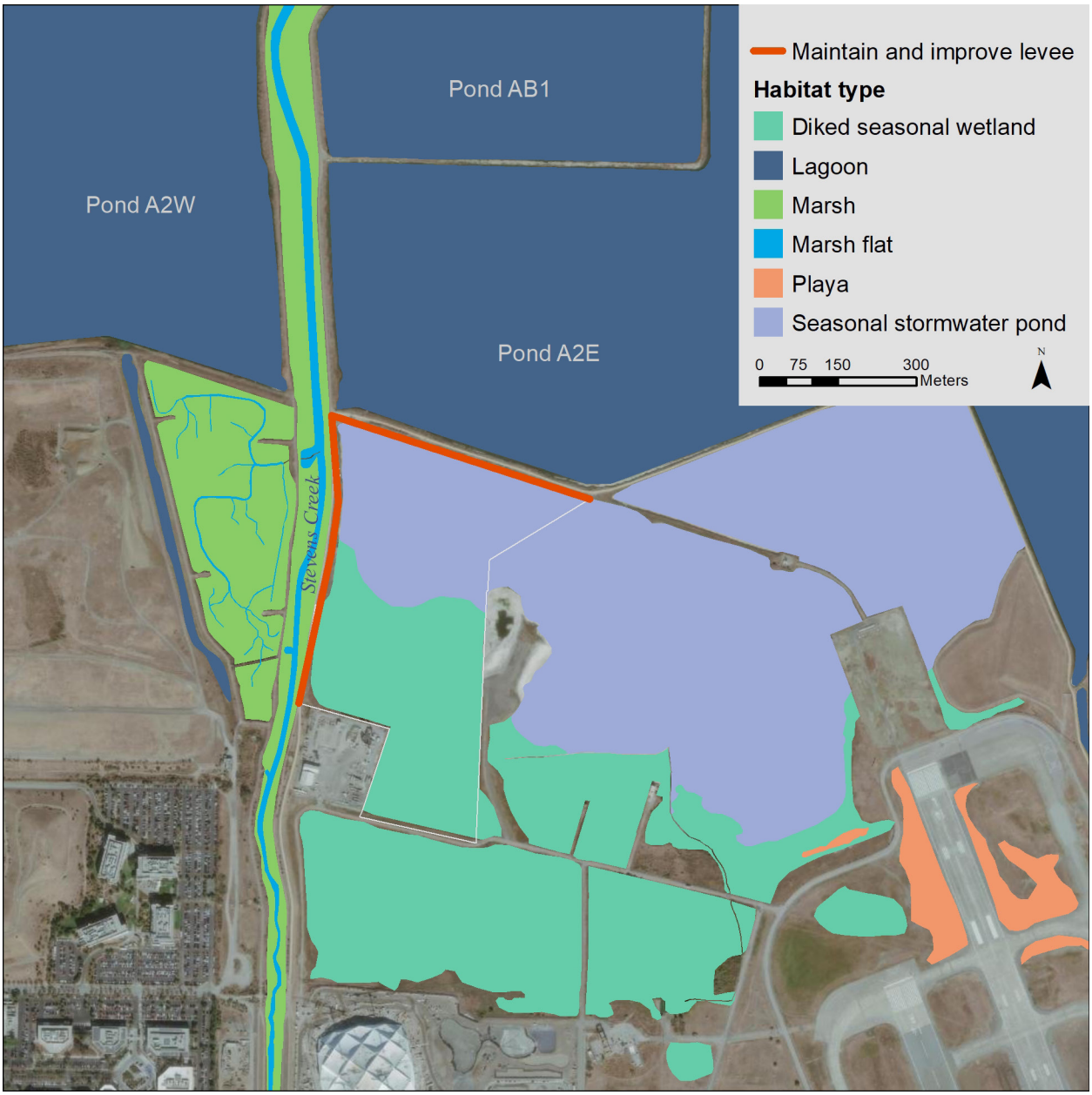

Figure 5.1. Option 1: Maintain existing diked marsh/stormwater pond

In this option, the target habitat type would be the existing condition of the site. Species that use the Stevens Creek Shoreline Nature Study Area (SCSNSA) today, including salt marsh harvest mouse and nesting snowy plover, would benefit from a continuation of current management practices.

There are a number of active management options that could be pursued to enhance existing habitat. One option would be to restore some connectivity to Stevens Creek through existing (currently silted-in) culverts. This may require permits from the SF Bay Regional Water Quality Control Board to address any water quality/discharge requirements. Ponding (stormwater pond levels) could be

managed more carefully for habitat benefit. Inputs of brackish water from Stevens Creek could be enhanced. Brackish habitats are important for both the Ridgway's rail and the salt marsh harvest mouse. While the salt marsh harvest mouse is known to use saline habitats, they also use brackish habitats in the South Bay (Shellhammer et al., 2010). Management of invasive species, particularly on levees, could be beneficial, though vegetation management is unlikely to have a major influence on habitat quality.

This option would require maintaining and improving existing levees as sea level rises. This will become increasingly challenging over time. Rising groundwater and changing precipitation conditions may increase the volume of water within the parcel even if levees are maintained, requiring more pumping in wet years to maintain existing habitat conditions. The strategy assumes continuation of the current stormwater management system and is therefore dependent on NASA stormwater management strategies. If NASA implements changes to their levee and stormwater management system, MROSD will need to adjust accordingly to maintain habitat conditions at the SCSNSA.

Maintaining existing conditions does not increase long-term resilience as much as the options that allow tidal flows into the site, restoring hydraulic connectivity and allowing sediment to accrete. Without this connection, the site will be increasingly disconnected from Bay water levels, and hydrology will be more difficult to manage as groundwater rises and stormwater inflows change.

However, habitat for snowy plover and other nesting bird species is needed as tidal restoration occurs elsewhere. Considering the existing use of the site by listed species, maintaining the existing habitat, which benefits limited numbers of snowy plover and salt marsh harvest mouse, could be a logical option in the short term until definitive plans have been made for neighboring areas. A "wait and see" approach may allow flexibility to implement restoration based on future habitat needs. For example, there may be potential to restore later in tandem with the SBSPRP and thereby reduce maintenance costs for the berm on the north side of the site. Possible triggers for action might include: significant decline or loss of site function (ecological or stormwater-related), progress on related projects by adjacent landowners, significant new funding opportunities, etc.).

This option involves continuation of current NASA stormwater management at the site. There would be no change to public access or the Bay Trail alignment.

Option 2: Manage pond for snowy plover

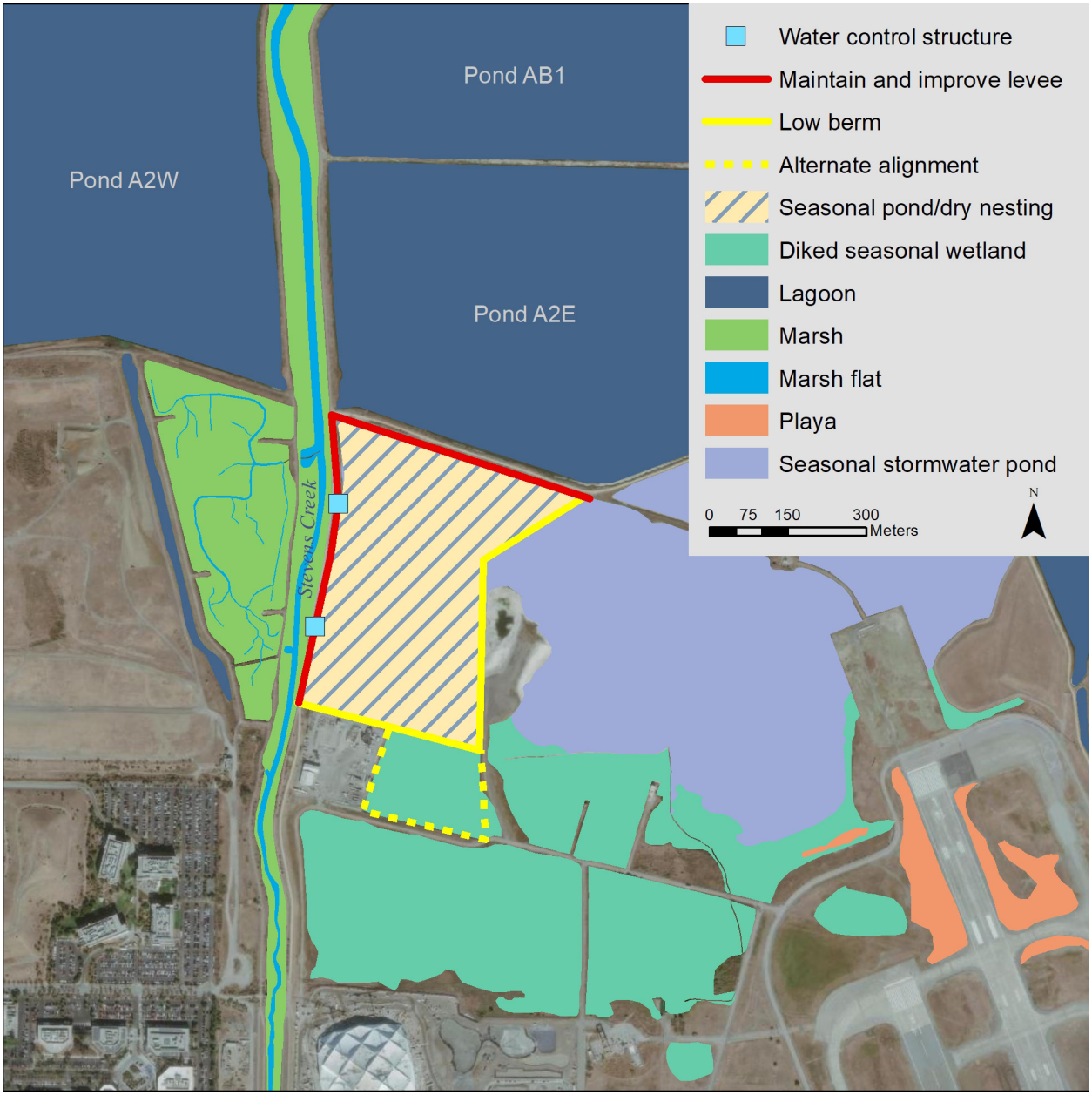

Figure 5.2. Option 2: Manage pond for snowy plover

The target habitat type for this option would be reconfigured managed pond habitat, specifically providing nesting habitat for western snowy plover, which intermittently use the SCSNSA as a nesting ground. Analogs for this type of managed pond exist at Ponds SF2 (Ravenswood) and E14 (Eden Landing). In addition to setting aside habitat for western snowy plover, managers at Ravenswood and Eden Landing have worked to improve nesting habitat by removing predator perches, spreading oyster shells, and providing vegetative cover in foraging areas for broods. While they have successfully provided valuable habitat that is lacking throughout the region, these areas

have also experienced mixed success in increasing the numbers of western snowy plover due to various challenges, including managing water levels during years of varied precipitation and predation by avian and terrestrial predators including California gulls, ravens, peregrine falcons, harriers, foxes, feral cats, raccoons and others. It is also important to note that these ponds have been managed to limit human disturbance during breeding season. This is an important consideration in locating habitat for western snowy plover within the SCSNSA, which is adjacent to the popular Bay Trail and may also be affected by human activity at the adjacent NASA disaster preparedness facility.

Water levels would be managed to provide shallow pond foraging habitat in the winter and dry nesting habitat for snowy plover in the spring/summer. Ponding would be limited to a depth of 1-2′. Water would have to be drawn down well in advance of snowy plover nesting season to ensure appropriate habitat is available during the nesting site prospecting period. The habitat enhancements would also provide benefits to other colonial nesting species including terns, avocets, and stilts. Other nesting enhancements, such as the placement of oyster shells or other similar features, could be used to promote successful fledging.

This option would require a robust water management system with flexibility to varying rainfall conditions. Managing water levels would require a water control structure such as a valve connecting the site to Stevens Creek (or retrofit of existing silted-in culverts in the northwest corner of the site) to facilitate seasonal ponding. Existing levees separating the site from Stevens Creek and Pond A2E would be maintained. A low berm, designed to allow 1-2′ of ponding, would separate the SCSNSA from the rest of the SWRP and block flows of stormwater to the site. An alignment that crosses in front of the emergency preparedness site would be shorter and cheaper, but one that goes around the full length of the SCSNSA would provide more pond/nesting habitat.

Because this option involves less water flow from the Bay than the tidal options (Options 3-4), sediment accretion is likely to proceed very slowly and result in lower initial elevations if the site is eventually converted to tidal marsh. However, providing habitat for snowy plover could fill a regional habitat need that allows for tidal restoration elsewhere. Considering the existing use of the site by plover, this could be a logical restoration option in the short term until definitive plans have been made for neighboring areas. Management of the pond will become increasingly challenging as sea levels rise, so it is important to consider long-term resilience and potential plans to transition to other habitat types in the future.

Implementation of this option would require coordination with NASA on stormwater management changes. There would be no change to public access or the Bay Trail alignment under this management option.

Option 3a: Restore muted tidal action

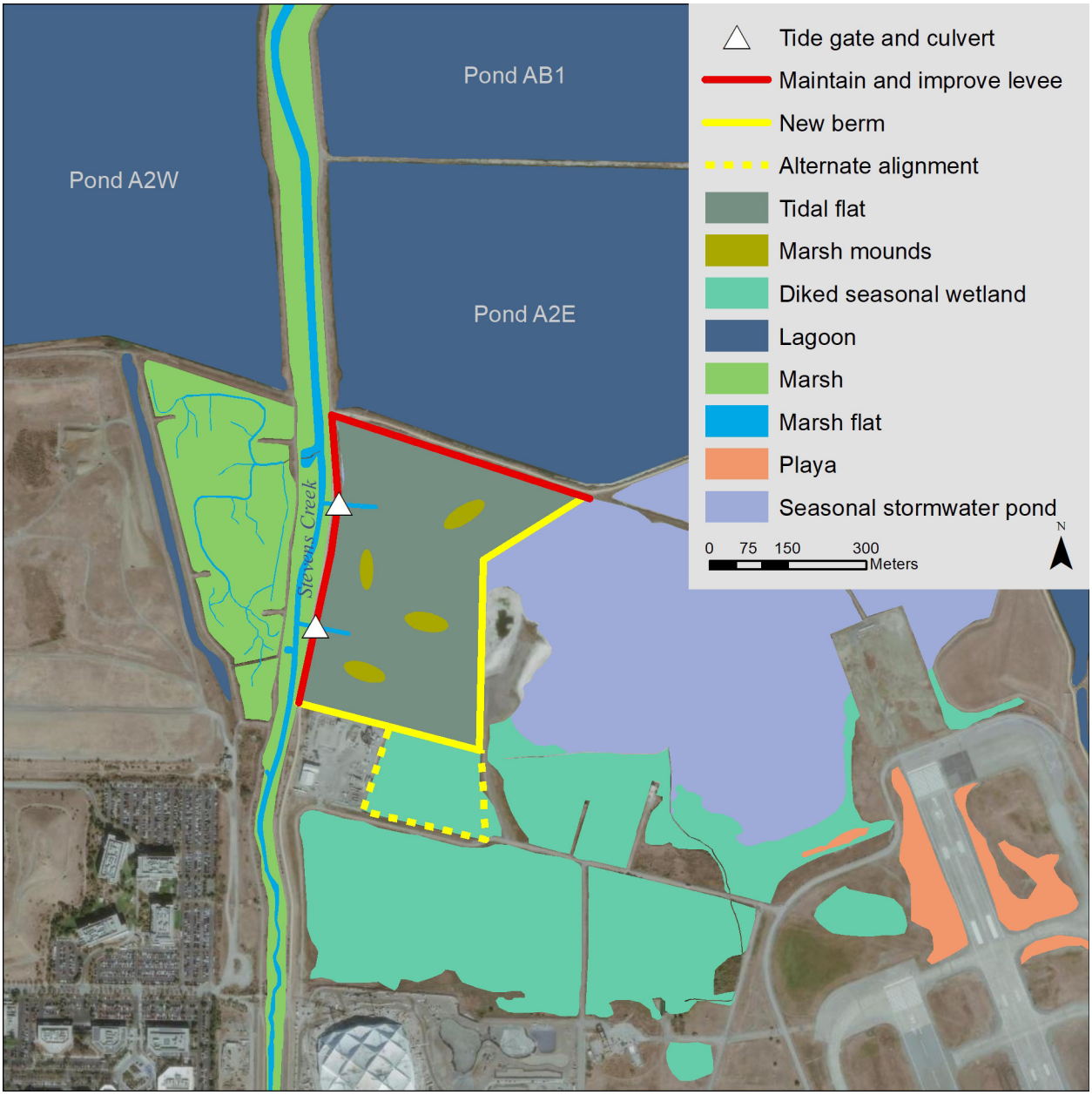

Figure 5.3. Option 3a: Restore muted tidal action

The target habitat type for this option would be similar to the current habitat in Stevens Creek Marsh on the Mountain View (west) side of Stevens Creek. Initially the site would provide mudflat habitat, and over time sediment would accrete and the area would colonize with salt marsh species. The tidal range in Stevens Creek Marsh is approximately 6.2′, approximately 60% of the full 8.7′ tidal range in the Bay in this area (Philip Williams & Associates, Ltd., 2002). While the restoration would benefit marsh species, conversion of existing habitat and displacement of species would require consideration.

Water levels in the SCSNSA would be managed with a muted tidal range of 5-6′ (comparable to Stevens Creek Marsh), with regular tidal inundation. This option would involve installing culverts (replacing the existing silted-in culverts) with tide gates in the Stevens Creek levee to connect the parcel to the creek. These culverts would be sized to self-scour. Over time, as sedimentation occurs, a channel network would develop in the site. While sedimentation rates are typically lower through culverts than open breaches (see Option 4), the fact that the tidal range would be truncated would likely offset the timing and allow for vegetated marsh establishment in a similar time frame to a fully tidal system. Using the muted tidal system across Stevens Creek as an analog, we would expect vegetated marsh to establish in the 10-15 year time frame. This option would require construction of a berm along the MROSD property boundary to protect Moffett Field and the rest of the SWRP from 5-6′ of tidal action and prevent stormwater from entering the SCSNSA. An alignment that crosses in front of the emergency preparedness site would be shorter and cheaper, but one that goes around the full length of the SCSNSA would provide more marsh habitat. Marsh mounds could be constructed to provide habitat complexity and high tide refuge in the site.

Reestablishing muted tidal flows could increase long-term resilience of the site by allowing sediment to accrete, increasing ground elevation. This could increase the viability of the site as a tidal marsh in the long term as sea level rises. Brackish water influence from Stevens Creek would be a benefit from this perspective, as brackish marshes with high primary productivity accrete organic material faster than saline marshes, helping raise marsh elevations (Schile et al., 2014). However, the effectiveness of the marsh as a tidal system may become more limited as sea level rises. Over time, as the low tide level (MLLW) rises and the maximum water elevation remains the same (limited by the elevation of the surrounding berms), the effective tidal range within the site will be reduced. In addition, if the ground elevation does not increase then there will be more permanent ponding, requiring pumping to mimic tidal exchange. Therefore, it will be important to plan for long-term management and potential habitat transitions as sea level rises.

Implementation of this option would require coordination with NASA on stormwater management changes. There would be no change to public access or the Bay Trail alignment under this management option.

Option 3b: Restore muted tidal action and add imported fill

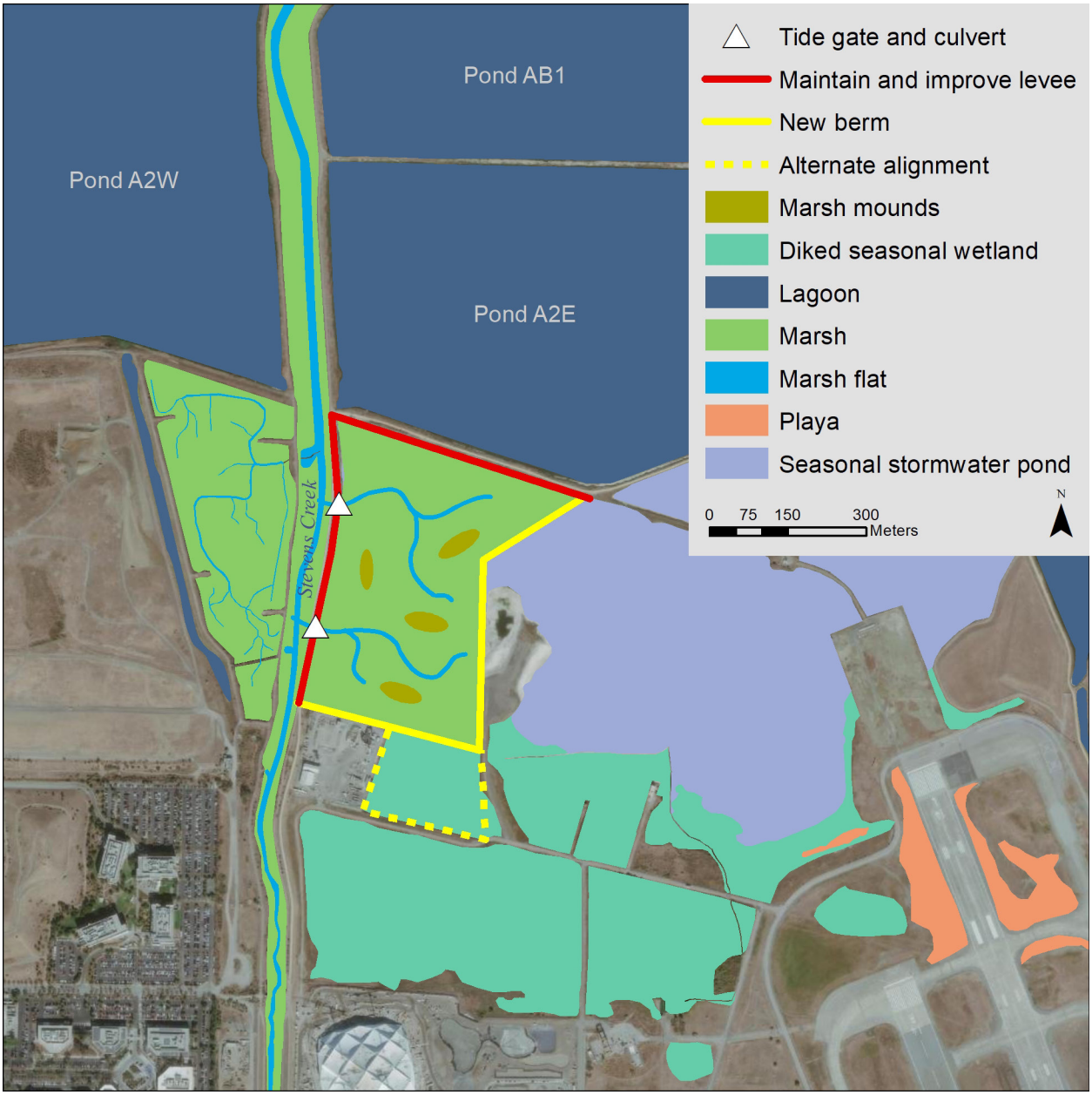

Figure 5.4. Option 3b: Restore muted tidal action and add imported fill

The target habitat and other considerations for this option are the same as Option 3a. Water levels would be managed with a muted tidal range of 5-6', with regular tidal inundation. Fill material would be placed and graded prior to restoring muted tidal action. This would allow for more rapid colonization of the site by marsh vegetation. Pilot tidal channels could be cut and low berms could be used to enhance hydraulic connectivity and drainage through the site. Marsh mounds could be constructed to provide high tide refuge habitat.

Option 4a: Restore full tidal action

Figure 5.5. Option 4a: Restore full tidal action

The target habitat type for this option would be tidal brackish marsh. Given the current subsided condition of the site, the initial habitat type would be mudflat. Tidal restoration would convert existing habitat and considerations would need to be made impacts to current species that use the site.

Water levels would be managed with a full tidal range from the Bay and regular tidal inundation. The levee along Stevens Creek would be breached, lowered, or removed to allow full tidal action and flooding of the site with brackish water. A flood risk management levee would be constructed

to protect Moffett Field and the rest of the SWRP from the full range of tidal influence, including extreme tides. An alignment that crosses in front of the emergency preparedness site would be shorter and cheaper, but one that goes around the full length of the SCSNSA would provide more marsh habitat. If the shorter alignment is chosen, seasonal wetland behind the levee could be enhanced. Marsh mounds or an ecotone slope could be constructed in the SCSNSA to provide high tide refuge. Coordination with the SBSPRP would be required to determine the appropriate design for the levee adjacent to Pond A2E, which would need to be raised and/or reinforced to allow controlled overtopping from the newly tidal SCSNSA.

Over time, sediment accretion would raise the elevation of the site and a channel network would develop. Restoring earlier would allow more time for the site to reach marsh elevations and keep pace with sea-level rise. Restoring the site to full tidal action would allow for the maximum amount of sediment accretion. Based on modeling of the adjacent Mountain View Ponds of the SBSPR Project, we estimate that it may take in excess of 15-20 years for vegetated tidal marsh to establish in this area in the absence of any sediment augmentation.

This option (or option 4b) could be a step on the way to creating a fully restored creek mouth as shown in option 4c. These options require coordination with the Shoreline Study regarding alignment and construction of a flood risk management levee. There is a potential synergy and cost savings in restoring in tandem with construction of the flood risk management levee. Implementation of this option would require coordination with NASA on stormwater management. Under this option, the Bay Trail could be rerouted on the new levee along the back of the SCSNSA.

Option 4b: Restore full tidal action and add imported fill

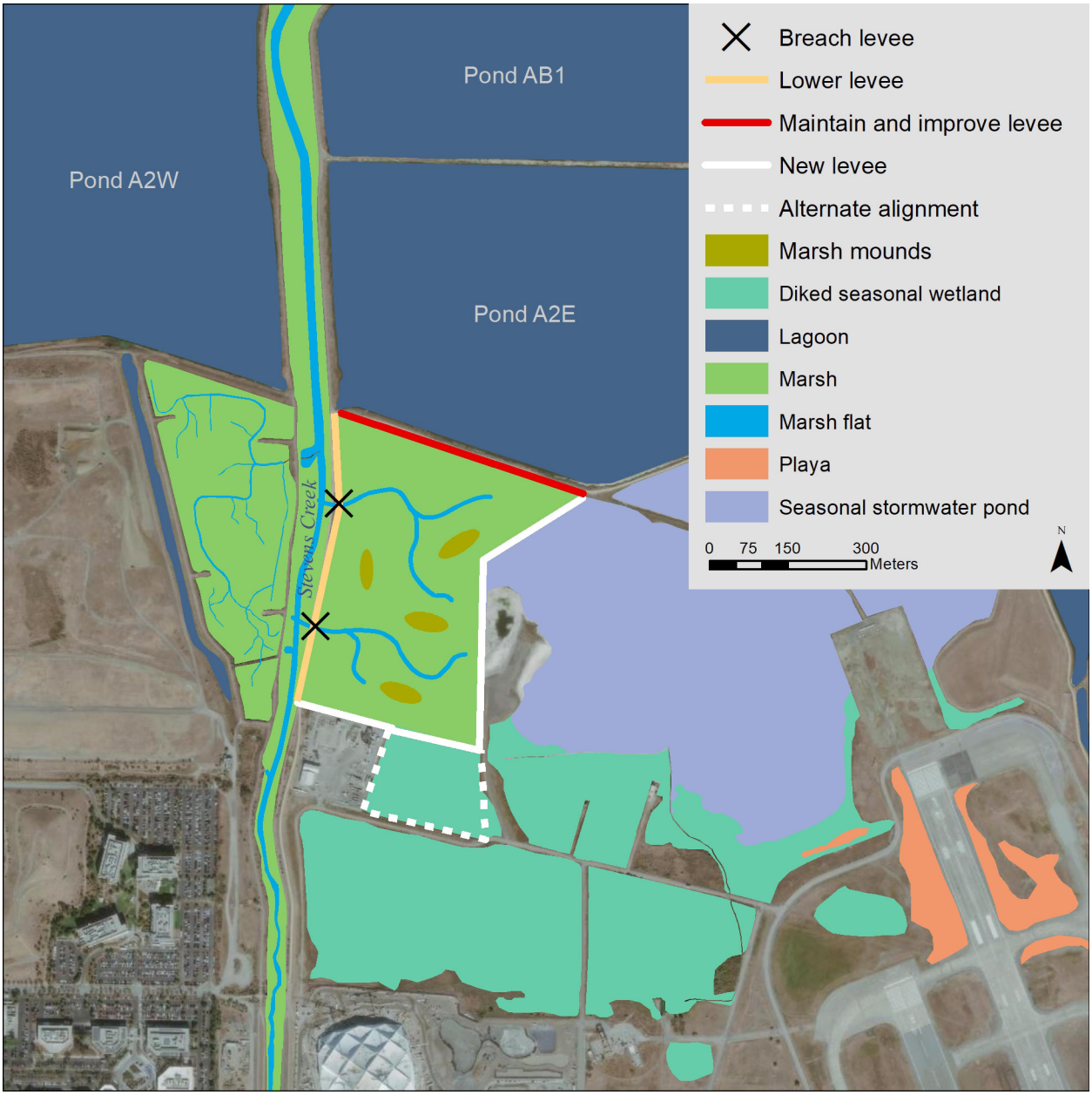

Figure 5.6. Option 4b: Restore full tidal action and add imported fill

The target habitat and other considerations for this option are the same as for Option 4a. The site would be opened up to full, regular tidal inundation. Fill material would be placed and graded prior to restoring tidal action. This would allow for more rapid colonization of the site by marsh vegetation. Pilot tidal channels could be cut and low berms used to guide tidal water through the site. Marsh mounds could be constructed to provide high tide refuge habitat.

Option 4c: Restore full tidal action (salt ponds restored)

Figure 5.7. Option 4c: Restore full tidal action (salt ponds restored)

In this longer-term alternative, the SCSNSA becomes part of a larger complex of restored and connected tidal marsh. The site is reconnected to Stevens Creek and Pond A2E. The full tidal range would be allowed into the site, with regular tidal inundation. A flood risk management levee would be required to protect Moffett Field from the full range of tidal influence and to separate the site from the NASA SWRP. An ecotone slope on the outboard side of this levee could provide transition zone and high tide refuge habitat (as an alternative to the marsh mounds shown in options 4a and 4b). As in previous alternatives, multiple levee alignments are possible.

The SCSNSA parcel could be restored in advance of SBSP restoration activities (as in the previous option) or in tandem with the pond restoration. In the long term, the SBSPRP has plans to restore the ponds near the SCSNSA to tidal action. SBSPRP maps show restored tidally-connected salt marsh in the SCSNSA, connected with Stevens Creek in the 50/50 (managed pond emphasis) alternative and connected with Pond A2E in the 90/10 (tidal marsh emphasis) alternative. Regardless of timing, close coordination with the SBSPRP and USFWS will be required.

Achievement of a fully connected creek mouth requires restoration of neighboring salt ponds and construction of a flood risk management levee. Levee construction along the NASA property line will require coordinated planning with NASA and Phase III of the Shoreline Study. SBSPRP restorations and the construction of the Shoreline Study levee are unlikely to occur at once; MROSD restoration could occur in advance of or in tandem with SBSP restoration. There is a potential synergy and cost savings in coordinating with the Shoreline Study and SBSPRP to complete this creek mouth restoration. There could also be an opportunity to collaborate with Valley Water to design the creek mouth reconstruction in a way that best ensures passage and enhanced habitat conditions for steelhead trout (SCVWD, 2018). Under this option, the Bay Trail could be rerouted on the new levee along the back of the SCSNSA.

6. FEASIBILITY AND IMPLEMENTATION

Looking south across the SCSNSA

Goals matrix

Each management option was qualitatively assessed against the management goals developed for the study. The matrix below (Table 6.1) can be used to assess tradeoffs between the options.

Symbol	○	◔	◑	◕	●
Relative contribution to achieving goal	Least → Most				

Table 6.1 Tradeoffs between management options in achieving management goals.

	Option 1: Maintain existing diked marsh/ stormwater pond	Option 2: Manage pond for snowy plover	Option 3a: Restore muted tidal action	Option 3b: Restore muted tidal action and add imported fill	Option 4a: Restore full tidal action	Option 4b: Restore full tidal action and add imported fill	Option 4c: Restore full tidal action (salt ponds restored)
Goal: Promote the growth and resilience of populations and habitats to benefit native species.							
Benefits tidal marsh species	○	○	◔	◑	◑	◕	●
Benefits plovers and other ground-nesting birds	◑	●	○	○	○	○	○
Goal: Increase connectivity of water, sediment, and species with adjacent habitat.							
Increases connectivity to the Bay	○	○	◑	◑	●	●	●
Increases connectivity to nearby tidal marsh	○	○	◑	◑	●	●	●
Increases connectivity to watershed	○	○	◑	◑	●	●	●
Maintains connectivity to NASA SWRP	●	○	○	○	○	○	○
Goal: Do not increase flooding in adjacent properties.							
Does not increase flooding in adjacent properties	●	●	●	●	●	●	●
Goal: Allow for continued public access via the Bay Trail.							
Bay Trail provides access either in current or rerouted alignment	●	●	●	●	●	●	●
Plover-related closures relatively less likely	◑	○	●	●	●	●	●
Goal: Be adaptable enough to allow for future management changes in response to shifting habitat needs and environmental conditions.							
Allows for sediment accretion	○	○	◑	◑	●	●	●
Minimizes active management (operation/ maintenance of water control structures)	●	○	◑	◑	●	●	●
Goal: Contribute to regional habitat goals and South Bay sea-level rise adaptation planning efforts.							
Contributes to regional tidal marsh goals	○	○	◔	◑	◑	◕	●
Contributes to regional creek connectivity goals	○	○	○	○	◑	◑	●
Contributes to regional snowy plover goals	◑	●	○	○	○	○	○

Feasibility analysis

The feasibility of each management option was quantitatively assessed in terms of benefits and costs to allow comparison between options (Table 6.2). These quantities are meant to allow comparison between options and only give a general sense of the level of effort and cost to implement and maintain each restoration option. Only the main elements that differ between alternatives were estimated—such as length of flood risk management (FRM) levee and area of ecotone slope. All unit costs are based on information from the South San Francisco Bay Shoreline Study and subsequent analysis by Valley Water (SCVWD, 2017). Acquisition, design, and permitting were not included. No contingencies have been applied to the costs. The costs should only be used for comparison between management options.

Several assumptions have been made:

- While the cost of the FRM levee is shown, it is assumed that this will be part of the South San Francisco Bay Shoreline Study and will not be the responsibility of the MROSD.
- Options 2 to 4c all depend on the construction of the Shoreline Study levee in a timely fashion to allow habitat to establish. Option 4c is dependent upon the restoration of Pond A2E to the north by the Salt Ponds project. More pertinent information about dependencies and synergies is provided in the following section.
- It is likely that the Shoreline Study will choose the shortest levee alignment to reduce cost and increase the B/C ratio. Table 6.2 therefore reflects the shorter levee alignment for each alternative. The difference in cost between the shorter and longer levee alignments is $5M (620 ft ($3M) versus 1,800 ft ($8M)) to protect 9 acres.

Table 6.2. Feasibility analysis (all options for the short levee alignment - see Figure 4.2)

	Unit Cost	Option 1: Maintain existing diked marsh	Option 2: Manage pond for snowy plover	Option 3a: Restore muted tidal action	Option 3b: Restore muted tidal action plus fill	Option 4a: Restore full tidal action	Option 4b: Restore full tidal action plus fill	Option 4c: Restore full tidal action (salt ponds restored)
Metrics								
Area of seasonal wetlands/ stormwater pond (ac)		54	0	0	0	0	0	0
Area of managed pond (ac)		0	45	0	0	0	0	0
Area of tidal marsh ~5 years after restoration (ac)		0	0	0	45	0	38	38
Area of mudflat ~5 years after restoration (ac)		0	0	45	0	38	0	0
Area of ecotone slope (ac)		0	0	0	0	7	7	7
Area of upland (ac)		0	9	9	9	9	9	9
Total area (ac)		54	54	54	54	54	54	54
Length of ecotone slope (ft)*		0	0	0	0	3,110	3,110	3,110
Length of new water control berm (ft)		0	3,110	3,110	3,110	0	0	0
Length of existing FRM levee to maintain & improve (ft)		3,540	3,540	3,540	3,540	1,620	1,620	0
Length of new FRM levee (ft)		0	0	0	0	3,110	3,110	3,110
Total FRM levee (ft)		3,540	3,540	3,540	3,540	4,730	4,730	3,110
Volume of fill to reach colonization elevation (6.4' NAVD)** (yd^3)		0	0	0	470,700	0	470,700	0
Costs								
Managed pond	$10,000/ac	$0	$450,000	$0	$0	$0	$0	$0
Marsh restoration	$10,000/ac	$0	$0	$0	$450,000	$0	$378,604	$378,604
Mudflat restoration	$10,000/ac	$0	$0	$450,000	$0	$378,604	$0	$0
Ecotone slope	$2,300/ft	$0	$0	$0	$0	$7,153,000	$7,153,000	$7,153,000
Fill†	$40/ yd^3	$0	$0	$0	$18,828,000	$0	$18,828,000	$0
Subtotal Habitat enhancements		$0	$450,000	$450,000	$19,278,000	$7,531,604	$26,359,604	$7,531,604
Water control berm	$1,000/ft	$0	$3,110,000	$3,110,000	$3,110,000	$0	$0	$0
FRM levee††	$4,500/ft	$15,930,000	$15,930,000	$15,930,000	$15,930,000	$21,285,000	$21,285,000	$13,995,000
Subtotal FRM & water control berm		$15,930,000	$19,040,000	$19,040,000	$19,040,000	$21,285,000	$21,285,000	$13,995,000
Total cost of construction		$15,930,000	$19,490,000	$19,490,000	$38,318,000	$28,816,604	$47,644,604	$21,526,604
Annual O&M - levee	$27/ft	$95,580	$95,580	$95,580	$95,580	$127,710	$127,710	$83,970
Annual O&M - marsh	$339/ac	$0	$0	$15,255	$15,255	$12,835	$12,835	$12,835

*Ecotone levee as shown in Option 4c (Figure 5.7)

**1 ft below MHHW (7.4' NAVD) used as target colonization elevation

†Cost varies depending on source of fill and distance from the restoration site

††Assuming paid by Shoreline Study

7. STAKEHOLDER ENGAGEMENT PLAN & NEXT STEPS

Given the opportunities for collaboration outlined above—including dependencies and synergies with relevant projects and the opportunity to contribute to regional habitat goals—a clear plan of action for stakeholder engagement is essential. MROSD has expressed interest in becoming more engaged with long-term visioning for regional efforts including the SBSPRP and the South San Francisco Bay Shoreline Study. Engagement with these processes will be an important first step in developing a plan that leverages the strategic location of the SCSNSA parcel to achieve regional habitat goals.

Relevant stakeholders

The following stakeholders will be important to consult with early in the process of exploring alternative management options:

- **NASA.** The NASA Ames Research Center borders two sides of the SCSNSA. The SCSNSA is currently an integral part of NASA's stormwater management system and close coordination with NASA will be required regarding issues including stormwater management and potential bird strike conflicts at the airfield if changes are made to the site.
- **US Fish and Wildlife Service (Don Edwards National Wildlife Refuge)**. The Refuge manages the ponds adjacent to the site. A future partnership with USFWS could be explored if site management needs increase with restoration.
- **Valley Water**. Valley Water is responsible for the management of the Stevens Creek channel and levees. Close coordination with Valley Water will be required regarding changes to the Stevens Creek levee and the alignment of a future shoreline levee. There will also need to be discussions with Valley Water on the implications of breaching into Stevens Creek due to the potential impacts on water surface elevation and sedimentation in the creek.
- **San Francisco Bay Trail**. Several of the management options presented could impact the future alignment or usage of the Bay Trail due to changes in levee alignments and/or additional potential for disturbance of sensitive wildlife species. Early coordination may lead to a more mutually beneficial plan.
- **South Bay Salt Pond Restoration Project.** As described in the Management Options section, there may be synergies and cost savings associated with restoring the SCSNSA in tandem with neighboring ponds.
- **SF Bay Bird Observatory.** Several proposed management options center on the protection/creation of habitat for species which are tracked by the SFBBO; they will be an important stakeholder to coordinate with for project monitoring.
- **City of Mountain View.** The parcel is within the City of Mountain View's sphere of influence. MROSD has historically collaborated with the City on public access projects including trail and bridge construction.

Participation in the Sunnyvale Shoreline Resilience Vision process, focused on planning for Phase III of the South San Francisco Bay Shoreline Study, is a good way to stay engaged with several of these stakeholders and with two key regional projects: the South Bay Salt Ponds Project and the USACE Shoreline Study. The partners involved in the Shoreline Resilience Vision process include the City of Sunnyvale, Valley Water, Google, Lockheed Martin, NASA, USFWS, and the South Bay Salt Pond Restoration Project. All of these partners are landowners along the shoreline between Stevens Creek and Calabazas Creek.

Environmental groups are other relevant stakeholders to consider. These include (but are not limited to): Citizens Committee to Complete the Refuge, Green Foothills, Friends of Stevens Creek Trail, the Audubon Society, and the Sierra Club.

Engagement with the public will also be important as MROSD considers habitat transitions for this popular nature sanctuary. At the most recent quarterly meeting of the Sunnyvale Shoreline Resilience Vision stakeholder group there was discussion of coordinating outreach efforts to the public and to decision-makers to reduce meeting fatigue. Presenting planning ideas for the SCSNSA as part of this effort could increase participation and streamline the incorporation of input from stakeholders on levee alignments, recreation plans, and restoration plans.

Engagement and planning timeline

Early engagement with stakeholders and ongoing planning processes will help MROSD determine the most efficient way to achieve management goals for the SCSNSA. A new flood risk mangement levee at the back of the site will be required if the site is opened up to full tidal influence, and a new berm will be required for several of the other management options. There may be opportunities to work with partners on Phase III of the South San Francisco Bay Shoreline Study to achieve MROSD's restoration goals and partners' flood protection goals together as part of the same project. The start of Phase III planning for the SBSPRP (the phase during which the ponds adjacent to the SCSNSA would be considered for restoration) is a bit farther out into the future, but opening a channel of communication early is likely to result in better long-term coordination and outcomes. A timeline showing the (approximate) expected dates for the Shoreline Study and SBSPRP is provided in Figure 8.1. Marsh restoration shown in some of the management options (one of the goals of the Shoreline Study, together with flood protection and recreation) cannot occur before the levee is in place.

Coordination with these key planning processes is can help guide MROSD's next steps for site-scale planning. After consulting with the key stakeholders listed above and with engineers for a more refined feasibility analysis, MROSD may pursue input from other stakeholders, including the general public, to refine management options and settle on a preferred management strategy for the SCSNSA.

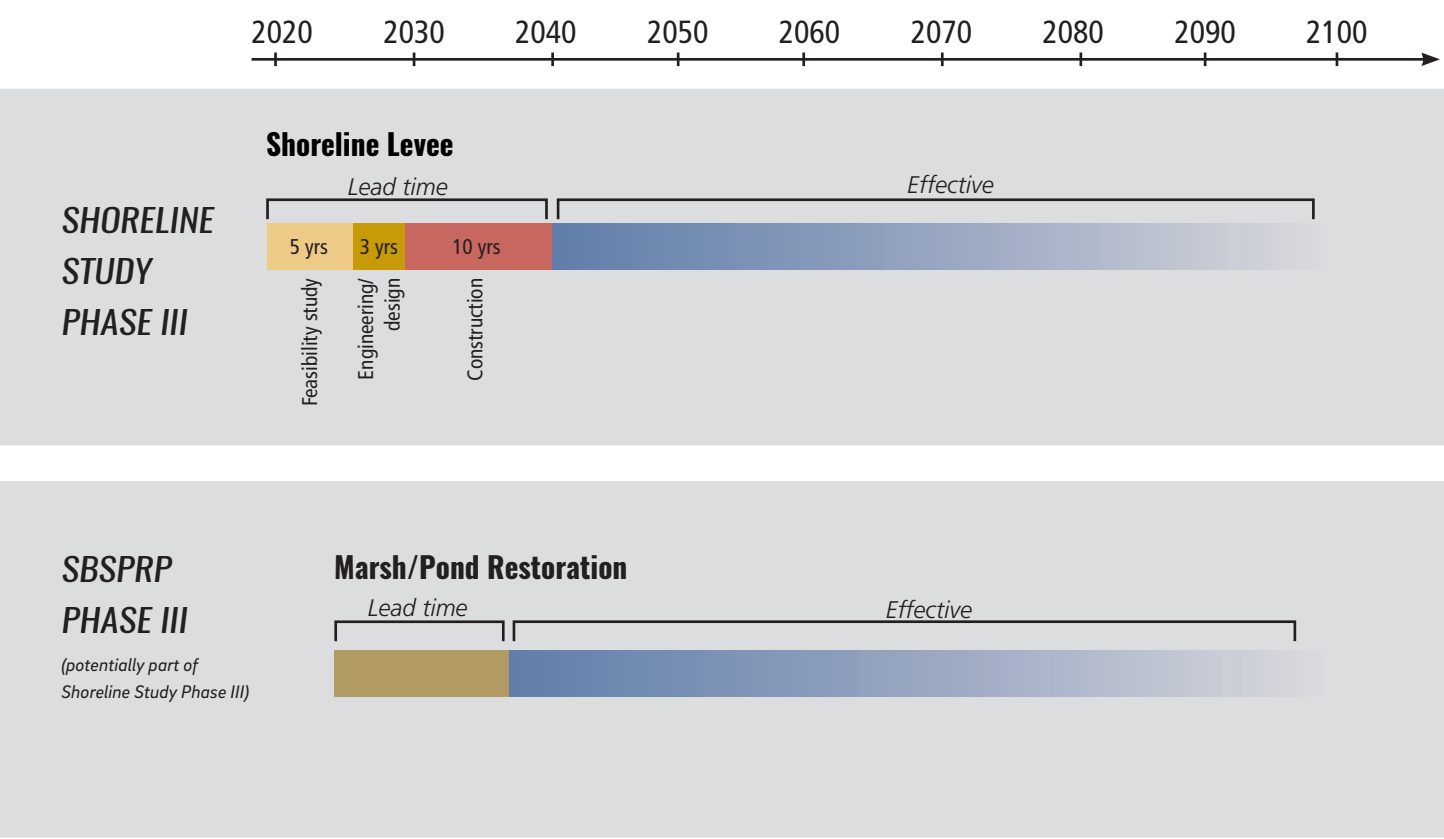

Figure 8.1. Key dates (approximate) for Phase III of the South San Francisco Bay Shoreline Study and Phase III of the South Bay Salt Ponds Restoration Project. According to Valley Water, the earliest possible start date for the USACE feasibility study process (Shoreline Study Phase III) is October 2021. The SBSPRP is currently working on Phase II construction. Phase III planning, which will include the ponds adjacent to the SCSNSA, is not likely to begin for a number of years.

Specific recommendations for coordination with Phase III of the Shoreline Study

MROSD should engage in discussion with Valley Water and NASA, along with other participants in the Sunnyvale Shoreline Resilience Vision process, to determine a preferred FRM levee alignment for the stretch of shoreline on MROSD property.

Specific recommendations for coordination with the South Bay Salt Pond Restoration Project

MROSD should engage in discussion with the Don Edwards Refuge to determine a preferred restoration scenario for the stretch of shoreline adjacent to MROSD property. We recommend scheduling a presentation for the SBSPR Project to discuss this feasibility study and how project goals for adjacent ponds might overlap and/or affect decision-making. Opportunities include monthly SBSP Project Management Team meetings, Annual Stakeholder meetings, and meetings with the SBSPR Project Science Team.

Permitting

For the feasibility-level analysis conducted for this study, it is premature to identify a permitting strategy. The most efficient permitting process, particularly for CEQA, and as if needed, NEPA, will depend on revised project descriptions, partners, and timing. Revised project descriptions will indicate which permits are needed and the extent of mitigation, if any, associated with each project. Coordination with potential partners, such as the South Bay Salt Pond Restoration Project and the USACE Shoreline Study, may enable projects to be self-mitigating and other entities to serve as lead permit applicants.

Early engagement with the regulatory agencies involved in permitting wetland projects is advisable. Because this project will involve wetland restoration along Bay, it will likely be eligible for consideration by the San Francisco Bay Restoration Regulatory Integration Team (BRRIT), which streamlines the permit review process. The BRRITT includes representatives from the US Army Corps of Engineers, US Fish and Wildlife Service, NOAA Fisheries, SF Bay Regional Water Quality Control Board, California Department of Fish and Wildlife, and the SF Bay Conservation and Development Commission. The BRRIT pre-application process provides applicants with early review and project input. MROSD can work in close coordination with the BRRIT to resolve issues identified during the pre-application process prior to the submittal of a permit application. After the pre-application process, the applicants submit permit applications to each individual BRRIT agency, and the applications are subject to review under each individual agency's policies. More details on the BRRIT project review process are available at http://www.sfbayrestore.org/announcement/request-project-submittals-brrit.

Other potential next steps

Soil testing. Given the history of contamination at the SWRP (the SWRP is part of the Moffett Field Naval Air Station Superfund site), soils testing will be required prior to implementation of restoration options at the SCSNSA. With the recent cleanup effort of contaminated soil and construction debris at AOI 14 by NASA, it is expected that any soil contaminants have been removed and restoration can proceed, but this will need to be confirmed. Soils testing should be performed after the conclusion of the snowy plover breeding season in September. Any imported fill would need to meet the San Francisco Bay Regional Water Quality Control Board's screening criteria.

Geotechnical evaluations. Geotechnical consultants can determine the condition of existing levees, potential design of new berms and levees, reinforcement of existing levees, and design of water control structures. Coordination with the US Army Corps of Engineers will be required for issues related to construction of flood risk management levees. Coordination with Valley Water would also be advisable as designs relate to Phase III of the Shoreline Study.

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APPENDIX: DOCUMENT LIBRARY

This is a list of collated documents for the Stevens Creek Shoreline Nature Study Area Feasibility Study. Each document is hyperlinked to its location in the Stevens Creek Document Library folder, with an accompanying short summary of content and relevance to the Feasibility Study.

General adaptation and restoration context

Baylands Ecosystem Habitat Goals Update. 2015 regional vision for the protection and restoration of bayland habitats in the context of climate change. Includes specific recommendations for the vicinity of the SCSNSA site in "Segment O" on pages 201-205.

Adaptation Atlas. 2019 regional framework for siting nature-based adaptation strategies, mapped at the scale of "operational landscape units," which are geographically connected areas sharing similar physical characteristics. Includes specific recommendations for the vicinity of the SCSNSA site in the "Stevens" Operational Landscape Unit description on pages 162-163.

MROSD

Board meeting notes. In progress - summary of activity at the SCSNSA over the years. A record of a MROSD comment on the NASA Ames Development Plan EIS (2002) establishes that the stormwater agreement is verbal and that there is no guarantee that NASA's use of the SCSNSA for stormwater storage must continue.

South Bay Salt Pond Restoration Project

Programmatic EIR. This 2007 environmental review document lays out the 50-year programmatic plan of the South Bay Salt Pond Restoration Project and Phase I of the project work. The SBSPRP aims to restore and enhance over 15,000 acres of wetlands in South San Francisco Bay while providing for flood management and wildlife-oriented public access and recreation. EIR includes Alternative A (No Action), Alternative B (Managed Pond emphasis - 50/50 alternative), and Alternative C (Tidal emphasis - 90/10 alternative). This document provides important context for restoring the SCSNSA in tandem with other restoration efforts.

Phase II EIR. This 2016 environmental review document lays out plans for SBSPRP Phase 2 projects. Most pertinent to the SCSNSA parcel are the Phase 2 project sites at the Alviso-Mountain View Pond cluster (Ponds A1 and A2W), which are located northwest of parcel.

Existing Conditions document. This 2005 document describes existing biological conditions relevant to the SBSPRP. Some site-relevant information on plant and wildlife surveys is included.

50/50 and 90/10 maps. These maps show the proposed alternative restoration strategies for the SBSPRP from the programmatic EIR: 50/50 tidal/managed pond habitat and 90/10 tidal/managed pond habitat.

Synthesis of scientific knowledge (Collins & Grossinger 2004). This South Bay-specific document was prepared for the science team of the SBSPRP and covers historical ecosystem conditions,

landscape modifications, modern conditions, and restoration tools. Relevant history about the creation of the lower Stevens Creek channel is included, particularly on page 55, which shows the evolution of the Stevens Creek landscape as the channel was extended to the Bay.

Sunnyvale Shoreline Resilience vision

Levee Vision document. This 2019 interim work product of the Sunnyvale Shoreline Resilience process was produced as a collaborative effort with stakeholders along the Sunnyvale shoreline and used in conversations with USACE in the South San Francisco Bay Shoreline Study Phase II process. A combined vision document that integrates urban ecology elements with the shoreline vision is currently in progress (2020).

Valley Water

2017 Shoreline Study report. This 2017 report is a preliminary feasibility study for the South San Francisco Bay Shoreline Study Phase II. It includes a conceptual plan and engineering evaluations for flood risk management levee alignments. The eventual alignment of flood risk management levees along the South San Francisco Bay shoreline will have a direct impact on restoration activities at the SCSNSA. The study includes some relevant information, particularly that Stevens Creek does not have 100-year flow capacity in the lower reach along the SCSNSA parcel, and that future SLR is likely to have a negligible impact on 100-year water levels in the creek (page 50).

Stevens Creek Stream Corridor Priority Plan. This 2018 report lays out priority actions for improving stream health in Stevens Creek. Priority actions for the reach along the SCSNSA property begin on page 19 and include invasive vegetation removal, native vegetation mapping, gravel augmentation, etc. The plan suggests re-connecting Stevens Creek to restored Baylands habitat and widening the mouth of the creek to augment sediment supply to tidal wetland habitats. The report lists species that could benefit from such restoration on page 22.

NASA

2017 NASA protected species mitigation & habitat restoration plan (Tetra Tech). This plan describes mitigation and conservation actions undertaken to avoid and minimize impacts to biological resources during the removal of contaminated fill at the peninsula just to the east of the SCSNSA. The plan includes extensive information on existing site conditions and listed species occurring in the project area.

2005 SWRP Tidal Restoration Feasibility Study (Brown & Caldwell) and pamphlet. The purpose of this study was to assess the feasibility of restoring the NASA stormwater retention ponds to tidal marsh. The study provides useful reference information for the present feasibility study, though the scale is different and some information may be outdated. Four alternative restoration strategies are explored and summarized in the pamphlet.

Bay Trail

Bay Trail Plan. This summary of the Bay Trail Plan (1989) lists trail alignment and policies, which are relevant to discuss in the SCSNSA feasibility study if changes to current levee/trail alignments are proposed.

Bay Trail Design Guidelines and Toolkit. This 2016 report lays out specific guidelines for the design of the trail in much more detail than the Bay Trail Plan, including accessibility, design specs, compatibility with wildlife, consideration of sea level rise, etc.

Bay Trail Gap Analysis. This 2005 study identifies gaps in the Bay Trail and lays out a strategy to fill these gaps.

Don Edwards National Wildlife Refuge

South Bay Weed Management Plan. This 2013 plan prioritizes the non-native weeds that have the greatest impact on native species and suggests actions for controlling them. The SCSNSA falls within the Alviso weed management area (WMA). Particular species of interest in the Stevens Creek area are not listed, though *Lepidium latifolium* is noted to be especially abundant in the Alviso WMA.

Comprehensive Conservation Plan with Appendix 1 and Appendix 2. This 2012 document guides management of the refuge for a 15-year period. The document notes that Stevens Creek was formerly prime steelhead trout habitat, but that today many barriers to fish passage exist. Detailed fish survey information is provided on page 105. As close coordination with the Refuge will be required for any changes to site management, understanding the management goals listed in this document is important.

USFWS (different branch from Refuge)

Tidal Marsh Recovery Plan. This 2013 report focuses on the recovery goals of five listed species, with the larger goal being comprehensive restoration and management of tidal marsh ecosystems. This is a valuable source of biological information on Ridgway's rail, salt marsh harvest mouse, *Cirsium hydrophilium* var. *hydrophlium*, *Suaeda californica*, and *Chloropyron molle* ssp. *Molle*. Salt marsh harvest mouse sightings at the SCSNSA have been documented.

City of Mountain View

Shoreline Regional Park Community Sea Level Rise Study. This 2012 report prepared for the City of Mountain View provides detailed information about the impacts of sea level rise in the general vicinity of the SCSNSA (the SCSNSA is not included in the modeled area, as Stevens Creek is the eastern boundary of the Shoreline Community studied). The modeling effort found that the lower Stevens Creek levee (west of the creek) is vulnerable to a 1% flood under existing conditions. Improvement of levees along lower Stevens Creek north of Crittenden Lane was recommended (a recent project provided FEMA-certified 1% flood protection upstream of Crittenden Lane). The report notes that Stevens Creek Marsh is particularly vulnerable to SLR because muted tidal flows through culverts reduce sediment delivery to the marsh.

North Bayshore Precise Plan. This 2014 plan, amended in 2019, guides the city of Mountain View's land-use and development decision-making in the North Bayshore area (southwest of the SCSNSA). Objectives of the Precise Plan include expanding existing habitat, improving the quality of existing habitat, and ensuring that new development limits impacts to wildlife (p. 117)

Google

Shorebird Master Plan & Bonus FAR Application. Related to the North Bayshore Precise Plan, these 2018 Google documents lay out Google's plan for the North Bayshore area, describing how it contributes to the Precise Plan's guiding principles and why bonus FAR (density) is justified. Google owns a significant proportion of the property in the North Bayshore area, including in the Shorebird neighborhood where this plan is focused (the Shorebird neighborhood is located west of Stevens Creek, south of the Charleston Detention Basin.

Audubon Society

PWA report on Stevens Creek Marsh. This 2002 document summarizing indicators of success at various marsh restoration projects describes the restoration plan for Stevens Creek marsh, including culvert diameters etc. It also provides sedimentation rates, vegetation trends, and tidal ranges. The report notes that the marsh's resilience to rising sea level may be limited by its small size, the levees surrounding the site, and the restricted tidal flow.

Other environmental stakeholders

Waterbird monitoring reports. This folder contains nesting waterbird monitoring reports from SFBBO ranging from 2005-2018, and snowy plover monitoring reports for 2004-2018. It also includes a USGS nest monitoring report for 2005-2010. All reports cover a larger geographic area than the project area, but most include some reporting for Pond AB2, A2E, or Crittenden Marsh. Overall, the reports indicate regular nesting presence of American avocets, Forster's terns, and double-crested cormorants near the project area, and intermittent presence of nesting snowy plovers within the project area.