FINAL

Channel Maintenance Special Study – Tijuana River

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1 INTRODUCTION

The City of San Diego (City) developed the Master Storm Water System Maintenance Program (MMP) (City of San Diego 2011) to govern channel operation and maintenance activities in an efficient, economic, environmentally and aesthetically acceptable manner to provide flood control for the protection of life and property. A lawsuit was filed regarding the MMP (*San Diegans for Open Government et al v. City of San Diego*, San Diego Superior Court Case No. 37-2011-00101571), and the City entered into a settlement agreement (Settlement Agreement), which requires the City to conduct a special study (Channel Maintenance Special Study) to evaluate the purpose, need and alternatives to channel maintenance activities for each channel maintained during the first two years of MMP implementation in City Fiscal Years 2014-2015 and 2015-2016 (FY 14-15).

The Pilot Channel and Smuggler's Gulch Channel maintenance project includes the mechanized removal of sediment, vegetation, trash, and debris from two drainage channels in the Tijuana River Valley area using heavy equipment. Two drainage facilities converge in this area of the Tijuana River Valley. The Pilot Channel and Smuggler's Gulch Channel (MMP Maps 138, 138a, 138c, and 139).

The Pilot Channel and Smuggler's Gulch Channel maintenance project includes maintenance of two facilities during FY 14-15. This special study fulfills Section 1.8 of the Settlement Agreement for channel maintenance activities occurring within the Pilot Channel and Smugglers Gulch Channel area.

1.1 Background

This Channel Maintenance Special Study summarizes the suite of channel assessment and retrofit opportunities for channels maintained during FY 14–15. Within the framework of the MMP, channel assessment and retrofit evaluation requires consideration of maintenance practices, environmental avoidance and minimization measures, adjacent infrastructure, and project alternatives. Combined, these elements address the specific terms of the underlying legal agreement for each focal channel. Table 1 provides a summary of the channel assessment and retrofit opportunity elements addressed in this Channel Maintenance Special Study.

Table 1
Channel Maintenance Special Study Overview Based on settlement Agreement Item 1.8

Settlement Agreement Requirements	Section of Special Study
Evaluate Current Maintenance Level	
Purpose of conveyance system location	2.1
Need for conveyance system	2.1

Table 1
Channel Maintenance Special Study Overview Based on settlement Agreement Item 1.8

Settlement Agreement Requirements	Section of Special Study
Need for maintenance at individual locations	2.2
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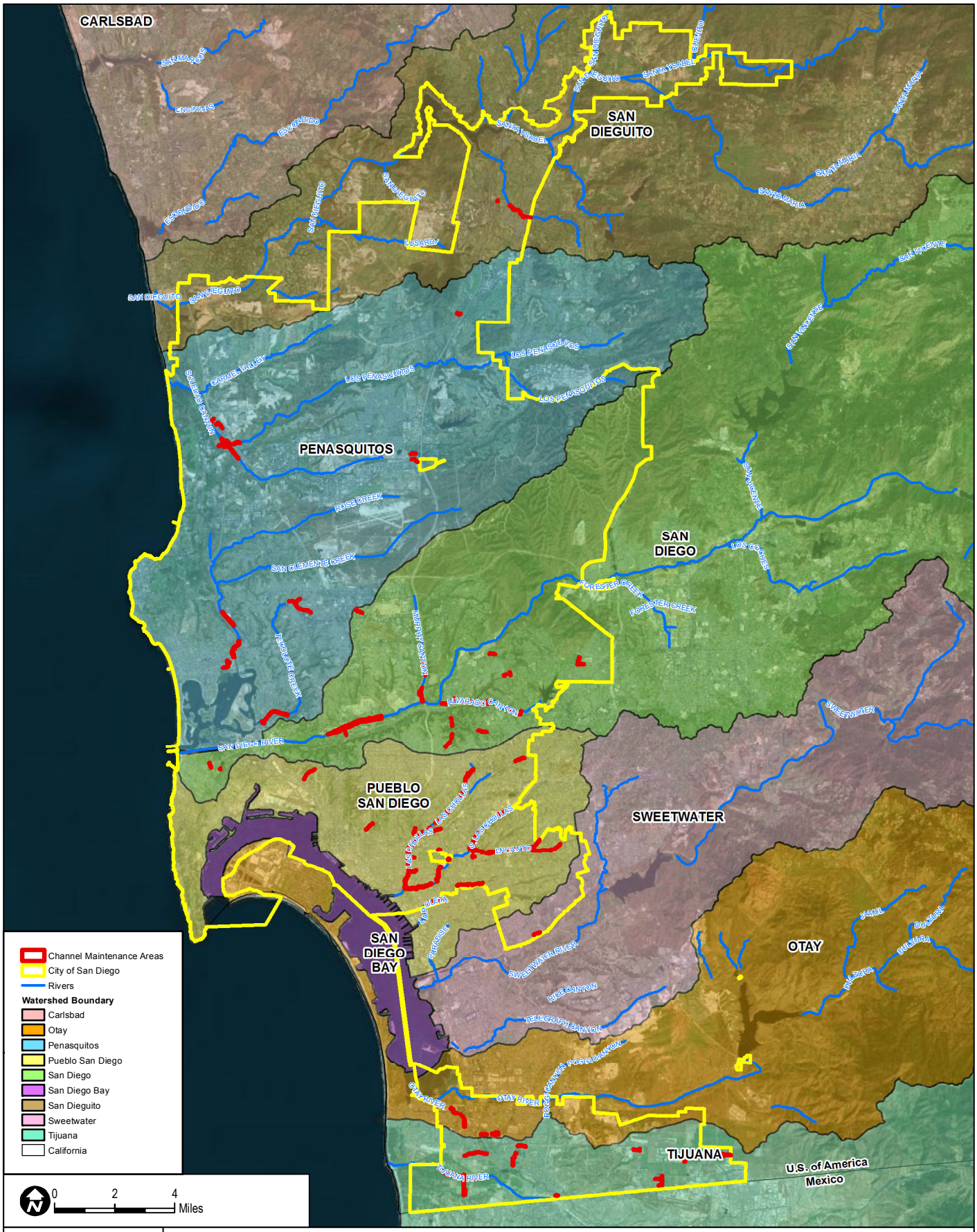
This Channel Maintenance Special Study evaluates the purpose, need and alternatives to channel maintenance activities in the Tijuana River Pilot Channel and Smuggler's Gulch Channel.

1.2 Master Maintenance Program Overview

The MMP identifies a specific planning, impact assessment, and mitigation process for channel maintenance activities within portions of the City (Figure 1). For each channel maintenance project, an Individual Maintenance Plan (IMP) and related Individual Technical Assessments (IAs) were prepared (City of San Diego 2011a). The IMP identifies the scope of work, maintenance methodology and procedures, equipment, and duration of maintenance activities planned in the channels, and include as appendices the channel-specific IAs. The IAs consist of an Individual Biological Assessment, Individual Historical Assessment, Individual Hydrologic and Hydraulic Assessment (IHHA), Individual Water Quality Assessment, and Individual Noise Assessment. The IMPs also include a comprehensive list of best management practices (BMPs); maintenance protocols and mitigation measures derived from the applicable permits; and regulations that are being implemented to avoid, minimize, and/or mitigate potential environmental effects to sensitive resources.



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SOURCE: Bing Maps 2014; City of San Diego 2013, 2014; SANGIS 2014; DWR 2014

FIGURE 1

Master Maintenance Program Channel Overview

Channel Maintenance Special Study - Tijuana River

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As part of the IMP process, the IHHA and IWQA provide data that allows for evaluation of the purpose, need and alternatives to channel maintenance activities and serve as a basis for this special study. The IWQA also provides a suite of water quality and soil monitoring activities that may be used to evaluate the potential water quality benefits of channel maintenance projects that remove sediment and pollutants from channel areas. The IMPs and IAs comprise the Substantial Conformance Review package for review and approval by the City's Development Services Department under the MMPs Programmatic Environmental Impact Report (City of San Diego 2011a).

In addition to the City's Substantial Conformance Review process, the City is also required to obtain permit authorization from the California Department of Fish and Wildlife (CDFW), Regional Water Quality Control Board (RWQCB), U.S. Army Corps of Engineers (ACOE), California Coastal Commission (CCC) and U.S. Fish and Wildlife Service (USFWS) for approval under the terms and conditions of their respective regulatory authorities.

1.3 Project Channels

The two maintenance channels discussed in this special study are the Pilot Channel and Smuggler's Gulch Channel, which are located in the Tijuana River Valley (Valley), within City jurisdiction, in southern San Diego County (County) just north of the U.S./Mexico border. The lower Valley has historically functioned as a braided system where channel alignments have migrated over time (Figure 2). The Pilot Channel and Smuggler's Gulch Channel are generally located in the Valley roughly bordered by Hollister Street to the east and Monument Road to the south. Specifically, the Pilot Channel flows from east to west, and drains flows from the Southern Channel of the Tijuana River. Smuggler's Gulch Channel flows from south to north, and drains flows from the Cañon de los Mataderos. Smuggler's Gulch Channel intersects the Pilot Channel, where flows from the two channels combine and are redirected west to flow into the Pacific Ocean.

The Tijuana River watershed covers an area of approximately 1,725 square miles, of which 73% is located in Mexico and 27% in the United States. The main Tijuana River flows in a northwesterly direction from the international border into the Valley and City jurisdiction. Approximately 21.9 square miles of the watershed (~1% of the total watershed area) is within City jurisdiction.

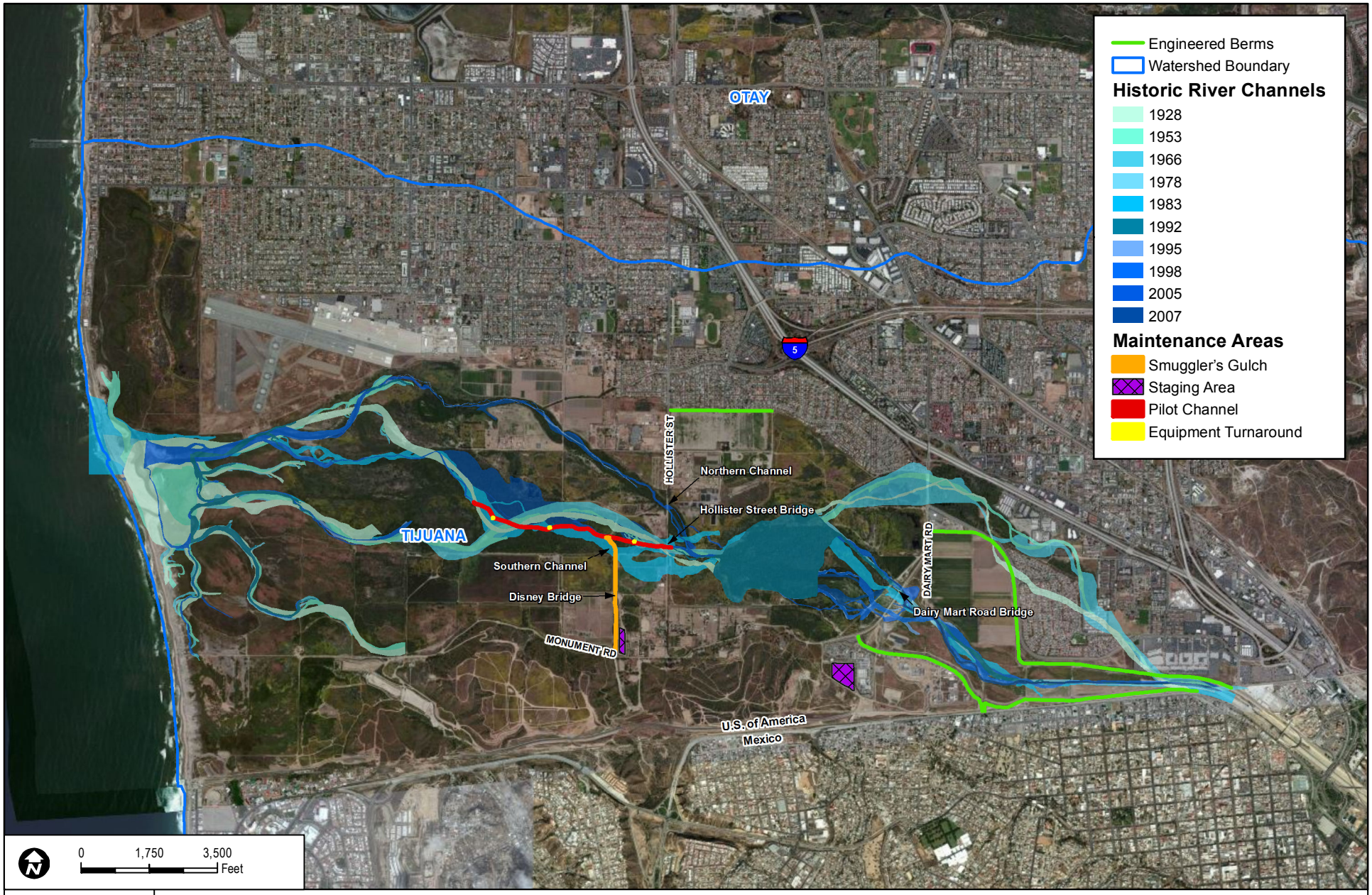
As a result of National Pollution Discharge Elimination System (NPDES) regulatory and other drivers, the City has prepared both jurisdictional and watershed scale plans that detail operational, administrative and structural activities for compliance with requirements. In 2015, the City updated its Jurisdictional Runoff Management Plan (JRMP) and is working collaboratively with stakeholders in the Tijuana River to complete a watershed plan, known as

Water Quality Improvement Plan (WQIP). The City's dual responsibility for water quality management and operation and maintenance of the storm drain system are integrated by implementation of the MMP, JRMP and WQIP. The City therefore performs operation and maintenance activities in the Pilot Channel and Smuggler's Gulch Channel within the context of the integrated water quality improvement and flood control risk management approach identified in the MMP, JRMP and WQIP documents.

1.4 Maintenance Activity

The Pilot Channel and Smuggler's Gulch Channel maintenance project IMP and IA package received SCR approval in December 2013. Approriate environmental permits were also issued by the CDFW, RWQCB, USFWS, ACOE, and the California Coastal Commission (CCC) in 2012 and 2013. Pilot Channel and Smuggler's Gulch Channel maintenance activities described in this report were conducted between September 23, 2013 and January 31, 2014. However, this report also relies on data produced during other channel maintenance activities, notably in fall 2009/winter 2010 and fall 2010.

The Pilot Channel and Smuggler's Gulch Channel maintenance project consists of excavating accumulated vegetation, sediment, and trash that significantly restricts the capacity of the channels to convey storm flows. The City was permitted to use heavy equipment to remove between 10,000 and 30,000 cubic yards of material within a project area that includes up to approximately 4.31 acres of channel maintenance areas. The Pilot Channel and Smuggler's Gulch Channel maintenance project area is generally within the 25-year floodplain (Figure 3).



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SOURCE: Bing Maps 2014; City of San Diego 2014; SANGIS 2014; DWR 2014

FIGURE 2

Vicinity of Project Work Areas

Channel Maintenance Special Study - Tijuana River

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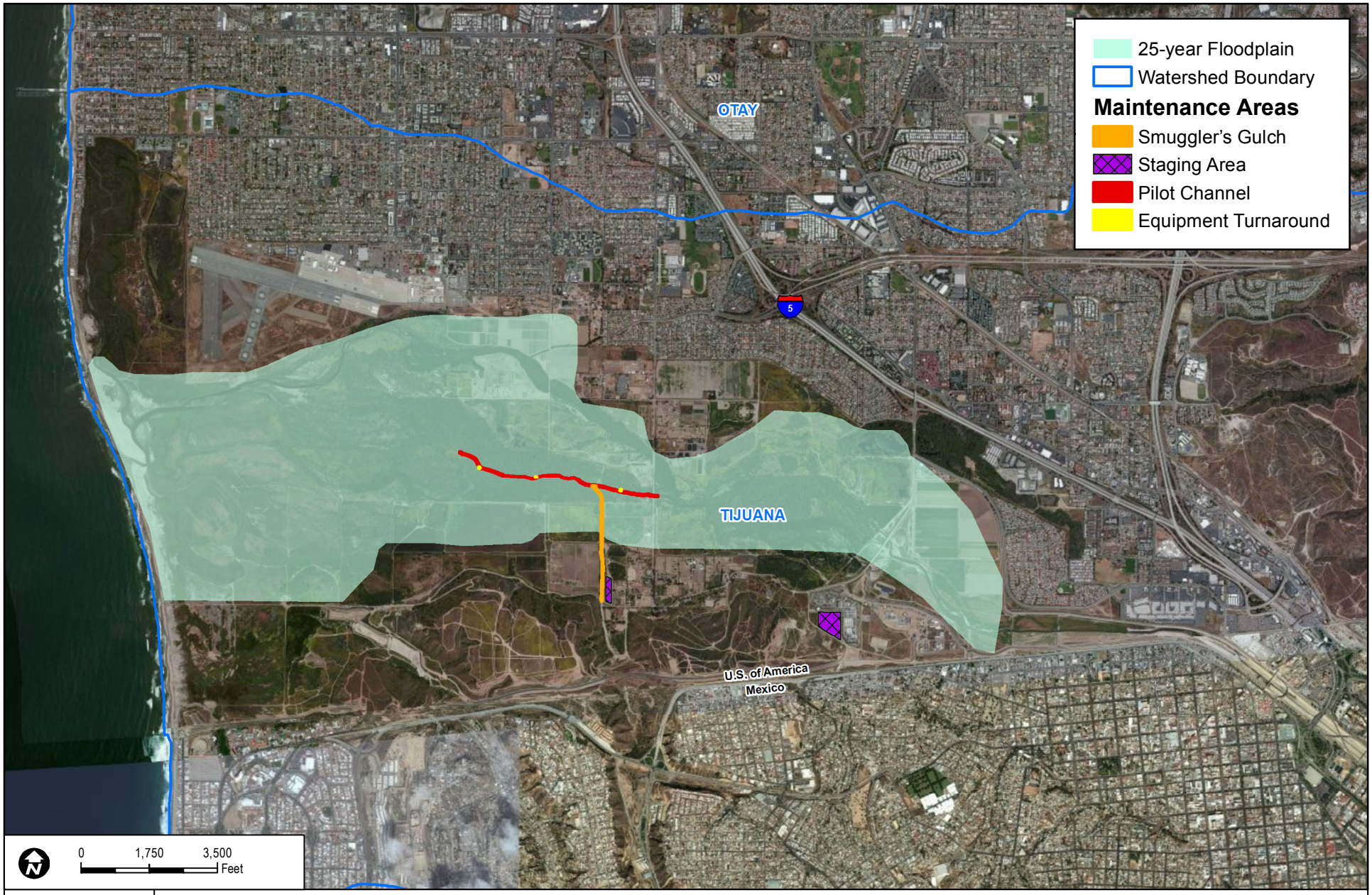

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SOURCE: Bing Maps 2014; City of San Diego 2014; SANGIS 2014; DWR 2014

FIGURE 3

Project Work Areas

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Channel Maintenance Special Study - Tijuana River

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2 CHANNEL ASSESSMENT

This section summarizes current maintenance practices, avoidance and minimization measures, and existing adjacent infrastructure and constraints for the Pilot Channel and Smuggler's Gulch Channel.

2.1 Current Maintenance Level

The Tijuana River has historically functioned as a dynamic river system in its natural state. In a dynamic system, channels that convey water during major storm events shift location over time, depending on channel and vegetation stability, storm event size and frequency, large-scale climatic dynamics and other factors.

2.1.1 Past Maintenance

Development related to agriculture, ranching and residential activities in the watershed and Valley over the past 100 years has significantly changed the hydrology of the river and made flood control a major issue in managing this dynamic system. In recent decades, the Tijuana River has had two main flow paths in the vicinity of Hollister Street Bridge: the Northern Channel and the Southern Channel (Figure 3). As a result of major flood events in the 1980s and 1990s, berms were constructed on several properties within the Valley to direct floodwaters away from existing infrastructure. In some cases, these changes have reduced channel capacity and may be responsible for an increase in upstream flooding.

Recent maintenance efforts within the Pilot Channel and Smuggler's Gulch Channel include maintenance in fall 2009 through early 2010 and in the fall of 2010. In fall 2009 through early 2010, approximately 30,000 cubic yards of material over a distance of 5,300 feet were removed within the Pilot Channel and Smuggler's Gulch Channel. The excavation process was slowed down due to rain, which eroded the walls of the channel and resulted in minor flooding and sediment deposition. Additional areas of the channels had to be re-excavated following the rain events (URS 2010a). Smuggler's Gulch Channel and part of the Pilot Channel were excavated to a final width of approximately 23 feet, and a depth of approximately 12 feet. The westernmost 2,000 feet of the Pilot Channel were cleared of vegetation and trash only (URS 2010a).

In fall 2010, maintenance resumed and involved the removal of approximately 13,244 cubic yards of sediment, trash, and vegetation over approximately 1.44 acres of channel. The entire Pilot Channel and Smuggler's Gulch Channel area was not maintained at that time due to inundation of the channel during storms as well as a court order to cease work.

Channel maintenance activities were also conducted in fall 2013 through winter 2014 in the Pilot Channel and Smuggler's Gulch Channel. The full length of Smuggler's Gulch Channel was

cleared of vegetation, and sediment, debris, and trash were excavated. Maintenance included clearing the culverts beneath Disney Bridge. Smuggler's Gulch Channel was excavated to a depth of 2 to 10 feet and a width of 15 feet (URS 2013). Only a portion of the permitted 5,400 linear feet of the Pilot Channel was maintained due to inundation from rain events. Approximately 5,098 linear feet of the Pilot Channel, including three turnarounds, was cleared of vegetation. Within the area that was cleared of vegetation, approximately 3,095 linear feet of the channel was excavated during this maintenance period. The excavation of the Pilot Channel was to an approximate depth of 5 to 7 feet with a 15-foot bottom width, and 23-foot top width. Approximately 19,863 cubic yards (25,823 tons) of material (i.e., sediment, trash, vegetation, and debris) was excavated from Pilot Channel and Smuggler's Gulch Channel during the 2013–2014 maintenance cycle and appropriately disposed of at the Miramar landfill (URS 2013).

2.1.2 Purpose and Location

The purpose of periodic maintenance of the Tijuana River Pilot Channel and Smuggler's Gulch Channel (a historic agricultural ditch) is to provide flood protection to surrounding properties and to protect the Tijuana River National Estuarine Research Reserve from impacts due to downstream transport of accumulated sediment, trash, and debris from areas upstream of the project area. The Pilot Channel was originally excavated in 1993 to convey low flows through the Southern Channel of the Tijuana River, as opposed to the Northern Channel. The Pilot Channel has been irregularly maintained since that time as an earthen trapezoidal channel that is approximately 5 feet deep, with a 23-foot top width, and a 15-foot streambed width. The Pilot Channel flows roughly in an east-west direction for a length of approximately 5,400 feet. The Smuggler's Gulch Channel is an existing historical agricultural channel with manufactured berms. The contributing sub-watershed area is approximately 6.7 square miles, primarily located south of the international border within Cañon de los Mataderos. The Smuggler's Gulch Channel, as originally constructed, is an earthen channel approximately 20 feet wide and 15 feet deep. The portion of the Smuggler's Gulch Channel maintained by the City extends for a distance of approximately 3,040 feet. The portion of the channel upstream of Monument Road, to the U.S./Mexico international border, is maintained by the County of San Diego.

Based on the results of the previous maintenance efforts, routine maintenance is being conducted to address ongoing sediment, debris, and trash deposition within the Valley. Currently, the channel maintenance work is the City's primary means of managing these inputs so that the channels can function to convey storm water flows.

Maintenance activities within the two channels provide some flood relief for 2-year storm events, but are not sufficient to support 5-year or greater storm events (Table 2) (URS 2013). The pre-maintenance capacity of the Pilot Channel is approximately 5% of its calculated design capacity. The capacity of the Pilot Channel is improved through maintenance, approaching design capacity

for the 2-year storm event (URS 2013). Smuggler's Gulch Channel, in its pre-maintained and designed state, has capacity to convey a 2-year storm (Table 2). Smuggler's Gulch Channel in its maintained state (i.e., design capacity), however, would have capacity to convey approximately 61% of a 5-year storm.

Table 2
Pilot Channel and Smuggler's Gulch Channel Conveyance Capacity Summary

Channel	Storm Event	Estimated Storm Event Flow Rate (cfs)	Calculated Design Capacity[1] (cfs)	Pre-Maintenance Capacity (cfs)
Pilot Channel	2-year[2]	278	200	10
Smuggler's Gulch Channel	2-year	653	900	653
Smuggler's Gulch Channel	5-year	1,479	900	800

Source: Data derived from IHHA (URS 2013)
1 Based on MMP channel dimensions (i.e., post-maintenance condition)
2 As Pilot Channel does not have capacity to sustain a 2-year storm event, it would not be able to sustain a 5-year event; therefore, only the 2-year event data is shown in Table 2.
cfs = cubic feet per second

The Pilot Channel and Smuggler's Gulch Channel conveyance capacity is generally less than the 5- or 10-year storm, representing a flow of between 7,000 and 14,000 cubic feet per second (cfs), even in the maintained condition. A 5- to 10-year storm can cause localized flooding along Monument Road and Hollister Street, and on private and leased properties in the Valley (URS 2013). During these flooding events, vehicular access in and out of the Valley is limited, residences and other infrastructure are impacted, and border protection operations can be impeded.

In 2009, a post-maintenance survey estimated that approximately 10,000 cubic yards of sediment accumulated from the Disney Bridge to the end of the Pilot Channel as a result of 2.5 inches of rain in December 2009 (URS 2010a). The amount of sediment accumulation depends on the intensity of the storm and whether previous storm events have occurred during the season, but this preliminary data shows that frequent and/or annual maintenance is likely needed to keep the channel free of accumulated sediment and debris.

2.2 Maintenance Practice Modification Evaluation

Current maintenance practices include sediment and vegetation removal. This section evaluates the efficacy of these practices.

2.2.1 Maintenance Practices

The general maintenance procedure that has been utilized within the channels consists of earth-moving equipment within the facility (bulldozer) pushing the accumulated material to a central site within the channel. Material is then scooped up with an excavator (operating within the

channel, or on the access routes along the channels), so that the excavated material can be deposited into a waiting transportation truck. The loaded truck then leaves the facility area and transports the material to a temporary stockpile area where disposal sorting is performed and ultimately a separate long-term staging area or landfill.

Due to the layout of the channels and approved access routes, the channels must be excavated in a specific order. Smuggler's Gulch Channel is excavated first to allow access to Pilot Channel. The confluence is excavated next, to provide turnaround areas for equipment within the channels. Finally, the Pilot Channel is excavated. It should be noted that prior to 2009, the City utilized a staging area north of the confluence (Staging Area A) (Dudek 2009). This staging area allowed for access to the Pilot Channel from the north, without needing to access through Smuggler's Gulch Channel (i.e., from the south). However, the ACOE determined that Staging Area A could not be included as part of the Least Environmentally Damaging Practicable Alternative (LEDPA) and therefore removed it as part of the project. This has resulted in avoidance of approximately 0.61 acres of additional jurisdictional resources (Dudek 2009).

In each channel maintenance section, vegetation is first removed from within the channel, and the methods depend on the location within the channel. Some vegetation along the banks of the channel (e.g., willows [*Salix* spp.], mulefat [*Baccharis salicifolia*], and arundo [*Arundo donax*]) is trimmed using machetes or a chainsaw so that equipment can access the channel. Vegetation within the channel is crushed with a bulldozer and then physically removed from the roots using large equipment, such as an excavator. Even after years of no channel maintenance activity (such as between 2006 and 2009, and 2010 and 2013), this vegetation is largely non-native and is dominated by arundo (URS 2013).

Vegetation removal alone does not improve the channel capacity.[1] Based on hydraulic modeling, the Pilot Channel's capacity was not significantly improved with only the removal of vegetation. The modeling data indicates 10 cfs flows can be conveyed in this state (URS 2013). Removing both vegetation and sediment from the Pilot Channel marginally improves the flood conveyance capacity of the channel. Because the Smuggler's Gulch Channel remains largely unvegetated even after years of no maintenance activities, there is no effect of vegetation removal within this stretch of the maintenance area.

Based on a review of the pre-maintenance and design conveyance capacity of the Pilot Channel and Smuggler's Gulch Channel areas, current maintenance practices provide limited flood protection for surrounding areas. Reduced maintenance practices such as hand trimming of vegetation and leaving root structures and accumulated sediment in the channels would further

[1] Hydraulic modeling results for the Pilot Channel and Smuggler's Gulch Channel are assumed to be the same for both hand trimming of vegetation (leaving the root structure in place) and vegetation removal only scenarios (URS 2013).

reduce this limited level of flood protection to surrounding property and infrastructure. It should also be noted that arundo is a relatively fast-growing and invasive (i.e., spreading) species. Leaving the roots in place would likely result in rapid regrowth of aboveground biomass, reducing channel capacity and negatively affecting adjacent habitats and the flood capacity within the adjacent areas.

2.2.2 Alternatives

This section describes additional alternative maintenance methods.

Vegetation Clearing. Vegetation clearing is identified in the MMP as a maintenance alternative to minimize habitat and/or water-quality impacts in sensitive channel areas. Vegetation trimming provides only minimal added benefit to improve flood control capacity within the Pilot Channel, and no benefit to the Smuggler's Gulch Channel because it is unvegetated. Accumulated sediment, trash, and debris in the channel are the primary impediments to flood conveyance capacity of these channels. Maintenance to trim vegetation trimming by hand without sediment and root removal provides an insignificant flow conveyance capacity benefit. Vegetation in the Pilot Channel is primarily fast-growing non-native arundo species. Further, vegetation clearing of the channel by hand has similar biological impact as removing both sediment and vegetation. Therefore, sediment and vegetation removal that includes the vegetative root system provides the maximum flood conveyance capacity.

Adjusting Maintenance Frequency. Observational evidence indicates that even relatively small storm events can result in sediment accumulation and allow vegetation establishment in the Pilot Channel and Smuggler's Gulch Channel 'channel areas'. Maintenance frequency is discussed in detail in Section 2.3.

Native Species Recruitment. The colonization of non-native species within the channels poses a potential flooding risk, because these species alter hydrology by reducing flood conveyance capacity and interfere with absorption of storm water flows and flooding. However, based on the year-to-year observations within the channels, arundo is the dominant form of vegetation colonizing the Pilot Channel and Smuggler's Gulch Channel. Arundo forms dense, monotypic stands that prevent recruitment of native species. Therefore, it is not anticipated native species will establish in the Pilot Channel and Smuggler's Gulch Channel in the current condition. According to the 2009 vegetation map (which represents 3 years post-maintenance), within the Pilot Channel and Smuggler's Gulch Channel there is 8.6% cover of native vegetation, 72.5% cover of non-native vegetation, and 18.4% cover of unvegetated channel. In 2013, which also represents 3-years of post-maintenance, there is cover of 14.2% native vegetation, 53.1% cover of non-native vegetation, and 32.7% cover of unvegetated channel within the Pilot Channel and

Smuggler's Gulch Channel. Although there is less cover of non-native vegetation in 2013 than in 2009, there is still only minimal native vegetation present within the channels.

Enhance Channel Capacity. The Smuggler's Gulch Channel configuration is limited by adjacent County-owned agricultural fields, a City-owned staging area (Staging Area B) that is unauthorized for use, private property and roads. Similarly, the Pilot Channel alignment is constrained by dimensions agreed upon prior to the first channel excavation that occurred in 1993. The 23-foot width was identified as the maximum allowable dimensions due to the channel's location in sensitive riparian habitat, including critical habitat for least Bell's vireo (*Vireo bellii pusillus*), and adjacent property ownership. The constraints of the site preclude any discussion of expanding the width of the channel. Therefore, there are limited opportunities to enhance the channel capacity through channel widening. The physical constraints of the channels are discussed in more depth in Section 2.7.

2.3 Maintenance Frequency Assessment

Over the past decade, maintenance within the Pilot Channel and Smuggler's Gulch Channel has been performed periodically. This has been due to hydrological conditions, sensitive biological resource protections, environmental permitting challenges, and weather constraints. This section analyzes the results of the current frequency of maintenance, and evaluates the potential impacts of changes in maintenance frequency.

Recent maintenance has occurred in fall 2009/winter 2010, fall 2010, and fall 2013/winter 2014. In its maintained condition, the capacities of the Pilot Channel and Smuggler's Gulch Channel can accommodate less than the 2-year and between the 2- to 5-year storms, respectively. To analyze the efficacy of maintenance, results of the 2009–2010 maintenance were compared to pre-maintenance conditions from fall 2013. Sediment accumulates within the two channels at different rates, which depend on a variety of environmental factors, including the intensity of rain events, the timing of rain events during the wet season, the quantity of trash that is mixed in with sediment, and other environmental factors. Given the environmental variability associated with these factors, robust data is not available to assess sediment accumulation rates in the Pilot Channel and Smuggler's Gulch Channel.

Figure 4 Pilot Channel near midpoint of western branch, with giant reed, castor bean, and trash prior to maintenance in 2012.

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Moving forward, the MMP process provides a framework to document maintenance effort, sediment accumulation and vegetation establishment rates. The City may use current maintenance effort documentation processes and other data such as local precipitation and large scale climactic information to estimate optimum frequency of maintenance activities in the Pilot Channel and Smuggler's Gulch Channel project area. It is expected that sediment accumulates within the two channels at different rates, depending on such environmental factors as the timing and volume of water discharged through the channel area, soil type and Erodibility of the upstream subwatersheds that contribute to each reach, the intensity of rain events, the timing of rain events during the wet season, and the quantity of trash that is mixed in with sediment.

Observational evidence from the 2009/2010 wet season indicates that approximately 7,500 cubic yards of sediment and trash was deposited in the Pilot Channel and Smuggler's Gulch Channel as a result of approximately 2.6 inches of rainfall. Given annual rainfall averages approximately 9 inches in the San Diego region, it is anticipated that watershed sources have potential to contribute to the accumulation of sediment and trash in excess of the limited capacity of the Pilot Channel and Smuggler's Gulch Channel. During wet years, biannual or more frequent maintenance may be required to maintain design capacity of the Pilot Channel and Smuggler's Gulch Channel. Accordingly, it is estimated that routine and/or annual maintenance may likely be required to maintain even minimal flood conveyance capacity in the Pilot Channel and Smuggler's Gulch Channel.

2.4 Herbicide Needs Assessment

Both the Pilot Channel and Smuggler's Gulch Channel, during post-maintenance periods, are characterized by recruitment and growth of non-native species, which could potentially be treated with herbicides. For example, the Smuggler's Gulch Channel supports a sparse mix of invasive non-native plants such as castor bean (*Ricinus communis*), tree tobacco (*Nicotiana glauca*), Mexican tea (*Dysphania ambrosioides*), and stinkwort (*Dittrichia graveolens*); these species recruit after maintenance activities clear vegetation in the channel. The banks of the channel support primarily invasive non-native vegetation that is dominated by large, old tamarisk trees (*Tamarix aphylla*), and invasive shrubs and herbs such as castor bean, tree tobacco, garland daisy (*Glebionis coronaria*), and wild radish (*Raphanus sativus*). Patches of arundo are present in some locations on and beyond the banks. The Pilot Channel is unvegetated at the confluence with Smuggler's Gulch Channel, but is dominated by arundo beginning a short distance to the west of the confluence and extending to the terminus of the Pilot Channel approximately 5,000 feet from the confluence area near the Tijuana River estuary.

As part of the compensatory mitigation for maintenance of the Pilot Channel and Smuggler's Gulch Channel, the City is required to maintain the maintenance channels themselves, free of invasive exotic species in perpetuity. An additional 4.31 acres of areas adjacent to the channels

that were occupied by invasive exotic species in 2013 was treated and is required to be maintained free of those species. In 2013, the majority of the invasive species within the "in-channel" mitigation area was treated through physical removal of the plants, that results from the channel maintenance itself. The areas of the channels that were not cleared of vegetation, were treated with herbicide both in fall 2013 and fall 2014 (Dudek 2014a). The out-of-channel mitigation areas were initially treated with herbicide to kill both the above- and below-ground structures of the plants. A few weeks following herbicide treatment, the above-ground vegetative structures were removed.

Hence, herbicide treatment is an important ongoing part of the compensatory mitigation program. This program is not only approved and sanctioned by multiple resource agencies, it is a requirement that has been determined to result in substantial benefits to the ecosystem, counteracting the adverse effects of channel maintenance.

The Pilot Channel and Smuggler's Gulch Channel IMP concluded that there would be limited potential for water quality impacts resulting from herbicide use due to the general lack of water flows through the channels in dry weather (URS 2013). Dry weather diversion structures, constructed by the federal government, generally diverts dry weather flows from Mexico to the sanitary sewer. This infrastructure prevents dry weather flows from entering the maintenance areas and limits the potential of herbicide transport to downstream receiving waters.

2.5 Vegetation Assessment

In the pre-maintenance condition, the Pilot Channel and Smuggler's Gulch Channel are dominated by non-native vegetation both within the channels and on the banks (Table 3). Vegetation communities removed during 2013–2014 maintenance included arundo, a small amount of southern riparian forest (including disturbed forms; consisting of less than 17% of the total impact acreage), southern willow scrub, and disturbed/ruderal. In general, vegetation was removed from within the channel and only very little was removed along the banks. Table 3 indicates the vegetation that was removed from within the channel, access route and staging maintenance area in 2013 (Dudek 2014b). A total of 1.34 acres of vegetation-only was cleared and 2.83 acres of sediment and vegetation was removed from within the channel area. A total of 9.19 acres was cleared for the staging areas and access routes. Nearly all of this area was populated with disturbed or ruderal weed-type vegetation. Approximately 0.33 acre within the maintenance area was not impacted by maintenance activities.

Table 3
Mapped Vegetation Communities Present
in the Smuggler's Gulch and Pilot Channel Areas[1]

Vegetation Type	Impact Acreage			No Impact[2]	Total Acres
	Vegetation Clearing Only	*Vegetation Clearing and Sediment Removal*	*Staging Areas and Access Routes*		
Open Water	0.005	--	--	0.089	0.094
Arundo	1.065	0.716	--	--	1.781
Southern Riparian Forest	0.054	0.316	--	0.034	0.404
Southern Riparian Forest (disturbed)	0.181	0.157	--	--	0.338
Southern Willow Scrub	0.029	0.193		--	0.222
Disturbed/Ruderal	0.005	0.082	9.148	0.143	9.378
Mulefat Scrub	--	--		0.062	0.062
Mulefat Scrub (disturbed)	--	--	0.042	--	0.042
Non-Vegetated Channel	--	1.357	0.004	--	1.361
Non-Native Vegetation	--	0.006	--	0.001	0.007
Subtotal	*1.339*	*2.827*	*9.194*	*0.329*	*13.690*

1 Data from Dudek 2014b
2 Acres within the maintenance area that were not impacted by construction activities.

In general, vegetation removal has had very little impact on overall habitat and species composition within the Tijuana River Valley. The maintenance access and staging areas, which totals the majority of the overall 13.7-acre project, and 4.3-acre channel area is only a small portion of the 1,800-acre Tijuana River Valley Regional Park. The Tijuana River Valley Regional Park supports extensive riparian forest, riparian scrub, wetland, and open water habitats. Even though a small amount of native plant species have been removed as part of the project implementation, the overall effect on the region is likely positive. As described in Section 2.4, the extent of non-native species within the region (U.S. and Mexico) means that non-native species are likely to continue to recruit and reestablish within the project area. Almost 75% of the Tijuana River watershed is located in Mexico, and therefore there is very little that can be done for invasive plant management solely within the U.S. jurisdiction. A more comprehensive binational invasive plant management program is needed to control these species within the Tijuana River Valley.

2.6 Habitat Assessment

The Tijuana River Valley is a critical wildlife corridor. The Valley has been designated as a biological resource core area in the City of San Diego's Multiple Species Conservation Program (MSCP), and lies almost entirely within the Multi-Habitat Planning Area (MHPA). Much of the project area is federally designated critical habitat for the least Bell's vireo. Designated Federal

State, and County open space located within the Valley includes the Tijuana Slough National Wildlife Refuge (TSNWR), Border Field State Park, and Tijuana River Valley Regional Park (TRVRP). The Valley is located within the Pacific Flyway, which provides foraging and breeding habitat for many migrating bird species. Several special-status species have been documented within and adjacent to the channel maintenance area, and include the coastal California Gnatcatcher (*Polioptila californica californica*), federally threatened and state Species of Special Concern (SSC); northern harrier (*Circus cyaneus*), State SSC; least Bell's vireo, state and federal Endangered; southwestern willow flycatcher (*Empidonax trailii extimus*), state and federal Endangered; western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), state Endangered, federal proposed threatened; and yellow-breasted chat (*Icteria virens*), state SSC (URS 2013). Additional species with potential to occur include light-footed clapper rail (*Rallus longirostris levipes*), state and federal Endangered (URS 2013).

With the implementation of mitigation measures, including compensatory mitigation in the form of invasive species treatment and control, project maintenance will not result in significant direct and indirect impacts to biological resources, including special-status species and habitats. Project activities follow all mitigation measures and BMPs outlined in the permits issued for this project, and the overall PEIR (City of San Diego 2011).

This project is not expected to substantially adversely affect any species found within the project area or the Tijuana River Valley. The project complies with all relevant Area Specific Management Directives that have been identified as management guidelines for the Regional Park (County of San Diego 2006). Furthermore, the project complies with the USFWS Biological Opinions that were issued for the project (USFWS 1993, 2012). Additional regional habitat assessment factors for this project include the following.

2.7 Infrastructure Assessment

A number of watershed configuration, land ownership, and infrastructure components provide limits to channel maintenance alternatives in the Pilot Channel and Smuggler's Gulch Channel. As described above, the Tijuana River has historically functioned as a dynamic river system, with variable historic river channels and flood courses (Figure 2). Urban development, agriculture, ranching and residential activities throughout the watershed and Valley have significantly changed the hydrology of the river over the past 100 years. Berms, bridges, and roadways constructed to direct floodwaters away from existing infrastructure and provide access have reduced the dynamic capacity of the river system to shift location over time. Accordingly, a multitude of land use, existing infrastructure and climatic factors impacting watershed dynamics serve to affect the feasibility of alternatives to channel maintenance needed to protect life and property in the Valley.

A general discussion of infrastructure configuration in the Valley must begin with an assessment of the natural flood plain for the 1,725 square mile watershed. Much of the lower Valley, and more specifically the Pilot Channel and Smuggler's Gulch Channel, are contained within the 25-year flood plain and subject to periodic riverine flooding (Figure 3). Riverine flooding occurs when rivers, streams and lakes overflow their banks. Areas adjacent to rivers can also experience flooding as a result of excessive runoff from heavy rainfall and accumulation of water flowing over broad flat areas. In the Valley, riverine flooding can be widespread, with floodwaters persisting for several hours to days, weeks, or more.

The two major flow paths to the Pilot Channel and Smuggler's Gulch Channel cross the international U.S./Mexico border through an engineered channel and culvert approximately 2.8 miles and 0.5 mile from the upstream ends of the channel areas, respectively. The main Tijuana River is constrained by flood control levees downstream of the international border. Main river flow to the Pilot Channel passes under both the Dairy Mart Road and Hollister Street bridges. Immediately upstream of the Hollister Street Bridge, the Tijuana River splits into a southern and northern channel with the southern channel conveying flows to the Pilot Channel. As part of the establishment of the Pilot Channel, an "erodible berm" was constructed from Hollister Street up to and across the northern channel, to help maintain low flows in the southern channel. Flow to Smuggler's Gulch Channel generally flows from Mexico through the Department of Homeland Security border fence culvert and an earthen channel to the Monument Road crossing. Flows then cross Monument Road via a modified "Arizona crossing" except during extreme low flows, when flow may travel under the road in an approximately 18-inch-diameter pipe.

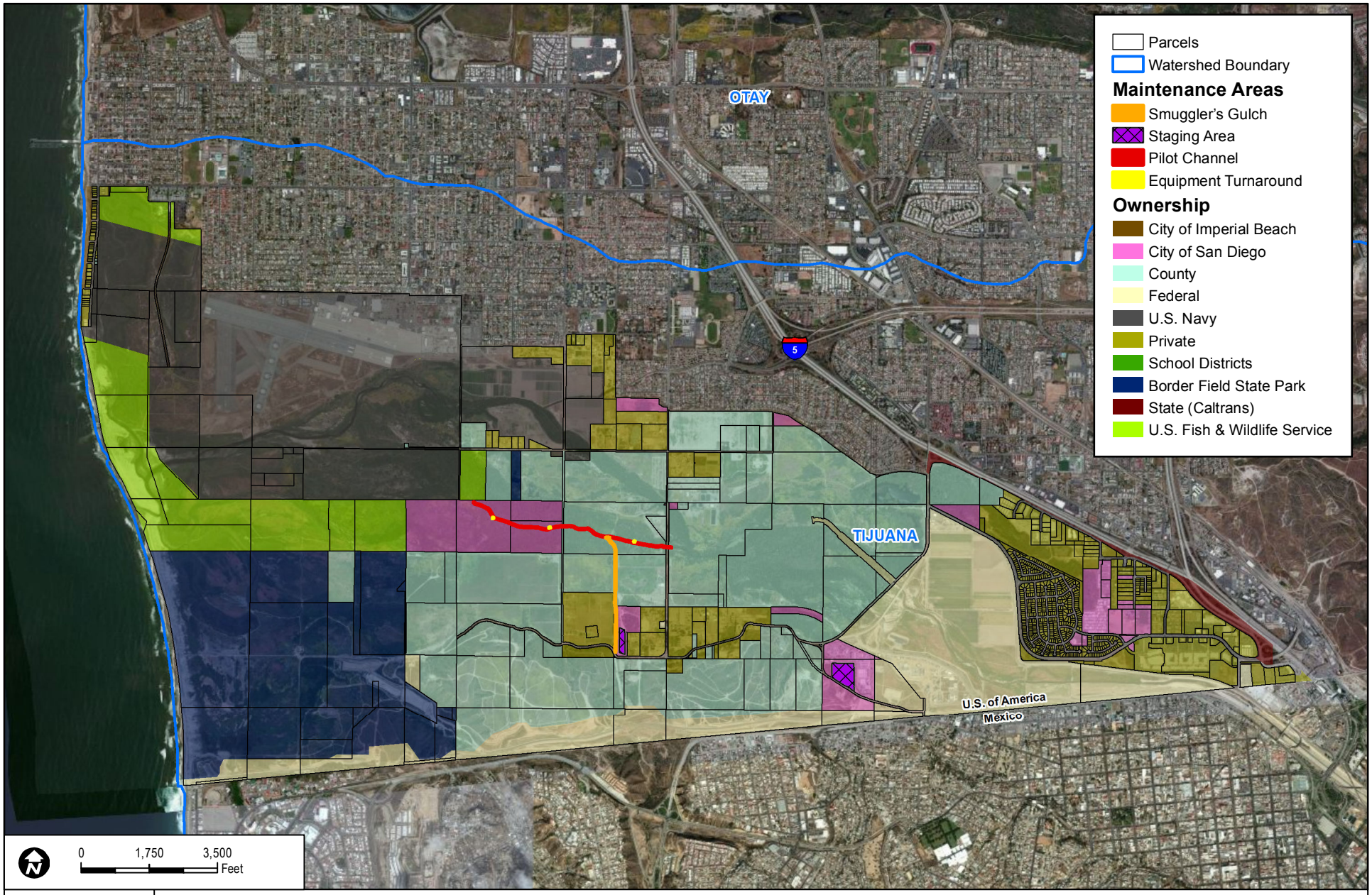
Within the 25-year flood plain upstream of the Pilot Channel, property is generally owned by the County and included within the MHPA (Figure 5). Some County-owned parcels within this area are leased to private entities for agriculture and other uses. Low-density housing and other associated infrastructure exist on portions of these parcels. Within the Smuggler's Gulch Channel drainage area downstream of the federally owned border infrastructure and upstream of Monument Road, land is owned by the County. The channel in this area is constrained by sensitive habitat and border patrol operations access roads. Downstream of the Monument Road crossing, Smuggler's Gulch Channel is constrained by a series of earthen berms that direct flows to a confluence point with the Pilot Channel.

A culvert, constructed of three 72-inch-diameter corrugated metal pipe (CMP) segments, bisects Smuggler's Gulch Channel and supports an unpaved access road/public trail known as the "Disney Bridge." Land adjacent to Smuggler's Gulch Channel is owned by public and private entities. A small parcel adjacent to the eastern channel berm is owned by the City and used as a staging area for operation and maintenance activities. The parcels west of Smuggler's Gulch Channel and south of the Disney Bridge are privately owned. The parcels adjacent to Smuggler's Gulch Channel, generally north of the Disney Bridge, are owned by the County and are part of the MHPA.

The majority of watershed area upstream of the Pilot Channel and Smuggler's Gulch Channel is outside the jurisdictional authority of the City and United States. Population growth in the City of Tijuana over the past few decades has resulted in a highly urbanized upstream area with residential, commercial, industrial and military land uses. In general, there are limited opportunities for the City or other U.S. agencies to influence and/or implement watershed-based storm water controls to reduce flows into downstream channel areas.

Given this watershed configuration, property ownership, and infrastructure framework, limited opportunities exist to integrate alternative approaches to channel maintenance efforts aimed at reducing flood risk. At the watershed scale, City participation in the TRVRT is intended to coordinate with various federal, state and local agencies with appropriate jurisdictional authority to implement watershed-based storm water management approaches in coordination with Mexico. The City has taken an active role in participating in and contributing to the TRVRT for tasks requiring directed geodatabase compilation, technical planning, and trash and sediment removal in the U.S.

Conservation and property acquisition has been utilized to balance property ownership and flood risk through a variety of mechanisms in the Valley. In 1964, California voters approved funding to acquire the Valley property that later became Border Field State Park. Since that time, a number of agencies have participated in partnership, grant and land acquisition programs to conserve and transition property in the Valley to estuary, riparian and upland habitat. These programs work simultaneously to provide recreation and education opportunities, restore and enhance native habitats, and preserve operational feasibility and security for adjacent U.S. Navy and border patrol operations. Given the long history of native people and hunters, agricultural, and equine mixed use land uses within the Valley and floodplain, the partnership and land acquisition programs have functioned through a willing seller program. Accordingly, the City may seek to identify appropriate partnership and grant programs that may provide capital and/or long-term operation and maintenance funding for purchase of property with existing infrastructure that may be restored to native habitat. Multiple benefits may include expansion of existing riparian corridors and native habitat, improved recreational trails, and reduction of infrastructure requiring flood protection.



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SOURCE: Bing Maps 2014; City of San Diego 2014; SANGIS 2014; DWR 2014

FIGURE 5

Tijuana River Valley Ownership and Project Work Areas

Channel Maintenance Special Study - Tijuana River

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Infrastructure improvements designed to enhance public safety or improve transportation efficiency can often provide opportunities for examination of drainage and flood control needs. In urbanized areas with undersized channels or sediment- and vegetation-filled drainage features, adjacent roadway and bridge infrastructure improvements regularly allow for evaluation of various alternatives to frequent channel capacity-restoring maintenance. Examples potential integrated infrastructure and flood control improvement projects include improved access to maintenance areas to reduce habitat impacts, channel widening and integration of low impact development-type features to reduce flow velocity and improve water quality.

In the Tijuana River Valley, Monument Road and the Dairy Mart Road and Hollister Street bridges are the major roadways and bridges that traverse main Tijuana River and Smuggler's Gulch Channel flows. Given the relative size and average daily traffic need of these infrastructure components to the contributing upstream watershed area, it is unlikely that routine maintenance or safety improvements of the Dairy Mart Road bridge or Monument Road will impact existing or necessitate channel conveyance capacity improvements that will be meaningful in reducing flood risk. The City has advocated for a detailed watershed hydrology and hydraulic modeling study to be conducted to allow evaluation of the 25- and 100-year floodplain. It is anticipated the results of this study can be used to identify current flow conditions to inform flood control and sediment management policy and project implementation decisions.

Moving forward, the City has initiated an integrated opportunity-based flood relief approach. The approach intends to evaluate current channel maintenance responsibility policies and requirements. Additionally, the City is beginning planning to evaluate the infrastructure flood risk reduction cost benefits and land use protections afforded by periodic maintenance of the Pilot Channel and Smuggler's Gulch Channel. Key outcomes may include identification of key areas where existing infrastructure may be affected by flooding and compile key property ownership, estimated value, and purchase options. The approach would also include a process to compile hydrology and hydraulic modeling data and information as it becomes available through other programs. The integrated process includes an adaptive management component to iteratively coordinate discussion with potentially impacted City departments and stakeholders and seek to initiate new or additional partnerships to improve overall flood protection efficiency. It is anticipated that potential partners will include private property owners, agricultural lessees, U.S. Customs and Border Patrol, U.S. Navy, U.S. Environmental Protection Agency, U.S. International Boundary and Water Commission, U.S. Fish and Wildlife Service, California State Parks, State Water Resources Control Board, Regional Water Quality Control Board San Diego Region, County of San Diego, and the City of Imperial Beach.

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3 RETROFIT OPPORTUNITIES

This section identifies different retrofit opportunities for channel maintenance operations, and includes analyzing the present channel configuration and opportunities to alter the capacity, habitat preservation options in the Tijuana River Valley, and channel discharge maintenance opportunities.

3.1 Channel Configuration

After heavy El Niño flooding in 1993 that led to extensive property damage, the Tijuana River Pilot Channel was constructed after emergency action taken by the San Diego City Council. Permits issued in 1993 authorized the construction of the Pilot Channel and delineated the channel configuration, which is still the authorized alignment today. As stated in the Biological Opinion, "The pilot channel will be constructed in such a manner that the top width of channel of 23 feet, the bottom width of channel of 15 feet, and the channel depth of 2 feet will not be exceed in width or depth" (USFWS 1993). This 23-foot alignment is still the maximum allowed channel width today, and is required to limit the impacts to sensitive species and habitat found within the vicinity of the channel. Due to the contentious nature of the initial and subsequent project permitting and sensitive adjacent habitat, it is unlikely that the agencies would approve either a wider channel or a different channel alignment. Utilizing the existing channel will minimize impacts to the sensitive resources found adjacent to the channel.

Some areas that were permitted for use in 1993 during the initial phase of the project have since been revoked. For example, one staging area located north of the confluence is no longer allowed for use because ACOE determined its location within the project floodplain resulted in unallowable impacts.

One potential retrofit opportunity could be to change the way that the channel is structured. However, both the Pilot Channel and Smuggler's Gulch Channel are earthen channels, so there are no concrete structures to be removed that would aid in channel maintenance. There are large culverts that are routinely clogged with sediment and trash, and are located under Monument Road and Disney Crossing. These culverts could be maintained more frequently to prevent a backup of sediment and trash. But, these are necessary pieces of infrastructure that cannot be altered or changed substantially. There is concrete located in the erodible berm upstream of the Smuggler's Gulch Channel, however its removal would not likely reduce channel maintenance requirements and in fact may increase the need for maintenance within the Northern Channel.

Additionally, based on the Infrastructure Assessment outlined above, the channels and surrounding property in the Valley are located within the 25-year flood plain and are subject to periodic riverine flooding (Figure 3). The City has advocated detailed watershed hydrology and

hydraulic modeling be conducted to add to the limited available data that may be used to inform flood control and sediment management policy and project implementation decisions. However, it is anticipated that based on the limited design capacity of the Pilot Channel and Smuggler's Gulch Channel (Table 2), channel configuration changes leading to meaningful conveyance improvements and reduced maintenance are likely limited by adjacent habitat and land use protection in the Valley.

Additional alternatives that could reduce the need for regular maintenance of the Pilot Channel and Smuggler's Gulch Channel were identified in the PEIR for the MMP, and are described below (URS 2013).

Raising the channel banks by constructing walls or berms along the top of the channels: The hydraulic analyses show that increasing the capacity of the Pilot Channel with construction of walls or berms would be beneficial to increase the channel's capacity. However, since the Pilot Channel works in conjunction with the Southern Channel to provide flood protection to the surrounding properties, this alternative is not recommended as the walls would disrupt the synergy between the channels. Further, given the sensitive adjacent habitat and species, it is unlikely the construction of walls or berms within the Valley is a feasible alternative to ongoing maintenance. At a minimum, the Pilot Channel is located within the MHPA and the City of San Diego Environmentally Sensitive Lands Ordinance (which is based on the provisions agreed to under the MSCP) prohibits the construction of concrete structures, including riprap. Based on the visual inspection of the manufactured berms along the Smuggler's Gulch Channel, the history of breaches in berms (especially in the area south of the Pilot Channel, west of Hollister Street, and east of Smuggler's Gulch Channel), and the available topography for the area, there are a number of discontinuities and depressions along the profiles of the berms. It is recommended that the reconstruction of existing berms be considered to reduce flood risk.

Diverting storm water in pipes around constrained segments: Using pipes around constrained segments to divert storm water does not eliminate the need for channel maintenance. In order to sustain the wetland habitat a diversion structure would need to be designed which maintains a low flow through the existing channel. Without maintenance, sediment and/or vegetation would build up in the existing channel and ultimately block the desired low flows from entering the channel, which would cause the wetland to dry out.

Widening channels to accommodate vegetation: These channels were constructed in larger drainages to reduce flooding impacts of the smaller storm events on properties in the Tijuana River Valley. The construction of larger channels to maintain the vegetation would be at odds with limiting the disturbance of the existing vegetation in the area. The studies of this area also indicate that the continuous and unpredictable sediment loads carried by the Tijuana River limit the potential efficacy of channel widening and ultimately would only provide a temporary

solution. This alternative would also potentially have significant biological and potentially cultural resource impacts.

Off-site runoff reduction: As noted above, 73% of the watershed tributary to the Tijuana River is in Mexico. While efforts are under way by the TRVRT to coordinate with the Mexican authorities to create programs that reduce the amount of runoff, sediment, trash and pollutants carried by the Tijuana River, these programs are dependent upon implementation by agencies and organizations generally outside the jurisdictional boundary of the U.S. Within the U.S., the relative impact of reducing impermeable areas, redirecting runoff into previous areas, and other low impact development (LID) approaches within the 27% of the watershed area that is within the U.S are likely to provide limited flow reduction and downstream flood relief.

3.2 Habitat Preservation

The Tijuana River Valley was historically been dominated by agriculture and farming. A conservation push following the listing of the least Bell's vireo as federally endangered has led to substantial increases of riparian forest, riparian scrub, and wetland habitats within the Valley, as many historical agricultural areas have been converted back to native habitats. This conservation effort has led to an increase in native wildlife populations, including a significant population increase of the least Bell's vireo within the Valley. Riparian woodland habitat in the Valley went from virtually nonexistent in the 1970s, to extensive by the late 1990s; vireos responded accordingly to the increase in available habitat, from one territory in 1980 to 134 by 1997 (Unit 2004).

The collaboration of more than 30 federal, state and local agencies and other interested parties that form the TRVRT have identified acquisition of land from willing landowner sellers has been identified as a priority in the Tijuana River Valley (TRVRT 2013). Coordinated effort by federal, state, and local governments has resulted in the purchase of more than 1,700 acres of private property in the Valley since the 1980s. This effort is complemented by ongoing efforts in Mexico to secure conservation easements in open space areas. It is generally acknowledged that conversion of private property to open space and preserved habitat will result in reduced risks to public health and safety from flooding and erosion and improved natural habitat connectivity.

However, additional habitat preservation options are limited. Within the U.S., almost all parts of the Tijuana River Valley have been either incorporated as a preserve, or are private property (e.g., agriculture, farming). A number of agencies and organizations are also actively investigating purchase of property from willing private sellers within the Valley. These efforts may increase habitat preservation, although financial resources and legal complications potentially limit purchase options. There are also potential benefits of encouraging habitat preservation within Mexico (e.g.,

Cañon de los Mataderos), which could lead to improved connectivity of wildlife corridors, reduced trash and sediment deposition, and expanded riparian habitat.

3.3 Channel Discharge

The discussion of channel discharge is related downstream water quality and flooding. Discharges from the Tijuana River Valley, and the watershed in general, have negative impacts on downstream water quality resources. Sediment is the highest priority water quality condition for the Tijuana River Watershed Management Area as outlined in the watershed's WQIP (Tijuana River Responsible Parties 2015). The lower Tijuana River and Pacific Ocean near the mouth of the river are listed on the Clean Water Act Section 303(d) list (SWRCB 2010) (Table 4). Pollutants within the Tijuana River include bacteria, sedimentation, trash, nitrogen, phosphorus, pesticides, surfactants, selenium, trace elements, synthetic organics and others (Table 4).

Table 4
Regional Water Quality Control Board 303(d) Listed Pollutants

Receiving Water Segment	Indicator Bacteria	Total Coliform	Fecal Coliform	Enterococcus	Turbidity	Solids	Sedimentation/ Siltation	Trash	Total Nitrogen as N	Ammonia as Nitrogen	Phosphorus	Eutrohic	Low Dissolved Oxygen	Pesticides	Surfactants (MBAS)	Lead	Manganese	Nickel	Selenium	Thallium	Trace Elements	Synthetic Organics	Perchlorate	Color	pH	Toxicity	Beneficial Uses Impacted1
Pacific Ocean Shoreline, Tijuana HU, at 3/4 mile North of Tijuana River		x	x	x																							REC-1
Pacific Ocean Shoreline, Tijuana HU, at end of Seacoast Drive		x	x	x																							REC-1, SHELL
Pacific Ocean Shoreline, Tijuana HU, at Monument Road		x	x																								REC-1
Pacific Ocean Shoreline, Tijuana HU, at the US Border		x	x	x																							REC-1, SHELL
Pacific Ocean Shoreline, Tijuana HU, at the Tijuana River mouth		x	x	x																							REC-1
Tijuana River (6 miles affected)	x					x	x	x	x		x	x	x	x	x				x		x	x				x	REC-1, REC-2, MUN, WARM
Tijuana River Estuary (1320 acres affected)	x				x			x				x	x	x		x		x		x							REC-1, REC-2, COMM, EST, MAR

Source: Data derived from SWRCB 2010 and RWQCB 2010

[1] **REC-1**: Contact Water Recreation – Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible.
REC-2: Non-Contact Water Recreation – Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water.
SHELL: Shellfish Harvesting – Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish for human consumption.
COMM: Commercial and Sport Fishing – Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms.
MUN: Includes uses of water for community, military, or individual water supply.
EST: Includes uses of water that support estuarine ecosystems.
MAR: Marine Habitat – Includes uses of water that support marine ecosystems.
WARM: Warm Freshwater Habitat – Includes uses that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

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As outlined in the IMP, there is little potential for water quality impacts from channel maintenance that would result from the loss of pollutant assimilative capacity through vegetation removal. This is due to the elimination of dry weather flow resulting from the dry weather diversion structures, combined with the fact that much of the Smuggler's Gulch Channel is void of vegetation and the Pilot Channel harbors primarily non-native and invasive plant species. Given the presence of the dry weather diversion structure upstream of the Smuggler's Gulch Channel and the absence of flowing water within the Pilot Channel and Smuggler's Gulch Channel, there is no estimated loss of temporary pollutant sorption/retention capacity as a result of channel maintenance activities in these channels.

Additionally, the proposed maintenance activities provide pollutant reduction benefit due to sediment (and associated pollutant) removal. Soil samples from the channel were found to have detectable concentrations of arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, vanadium, and zinc (URS 2010b). Other chemicals detected in samples included total petroleum hydrocarbons, semi-volatile organic compounds, and polynuclear aromatic hydrocarbons (URS 2010b). Therefore, the removal of pollutants sediment from within the channels results in removal of pollutants that could potential contribute to water quality downstream, human health complications, and native vegetation impacts.

Based on the channel configuration and relative proportion of watershed area within the jurisdiction boundaries of the U.S., there are limited opportunities to reduce flooding through "daylighting" of concrete channels or implementation of LID. The Tijuana River upstream of the Pilot Channel and Smuggler's Gulch Channel area and within U.S. jurisdiction has very little concrete-lined area. Removal or "daylighting" of lined areas in and around the international border area is infeasible due to flood control and border security considerations. LID is a site design strategy with a goal of maintaining or replicating the pre-development hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic landscape. Hydrologic functions of storage, infiltration, and ground water recharge, as well as the volume and frequency of discharges are maintained through the use of integrated and distributed micro-scale storm water retention and detention areas, reduction of impervious surfaces, and the lengthening of flow paths and runoff time (Coffman 2000). In the Tijuana River Valley, the relative size of potential micro-scale storm water features within the small portion of watershed area available in the U.S. is assumed to have a functionally negligible impact on flood control in the Pilot Channel and Smuggler's Gulch Channel area.

During maintenance, sediment control measures such as silt fences, temporary sediment basins, berms, fiber rolls, and gravel bags were implemented to prevent sediment from entering the water column. Removing sediment from within the channels and preventing the introduction of soil and sediment to the water column during maintenance results in removal of pollutants that could potentially negatively affect water quality downstream and could contribute to human

health complications and native vegetation impacts. Sediment removal prevents the metals and inorganic non-metals present in the sediment from being mobilized during storm events, thus benefiting the overall water quality in the lower Tijuana River and estuary.

A suite of water quality BMPs are required as part of the Coastal Development Permit authorizing channel maintenance activities in the Pilot Channel and Smuggler's Gulch Channel (Table 5).

Table 5
City of San Diego BMPs to Reduce Sediment and Pollution Load

Water Quality Activity Type	Description	Implementation Frequency	Duration
Pollution Prevention	Commercial and residential property sediment reduction outreach distribution.	250 parcels	Approximately one month prior to maintenance initiation
Source Control	Street sweeping improvements- targeted vacuum-assisted/regenerative air machine usage	5.0 curb miles	One year subsequent to sediment removal maintenance events
Treatment	Enhanced catch basin inspection and as-needed cleaning implementation	10 inlet locations	One year subsequent to sediment removal maintenance
Source Control	Municipal and bi-national agency collaboration through Tijuana River Valley Recovery Team to address sediment and trash	Ongoing	Five years

Implementation of these BMPs may potentially reduce the need for maintenance through the integrated suite of required pollution prevention, source control, and treatment activities.

4 DISCUSSION

The City's MMP is designed to allow flood control channel operation and maintenance activities for the protection of life and property to be conducted in an efficient, economic, and environmentally and aesthetically acceptable manner. This technical report evaluates the purpose, need and alternatives to channel maintenance activities in the Tijuana River Pilot Channel and Smuggler's Gulch Channel. The technical report is part of the Channel Maintenance Special Study required under a legal agreement related to the MMP.

The City performs maintenance activities in the Pilot Channel and Smuggler's Gulch Channel to reduce flood risk to life and property. Current maintenance practices for the Tijuana River Pilot Channel and Smuggler's Gulch Channel include periodic clearing of vegetation and sediment removal using hand trimming and mechanized equipment. Channel conveyance capacity is marginally improved after maintenance, but is not sufficient to support a 5-year storm event. Channel and associated berm configuration, adjacent biological resources, and private property generally limit maintenance practice modifications and alternatives to current activities. Maintenance has been occurring since 1993 within the two channels, and the City and resource agencies have reviewed the project impacts and determined a set of compensatory mitigation measures, including implementing habitat and water quality mitigation measures, that are commensurate with the impacts of the project.

Further, as the Pilot Channel and Smuggler's Gulch Channel maintenance area is located in only a small portion of the overall watershed, the existing conditions in the contributing watershed upstream from the maintenance area and altered hydrology in the lower main river floodplain generally result in rapid sediment accumulation and maintenance need. The root cause of sediment and debris accumulation within the channels is not appropriately addressed by the maintenance methodologies, and will continue to result in flooding risk to life and property unless additional measures are taken.

The City is participating with other municipal agency dischargers to develop a WQIP aimed at reducing pollutants in the municipal separate storm sewer system (MS4). Under the current NPDES regulatory framework, dischargers have identified indicator sediment as the highest-priority water-quality condition for the Tijuana River Watershed Management Area. The WQIP identifies a suite of water quality improvement strategies to effectively and efficiently eliminate non-storm water discharges to the MS4, reduce pollutants in storm water discharges from the MS4 to the maximum extent practicable, and achieve identified interim and final regulatory numeric goals. The Tijuana River WQIP identifies a strategy of implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, channels as allowed by resource agencies, detention basins, pump stations, etc.) for water quality improvement and for flood control risk management.

The City has taken a leadership role in the bi-national effort to address storm water issues in the Tijuana River watershed through partnership with the TRVRT. A key result of that Recovery Team's efforts has been to develop a collaborative vision summarizing the first phase of bi-national actions to clean up the Valley and restore its beneficial uses (TRVRT 2013). The bi-national planning effort acknowledges that partnerships between the U.S. and Mexico are needed to provide watershed-based solutions to the sediment and trash loading that necessitates maintenance need in the Pilot Channel and Smuggler's Gulch Channel area. Due to the geographic configuration of the watershed areas contributing to the Pilot Channel and Smuggler's Gulch Channel, sediment and trash loads that accumulate within City jurisdiction and exacerbate flooding issues are generally derived from land use practices, improper trash disposal, and other issues in Mexico. Accordingly, the City has moved forward with various partnership efforts within the framework of the TRVRT with appropriate agencies in Mexico in order to develop a more complete understanding of water, sediment and trash flow and develop appropriate source control measures to reduce sediment and trash inputs to the Pilot Channel and Smuggler's Gulch Channel. Through these partnership efforts and collaboration with federal, state and local agencies in the TRVRT, the City aims to pursue appropriate multi-agency projects aimed at sediment and trash capture at or near the international border prior to discharge to the Pilot Channel and Smuggler's Gulch Channel and reduce the long-term need for channel maintenance activities.

5 REFERENCES

City of San Diego. 2011. Master Storm Water System Maintenance Program (MMP).

Coffman, Larry. 2000. Low-Impact Development Design Strategies, an Integrated Design Approach. EPA 841-B-00-003. Prince George's County, Maryland. Department of Environmental Resources, Programs and Planning Division.

County of San Diego. 2006. Tijuana River Valley Regional Park Trails and Enhancement Project Recirculated Draft Environmental Impact Report. August 1, 2006. Accessed online November 2014: http://www.sandiegocounty.gov/content/dam/sdc/common_components/images/parks/doc/tocnew.pdf

Dudek. 2009. Draft Biological Resources Technical Report, Tijuana River Valley Emergency Maintenance Project. Prepared for City of San Diego Storm Water Department. September 2009.

Dudek. 2014a. First Annual Mitigation Monitoring Report for the Tijuana River Valley Channel Maintenance Mitigation Project. Prepared for City of San Diego Storm Water Division. December 2014.

Dudek. 2014b. Additional Information Regarding Maintenance Activities for Tijuana River and Sorrento Valley (Reach 7) Channels for City of San Diego Master Storm Water System Maintenance Program 2013–2014 Annual Report. Prepared for City of San Diego Storm Water Division. June 20, 2014.

RWQCB (San Diego Regional Water Quality Control Board). 2010. Appendix J. Final Technical Report Bacteria TMDLs for Beaches and Creeks. February 10, 2010. http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/tmdls/bacteria.shtml.

Settlement Agreement. *San Diegans for Open Government et al v. City of San Diego* San Diego Superior Court Case No. 37-2011-00101571.

SWRCB (State Water Resources Control Board). 2010. Impaired Water Bodies. 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report) – Statewide. San Diego, CA. http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

Tijuana River Responsible Parties. 2015. *Tijuana River Watershed Management Area Water Quality Improvement Plan* (WQIP)

TRVRT (Tijuana River Valley Recovery Team). 2013. Tijuana River Valley Recovery Strategy-Living with the Water. http://www.waterboards.ca.gov/rwqcb9/water_issues/tijuana_river_valley_strategy/docs/Recovery_Strategy_Living_with_the_Water.PDF.

Unitt, P. 2004. San Diego County Bird Atlas. Online (Google Earth) version. Proceedings of the San Diego Society of Natural History, no. 39. San Diego, California: San Diego Natural History Museum. http://www.sdnhm.org/science/birds-and-mammals/projects/san-diego-county-bird-atlas/.

URS (URS Corporation Americas). 2010a. Draft Report, Excavation and post-storm observations in TJ River Valley. Task Order #10, Doc ID#CSD-RT-10-URS 10-03.D1. April 9, 2010.

URS. 2010b. Draft Report No. 1, Pilot Channel Borings and Sediment Characterization Report. Task Order #9, DOC ID# CSD-TM-09-URS09-01.D1. March 16, 2010.

URS. 2013. Tijuana River Pilot Channel & Smuggler' Gulch Channel, Attachment 1 – Individual Maintenance Plan.

USFWS (U.S. Fish and Wildlife Service). 1993. Biological Opinion on Permit Application 93-996-EW, Tijuana River Pilot Channel, City of San Diego (1-6-93-F-35). Issued October 1, 1993.

USFWS. 2012. Draft Formal Section 7 Consultation on the Tijuana River Valley Channel Maintenance Project, San Diego County, California (Corps File No. SPL-2009-00719-RRS). Issued August 15, 2012.