Water Infrastructure Alternatives Analysis

Final Report

USMCA Mitigation of Contaminated Transboundary Flows Project

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

AAA	Augmented Alternatives Analysis
APTP	Advanced Primary Treatment Plant
BOD_5	amount of oxygen consumed by microorganisms within five days
BWIP	Border Water Infrastructure Program
CBP	Customs and Border Protection
CEQA	California Environmental Quality Act
CESPT	Comisión Estatal de Servicios Públicos de Tijuana
CILA	Comisión Internacional de Límites y Aguas
CONAGUA	Comisión Nacional del Agua
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FIB	fecal indicator bacteria
IBWC	International Boundary and Water Commission
ITP	South Bay International Wastewater Treatment Plant
kWh	kilowatt-hour
L/s	liters per second
mg/L	milligrams per liter
MGD	million gallons per day
NADB	North American Development Bank
NEPA	National Environmental Policy Act
NPDES	National Pollution Discharge Elimination System
O&M	operation and maintenance
PB1-A	Pump Station 1-A
PB1-B	Pump Station 1-B
PB-CILA	CILA Pump Station
PG	PG Environmental, LLC
RWQCB	Regional Water Quality Control Board
SAB	San Antonio de los Buenos
SABTP	San Antonio de los Buenos Wastewater Treatment Plant
SBOO	South Bay Ocean Outfall
SEMARNAT	Secretaría de Medio Ambiente y Recursos Naturales
USACE	United States Army Corps of Engineers
USMCA	United States–Mexico–Canada Agreement
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

This report is the culmination of a year of technical analysis investigating possible infrastructure solutions to chronic transboundary wastewater flows from Mexico to the U.S. in the Tijuana River watershed and adjacent coastal areas. This analysis, undertaken on behalf of future funding recipients, responds to Section 821 of the United States–Mexico–Canada Agreement (USMCA) implementing legislation that directs EPA to coordinate with eligible public entities to identify infrastructure solutions in the Tijuana River watershed. EPA convened public meetings and held discussions with the Eligible Public Entities Coordinating Group, composed of federal, state, and local organizations, to promote coordination and information sharing as the analysis unfolded.

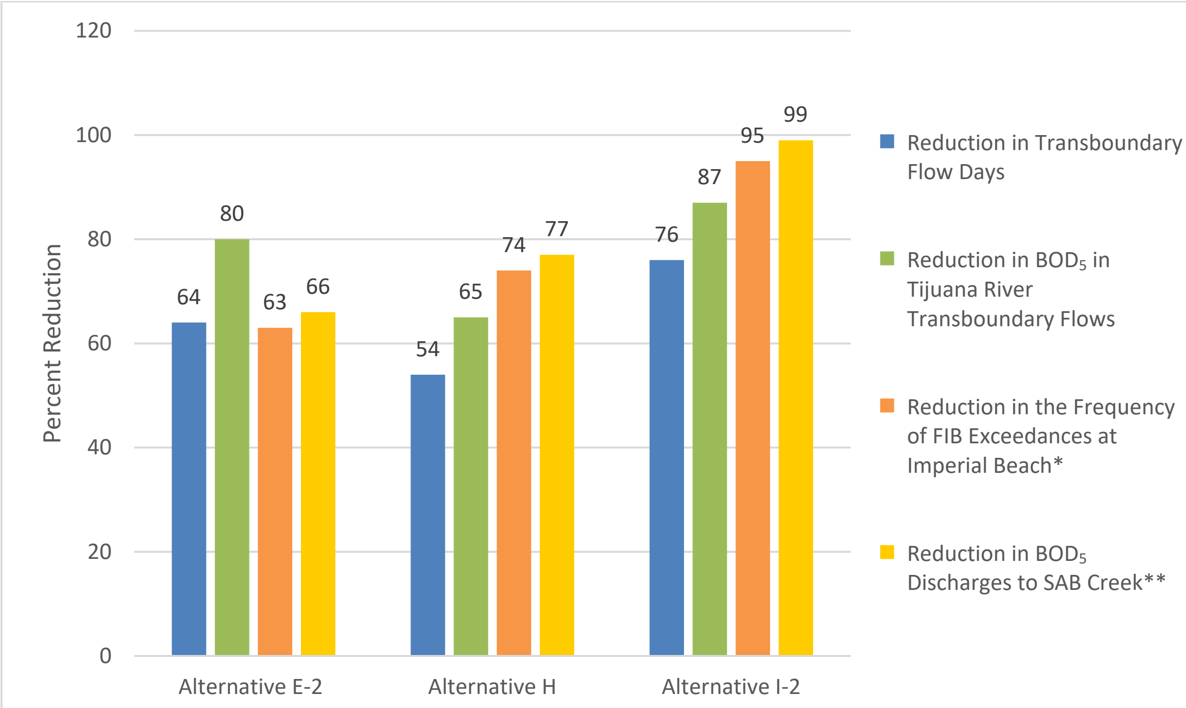
The technical analysis began with a feasibility assessment of 10 infrastructure projects, representing over 40 individual project components, located in both the U.S. and Mexico. These individual components were grouped into alternatives (logical groupings of projects) based on their capital costs and their ability to reduce untreated wastewater in the Tijuana River and/or the Pacific Ocean, with a primary focus on U.S.-side solutions. The alternatives were subsequently scored and ranked using EPA's Augmented Alternatives Analysis, a systematic, replicable, and transparent evaluation tool with four overarching goals: public health and community livability, stewardship of public resources, ecological protection, and system resiliency. This document further evaluates three of the higher-scoring alternatives for their potential to mitigate transboundary river and coastal wastewater flows, among other impacts. These three final alternatives (Alternatives E-2, H, and I-2) represent a wide range of infrastructure solutions that are technically feasible and broadly supported by the stakeholder community.

The highest-scoring alternative is Alternative I-2. While over budget, it represents the most comprehensive solution to both transboundary river and coastal wastewater flows. The other two alternatives, E-2 and H, are within budget and are expected to significantly improve water quality. All three alternatives focus on U.S.-side infrastructure that (1) diverts and treats contaminated flows after they are already in the river and/or (2) treats contaminated flows before they reach the river and coast. These three alternatives represent a broad range of infrastructure solutions that are expected to be evaluated as part of the National Environmental Policy Act (NEPA) analysis, leading to selection of an alternative for design and construction.

In addition to providing a balanced analysis of the three final alternatives, this report discusses technical uncertainties, data limitations, implementation challenges, and uncertainties in both the U.S. and Mexico that could alter the analysis should conditions change in the future.

Summary and Key Findings for Each Alternative

As noted above, three of the higher-scoring alternatives were further evaluated for their potential to mitigate transboundary river and coastal wastewater flows, among other impacts. This evaluation considers four data-driven criteria that indicate the potential of each alternative to reduce the number of transboundary flow days in the Tijuana River, reduce discharges of five-day biochemical oxygen demand (BOD_5, a surrogate for untreated wastewater) into the Pacific Ocean and into the Tijuana River, and reduce the frequency of fecal indicator bacteria concentrations that exceed EPA's beach action value (referred to hereafter as "FIB exceedances") at Imperial Beach during the tourist season (May 22–September 8). For this analysis, PG evaluated the water quality improvements at Imperial Beach, but similar improvements can be expected at other beaches along the Pacific Coast in the San Diego region. Figure ES-1, below, presents the anticipated performance of each alternative as indicated by the four data-driven criteria. The summaries and key findings for each alternative include a description, anticipated benefits, potential drawbacks, and cost estimates. Anticipated benefits are based on the data presented in the figure.



* "FIB Exceedances" refers to fecal indicator bacteria concentrations that exceed EPA's beach action value.

** Discharges into San Antonio de los Buenos Creek (SAB Creek) enter the Pacific Ocean 6 miles south of the border, affecting U.S. beaches when there are northward currents, which occur predominantly during the tourist season (Feddersen et al. 2020).

Figure ES-1. Comparison of Each Alternative's Water Quality Impacts

Alternative E-2

Alternative E-2 provides treatment of both river water and untreated wastewater generated in Tijuana. Alternative E-2 would treat contaminated wastewater in the U.S. after it is already in the river through a new 35 MGD U.S.-side river diversion and an Advanced Primary Treatment Plant (APTP). River flows that are currently diverted in Mexico would be conveyed to the APTP in the U.S. Alternative E-2 would also treat all current untreated wastewater from central Tijuana through a 15 MGD expansion of the South Bay International Wastewater Treatment Plant (ITP). Alternative E-2 is within the combined budget of the USMCA appropriations and supplemental funding.

Alternative E-2 is expected to reduce days of transboundary flow in the Tijuana River by 64%, BOD_5 in river water by 80%, frequency of FIB exceedances at Imperial Beach during the tourist season (May 22–September 8) by 63%, and BOD_5 in discharges to the Pacific Ocean via SAB Creek by 66%, as shown in Figure ES-1. Diverting flows from the CILA Pump Station (PB-CILA) that are currently sent to the Pacific Ocean via SAB Creek and sending them to the APTP, combined with the expanded ITP, are expected to reduce the discharge of untreated wastewater to the Pacific Ocean, thus reducing impacts at Imperial Beach. The U.S.-side river diversion in Alternative E-2 is expected to provide backup for the existing Mexico-side river diversion, reduce transboundary flow days, and operate during higher flow rates in the river when the Mexico-side diversion would be shut down due to operational threshold limits. However, the U.S.-side river diversion could interfere with Customs and Border Protection (CBP) operations and be lengthy to implement due to the necessary regulatory and data collection requirements. Also, the 15 MGD expansion of the ITP would be unlikely to have reserve capacity to account for future population growth. Alternative E-2 relies on Mexico's existing and future infrastructure implementation and maintenance to provide the greatest benefits for the Tijuana River. Untreated wastewater from the canyon pump stations and coastal communities in Mexico would continue to be discharged into the Pacific Ocean.

This analysis includes the following cost estimates[1] for Alternative E-2: $367 million in capital costs, $15 million in annual operation and maintenance costs, and $951 million in 40-year life cycle costs.

Alternative H

Alternative H focuses on expanding the ITP by 25 MGD to treat wastewater collected in Tijuana and the Mexico-side canyon pump stations. The expanded ITP also includes reserve capacity to account for future population growth in Tijuana. This alternative would also involve decommissioning the canyon pump stations in Mexico and conveying untreated wastewater generated in the canyons via gravity to the ITP for treatment. Alternative H is within the combined budget of the USMCA appropriations and supplemental funding.

Alternative H is expected to reduce days of transboundary flows in the Tijuana River by 54%, BOD_5 in river water by 65%, frequency of FIB exceedances at Imperial Beach during the tourist season by 74%, and BOD_5 discharges to the Pacific Ocean via SAB Creek by 77%, as shown in Figure ES-1. The expansion of the ITP in Alternative H is expected to have sufficient capacity to account for future population growth until 2030, thus reducing reliance on Mexico to treat untreated wastewater that is currently being discharged out to the coast and contributing to impaired water quality at Imperial Beach. Also, by decommissioning the canyon pump stations and conveying the wastewater from those canyons by gravity to the ITP, untreated wastewater discharged to the Pacific Ocean via SAB Creek would be further reduced. Existing dry weather transboundary flows in the canyons would also likely be reduced, protecting CBP agents working in the canyons. However, Alternative H relies on Mexico's existing and future infrastructure implementation and maintenance to achieve the expected water quality benefits in the Tijuana River and the Pacific Ocean. Diverted river water and wastewater from coastal communities in Mexico would continue to be discharged into the Pacific Ocean untreated.

This analysis includes the following cost estimates for Alternative H: $368 million in capital costs, $11 million in annual operation and maintenance costs, and $817 million in 40-year life cycle costs.

Alternative I-2

Alternative I-2 combines and expands on the previous two alternatives. Alternative I-2 would provide treatment of wastewater already in the river with a new 60 MGD U.S.-side river diversion and APTP, which would also receive river flows currently being diverted in Mexico. A 35 MGD expansion of the ITP would account for future population growth in Tijuana. This alternative would involve decommissioning the canyon pump stations in Mexico and conveying untreated wastewater generated in the canyons via gravity to the ITP for treatment. It would also enable beneficial reuse in Mexico of treated effluent from the ITP. Lastly, Alternative I-2 would include a new 5 MGD

[1] Calculation methodologies, assumptions, and uncertainties regarding cost estimates are detailed in the body of the report.

treatment plant at the existing site of the San Antonio de los Buenos Wastewater Treatment Plant to treat wastewater from coastal communities in Mexico, thereby further reducing FIB exceedances at Imperial Beach during the tourist season. This alternative would treat wastewater already in the river, while also reducing wastewater that reaches the river and coast. Alternative I-2 is above the combined budget of USMCA appropriation and supplemental funding.

The report describes how either Alternative E-2 or Alternative H could serve as an initial building block to fully implement Alternative I-2 if available funding levels change. It also highlights that the infrastructure components in each individual alternative could be built sequentially within the existing budget. The potential sequencing of individual projects would be considered during the NEPA analysis and during continued discussions and information sharing with the Eligible Public Entities Coordinating Group and the general public.

Alternative I-2 is expected to reduce days of transboundary flows in the Tijuana River by 76%, BOD_5 in river water by 87%, frequency of FIB exceedances at Imperial Beach during the tourist season by 95%, and BOD_5 discharges to the Pacific Ocean via SAB Creek by 99%, as shown in Figure ES-1. Diverting flows from PB-CILA that are currently discharged to the Pacific Ocean via SAB Creek and sending them to the APTP is expected to reduce untreated wastewater discharges to the coast that contribute to beach impacts in the U.S. The U.S.-side river diversion in Alternative I-2 is expected to provide backup for the existing Mexico-side river diversion, reduce transboundary flow days, and operate during higher flow rates in the river when the Mexico-side diversion would be shut down due to operational threshold limits. However, the U.S.-side river diversion could interfere with CBP operations and be lengthy to implement due to the necessary regulatory and data collection requirements. The large expansion of the ITP is expected to have sufficient capacity to account for future population growth until 2050, thus reducing reliance on Mexico to treat untreated wastewater that is being discharged to the coast and contributing to impaired water quality at Imperial Beach.

This analysis includes the following cost estimates for Alternative I-2: $627 million in capital costs, $26 million in annual operation and maintenance costs, and $1.65 billion in 40-year life cycle costs.

Common to All Three Alternatives

All three alternatives are expected to reduce transboundary flow days in the Tijuana River, BOD_5 load in the river, BOD_5 load discharged to the Pacific Ocean via SAB Creek, and the frequency of FIB exceedances at Imperial Beach during the tourist season. All three alternatives also include targeted sewer collector repairs in Tijuana, modifications to the U.S-side canyon flow diversion structures, a trash boom in the Tijuana River, and rerouting treated effluent to the Rodriguez Dam impoundment for beneficial reuse. The targeted collector repairs in Tijuana are expected to reduce untreated wastewater discharges into the Tijuana River. This is expected to improve conditions for U.S. Navy operations and residents in the Tijuana River watershed and neighboring coastal areas. The U.S.-side canyon flow diversion structure modifications are expected to benefit CBP operations by reducing pooling at the canyon flow diversion structures. A trash boom in the Tijuana River main channel would reduce the volume of trash that is deposited in the Tijuana River Valley and Tijuana River Estuary. Rerouting the treated effluent to the Rodriguez Dam impoundment would allow U.S.-side and Mexico-side river diversions to operate more often and provide Mexico with a potential water reuse source.

An important benefit of all three alternatives is a significant reduction in the need for pumping untreated wastewater in Tijuana. Each alternative would increase the conveyance of untreated wastewater by gravity and decrease the conveyance of untreated wastewater by mechanical pumping, thereby reducing energy use, costs, and reliance on pumping stations in Mexico. Another common benefit is the installation of anaerobic digesters as part of any ITP expansion project, which would eliminate half of the sludge solids produced at the ITP. There is also the potential in the future to convert the methane produced from the anaerobic digesters into electrical power to offset the increased power requirements.

An expected drawback for all three alternatives is the potential adverse effects of the operational changes and requirements of wastewater treatment facilities on local communities, such as increased traffic for hauling trash and sediment. Additionally, an expanded ITP that includes anaerobic digestors would be more complex to operate than the existing ITP. Another potential drawback is adverse impacts to downstream habitat and riparian vegetation due to the reduced Tijuana River flows. Also, inadequate maintenance of the Tijuana River trash booms could hinder operations for CBP. Lastly, the substantial increase in operation and maintenance for any of the alternatives is a drawback and challenge that would require securing long-term funding on both sides of the border.

Technical uncertainties and unknowns include the effectiveness and future operations of the recently upgraded pump station and river diversion in Mexico as well as the amount of trash and sediment in the Tijuana River that would need to be removed in a U.S.-side river diversion and treatment system. In addition, the feasibility of some projects in Alternatives E-2, H, and I-2 is dependent on projects currently under consideration in Mexico, as well as reliable operation and maintenance of them. The structural integrity of Rodriguez Dam is another unknown that would require inspection before treated effluent is rerouted for potential reuse in Mexico.

Essential Next Steps

As noted above, Section 821 of the USMCA directed EPA to coordinate with eligible public entities to identify infrastructure solutions to the chronic transboundary wastewater flows in the Tijuana River watershed. The alternatives analysis presented in this document is a significant milestone. It describes the process by which EPA, with support from PG Environmental, identified a broad range of infrastructure alternatives with the potential to comprehensively address water quality issues in transboundary flows in both the Tijuana River and adjacent coastal areas. Essential next steps include fully executing NEPA requirements for these alternatives, including development of an Environmental Impact Statement, which would further evaluate regulatory permitting requirements for these infrastructure solutions. Binational negotiations with Mexico are needed to identify priority projects and reach agreement on cost-sharing for construction and operations. Discussions with Mexico would also advance the framework for codifying future binational agreements. Lastly, regardless of which alternative is chosen for implementation, funding sources for operation and maintenance must be secured before any of the projected environmental benefits can be attained.

1. INTRODUCTION

Under EPA Contract No. 68HERH19D0033, Task Order No. 53, PG Environmental conducted feasibility analyses of 10 projects to mitigate the impacts of transboundary flows from Mexico into the U.S., followed by a water infrastructure alternatives analysis to identify three final alternatives (i.e., groups of projects) for consideration under the United States–Mexico–Canada Agreement (USMCA).

1.1 Overview

Table 1-1, below, lists the 10 projects that PG evaluated. Many of these projects have individual components and sub-projects. Refer to Appendix D for the full list of USMCA projects and sub-projects.

Table 1-1. Description of USMCA Projects

Project	Description
1	Constructing a U.S.-side Tijuana River diversion and Advanced Primary Treatment Plant (APTP) to divert and treat transboundary river flows. PG evaluated the following sizes: 35 MGD, 60 MGD, 100 MGD, 163 MGD. PG also evaluated an 82 MGD off-channel storage basin and determined it to be impractical.
2	Conveying flows from the CILA Pump Station (PB-CILA) to a new U.S.-side APTP for treatment. PG evaluated 35 MGD and 60 MGD conveyance system sizes.
3	Expanding the 25 MGD South Bay International Wastewater Treatment Plant (ITP) to treat flows from the International Collector and the canyon pump stations. PG evaluated the following expanded sizes: 40 MGD, 50 MGD, and 60 MGD. PG also evaluated infrastructure for future potential reuse of the ITP effluent and relocating the International Collector.
4	Constructing a new conveyance system to convey flows from the Mexico-side canyon pump stations by gravity to the ITP for treatment. PG also evaluated upgrading the U.S.-side canyon flow diversion structures to reduce pooling.
5	Improving the existing infrastructure in Tijuana to better collect, contain, and convey wastewater. PG examined both rehabilitating targeted collectors and a systemwide overhaul.
6	Constructing trash and sediment control infrastructure in the Tijuana River main channel and the canyons. In the Tijuana River main channel, PG evaluated restoring the main channel to its original design and installing trash booms. In Smuggler's Gulch, PG examined a new sediment basin in either the U.S or Mexico, and a Mexico-side trash boom. Finally, PG evaluated a pilot channel or raising Monument Road in Yogurt Canyon, as well as a culvert under Monument Road at Smuggler's Gulch, to reduce flooding on the road during wet weather.
7	Preventing effluent from the Arturo Herrera and La Morita Wastewater Treatment Plants (WWTPs) from entering the Tijuana River by conveying it either to the South Bay Ocean Outfall (SBOO) for discharge or to the Rodriguez Dam impoundment for potential future reuse.
8	Replacing the San Antonio de los Buenos Wastewater Treatment Plant (SABTP) to effectively treat wastewater from Pump Station 1-B (PB1-B), the canyon pump stations, and the Playas Pump Station. PG evaluated 5 MGD and 10 MGD treatment plant sizes.
9	Treating wastewater flows from the International Collector and the canyon pump stations at the South Bay Water Reclamation Plant. PG evaluated the following sizes: 15 MGD without solids treatment and 15 MGD and 30 MGD with solids treatment. This project was determined to be infeasible because the plant is not available for purchase from the City of San Diego.
10	Reducing trash and sediment in Tijuana River and Goat Canyon via source control projects in Mexico.

Each project's feasibility analysis included an estimate of capital costs; an estimate of design, project, and construction management costs; an estimate of operation and maintenance (O&M) costs; a rough project implementation schedule; a summary of regulatory, engineering, and potential implementation issues; and a preliminary summary of social and environmental impacts. Each feasibility analysis also identified additional data and information that would enhance the analysis. Along with the 10 feasibility analyses, PG developed the *Baseline Conditions Summary: Technical Document*, which contains background information about current transboundary flow conditions in the watershed and summarizes the costs, benefits, and challenges associated with each of the 10 projects.

Consistent with the task order scope, PG worked with EPA to develop and analyze alternatives to mitigate the contaminated transboundary wastewater and stormwater flows. Each alternative is an assemblage of some of the 10 proposed projects and their individual components and sub-projects, scaled if necessary, based on available USMCA funding.

The purpose of the alternatives analysis was to identify and evaluate three final alternatives as candidates for implementation using USMCA funds allocated to mitigate contaminated transboundary flows that cause impacts in the Tijuana River area and neighboring coastal areas in the U.S. As detailed in Section 2.2, PG also considered funds beyond those allocated as part of the USMCA appropriation, resulting in an increased available budget for the alternative to be implemented. PG and EPA collaborated to identify a set of 13 alternatives that could be constructed using the available USMCA funding, plus other supplemental funding sources. PG and EPA then compared the impacts, costs, and challenges associated with implementing each of the alternatives using the Augmented Alternatives Analysis (AAA) as discussed in Section 2.3.

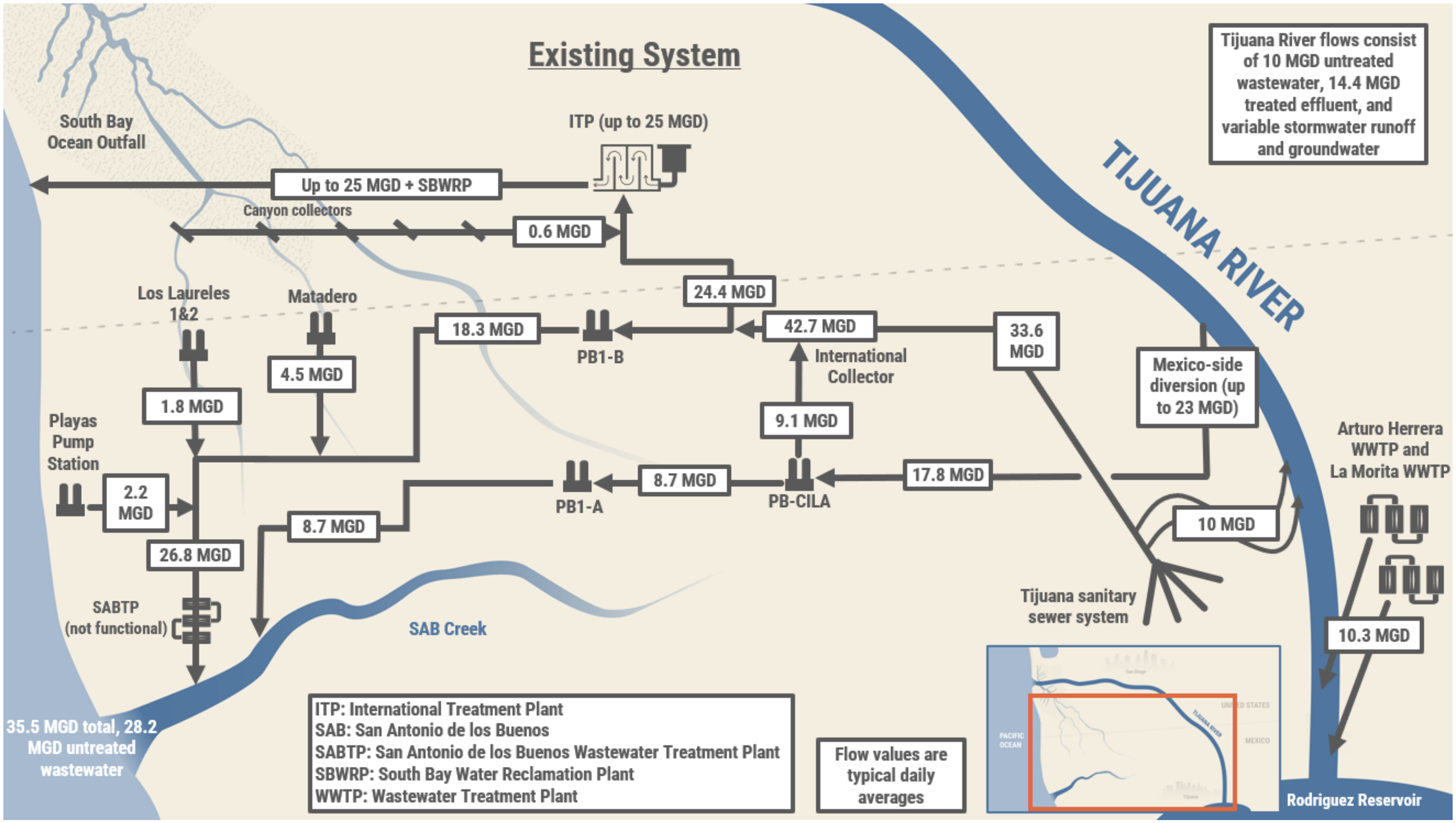
1.2 Current Conditions

Relevant current conditions in the Tijuana River watershed are summarized below. Refer to the *Baseline Conditions Summary: Technical Document* for more information on these topics.

PG focused on the current conditions and existing water infrastructure in the following primary areas of interest:

- Tijuana River main channel
- Tijuana sanitary sewer system
- Beaches in San Diego County
- Canyons that drain into the Tijuana River Valley

PG defines transboundary flows in the Tijuana River main channel as flows that cross into the U.S. from Mexico and are not captured by a U.S.-side diversion. PG evaluated transboundary flows in the main channel using data from the International Boundary and Water Commission (IBWC) flow gauge downstream of the border. Transboundary flows also occur in the canyons and offshore at the maritime boundary in the Pacific Ocean; PG relied on data provided by IBWC to characterize transboundary flows in the canyons, but no data exist for the maritime transboundary flows. PG used BOD_5 (the amount of oxygen consumed by microorganisms in five days) as the surrogate parameter to evaluate the presence of untreated wastewater in the primary areas of interest. PG used BOD_5 because it is readily measurable and BOD_5 data are already available for untreated wastewater in Tijuana. Additionally, the non-wastewater flows in the river, composed primarily of stormwater and treated effluent from the Alamar River and the Arturo Herrera and La Morita WWTPs, generally have very low BOD_5 concentrations. PG estimates that untreated wastewater in Tijuana has a BOD_5 concentration of 400 mg/L based on the IBWC Water Quality Study and ITP influent data from 2016 through 2019 (IBWC 2020). PG also evaluated the sediment and trash loads in Tijuana River transboundary flows due to environmental concerns in the Tijuana River Valley and the Tijuana River Estuary. Refer to Appendix B for more details about current water quality conditions. The existing system is shown in Figure 1-1, on the next page.



Not to scale; locations are approximate.

Figure 1-1. Flow Diagram of the Existing System of Pumps and Pipelines in the Lower Tijuana River Watershed

1.2.1 Tijuana River Main Channel

The Tijuana River watershed is a 1,750-square-mile watershed that includes portions of San Diego County in California and northern Baja California in Mexico. About three-quarters of the watershed is in Mexico, including the cities of Tijuana and Tecate. The remaining one-quarter is in the U.S., including portions of the cities of San Diego and Imperial Beach. Flows in the Tijuana River are naturally intermittent and distinctly different under dry and wet weather conditions.

PG evaluated the frequency and magnitude of transboundary flows using data from IBWC's main channel flow gauge between January 1, 2016, and December 31, 2019. During that period, PG determined that an average of 153 days with transboundary flows occurred annually and the average annual volume of transboundary flows was 17,500 million gallons. Figure 1-1 displays the distribution of average daily flow rates for transboundary flows over the four-year period. Refer to the *Baseline Conditions Summary: Technical Document* for further discussion about the frequency and magnitude of transboundary flows in the Tijuana River main channel.

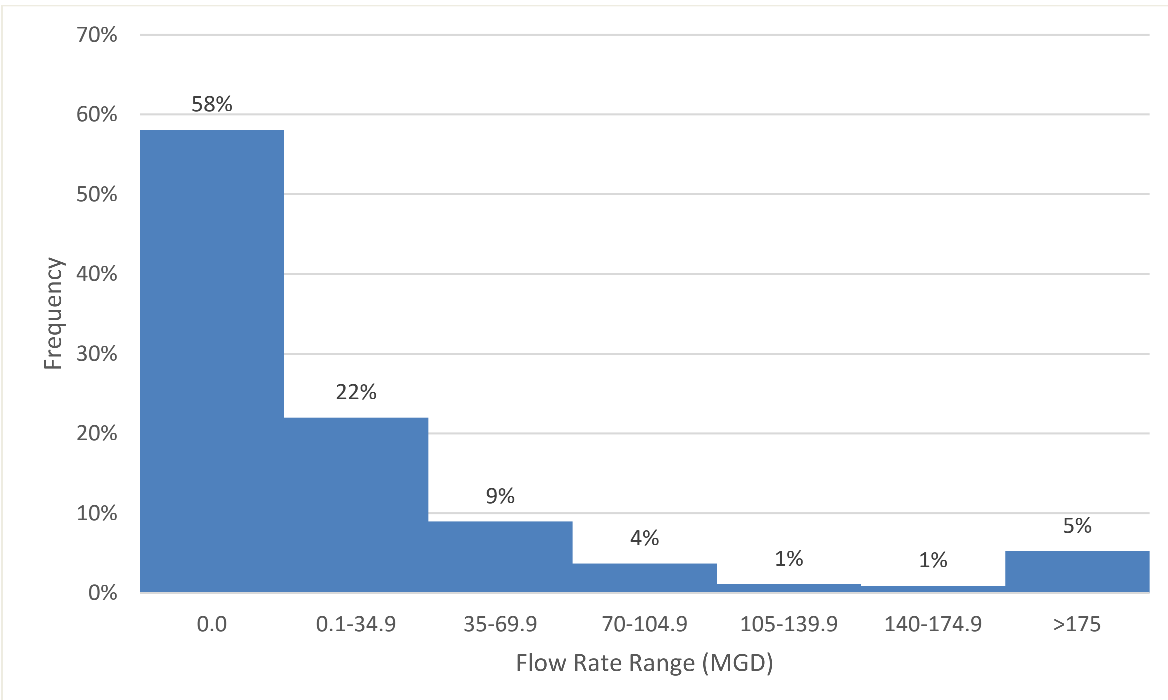


Figure 1-2. Tijuana River Transboundary Flows (2016–2019)

1.2.1.1 Dry Weather

In dry weather, flow in the Tijuana River upstream of the U.S.-Mexico border consists of untreated wastewater that escapes the City of Tijuana's sanitary collection system, urban runoff, treated effluent from the Arturo Herrera and La Morita WWTPs, and flows from the tributary Alamar River, which mostly consist of treated effluent from Tecate. Under normal conditions, all dry-weather flows in the river are diverted to PB-CILA about 1,000 feet upstream of the U.S.-Mexico border. When operating properly, the PB-CILA diversion prevents river flows up to 1,000 L/s (about 23 MGD) from entering the U.S. Historically, dry weather transboundary flows have occurred when PB-CILA was shut down due to malfunctioning equipment or other operational issues at PB-CILA, PB1-A, PB1-B, or pipelines downstream.

1.2.1.2 Wet Weather

In wet weather, the flow rate in the river can reach several thousand MGD. PB-CILA shuts off when the flow rate in the river exceeds 23 MGD to protect the pumping equipment (Arcadis 2019). The flows in the river then cross the border and flow into the Tijuana River Valley. The river diversion and PB-CILA were recently upgraded with a new river intake, new bar screens, a new vortex desander, and new pumps to improve reliability and allow for up to 35 MGD of flow to be diverted from the Tijuana River and pumped to PB1-A or the International Collector. Data do not exist on the effects these upgrades will have on the reduction of transboundary flows, particularly during the wet season—though PG estimates they will result in fewer transboundary flows. Refer to the *Baseline Conditions Summary: Technical Document* for additional details on PB-CILA's operational procedures and recent upgrades.

1.2.1.3 Water Quality in Transboundary Flows

When transboundary flows occur, the river conveys untreated wastewater (mixed with stormwater and groundwater) into the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean. Information from the Comisión Estatal de Servicios Públicos de Tijuana (CESPT) on flow sources into the Tijuana River suggests that an average of 10 MGD of untreated wastewater escapes or evades Tijuana's collection system and flows into the main channel (monthly CESPT flow data provided by the North American Development Bank [NADB]; see Appendix E). The CESPT information further suggests that the flow rate of untreated wastewater that enters the river is not affected by wet weather events. PG used the methods discussed in Appendix B to estimate that BOD_5 concentrations in the river range from 165 mg/L during dry weather to <10 mg/L during peak wet weather conditions. PG estimates that the river conveys an annual transboundary BOD_5 load of 1,670 tons, equivalent to about 1 billion gallons of untreated wastewater from Tijuana. A long-term BOD_5 monitoring program should be established to better understand the volume of wastewater that is discharged into the river.

During wet weather, the Tijuana River conveys large sediment loads into the Tijuana River Valley, Tijuana River Estuary, and Pacific Ocean. Sediment deposition within the estuary reduces the area and volume of tidal influence by raising elevations and promoting establishment of more vegetation, which in turn traps additional sediment and trash. The Tijuana River pilot channel downstream of the Hollister Street bridge and the channel downstream of Smuggler's Gulch require dredging to ensure proper drainage, and the estuary mouth requires occasional dredging to allow continued tidal flushing. Based on data available to PG, the sediment concentration in the river is highly variable and increases with the flow rate in the river. PG estimates that the average annual sediment load in main channel transboundary flows is 187,000 tons. This estimate is based on dry-weather monitoring data collected by CESPT, wet-weather monitoring data collected by the Southern California Coastal Water Research Project and San Diego State University, and the U.S. Army Corps of Engineers Phase 2 study (USACE 2020).

Wet-weather flows in the Tijuana River also convey large loadings of trash into the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean. Trash in the Tijuana River Valley tends to accumulate along channels and in areas with vegetation or other physical barricades, where it can diminish aesthetics and contribute to human health concerns (e.g., exposure to bacteria, viruses, and toxic substances; risk of puncture and laceration injuries; and exposure to disease vectors from ponded water). PG estimated the average annual trash load consistent with the methodology used in the *SB-507 Tijuana River Valley Needs and Opportunities Assessment* developed by HDR, which assumes that the annual trash load is 10% of the annual sediment load by volume (HDR 2020). This approach yielded an average annual trash load in main channel transboundary flows of 15,000 cubic yards. Additional monitoring should be conducted to better characterize the loadings and types of trash that are carried by the Tijuana River.

1.2.2 Tijuana Sanitary Sewer System

A system of pumps and pipelines in Tijuana collects untreated wastewater and diverted river water and conveys it to an outfall into SAB Creek, near the coast southwest of the city. SAB Creek then flows into the Pacific Ocean. PG estimated the average flow rate for each stream using pump station flow data, ITP influent data, and other data sources.

Under proper operating conditions, PB-CILA pumps diverted Tijuana River water to PB1-A through a pressurized pipeline. PB1-A (operated by CESPT) then pumps the river water to the outfall into SAB Creek as shown in Figure 1-1. However, PB1-A is often not operational due to mechanical or electrical challenges. When PB1-A is not operating, PB-CILA either pumps diverted river water into the International Collector or shuts off and allows transboundary flows to occur in the Tijuana River main channel.

The International Collector is a 72-inch pipeline that runs along the U.S.-Mexico border. It collects untreated wastewater from the Tijuana metropolitan area and also receives some diverted river water from PB-CILA, as discussed above. The International Collector conveys mixed untreated wastewater and river water by gravity to either the ITP or to PB1-B, which pumps the flows to the SABTP and SAB Creek. The operators of the ITP (IBWC) and PB1-B (CESPT) communicate daily to determine how much flow will be conveyed to each facility. Generally, the ITP receives enough flow to reach its average daily flow capacity (25 MGD) and the remainder is sent to PB1-B.

The analysis throughout this document assumes that PB1-A and PB1-B operate properly as designed, with PB1-A pumping diverted river water to SAB Creek and PB1-B pumping flows that the ITP cannot receive from the International Collector to SAB Creek.

The ITP is a wastewater treatment plant on the U.S. side of the border that is designed to treat an average daily flow rate of 25 MGD of wastewater to secondary treatment standards. The ITP is owned by IBWC and operated by a contract operator, Veolia. It primarily treats water from the International Collector, but also treats wastewater that flows across the border in a series of canyons and low spots where it is collected by the following U.S.-side canyon flow diversion structures:

- Smuggler's Gulch
- Goat Canyon
- Cañón del Sol
- Silva Drain
- Stewart's Drain

The actual average dry-weather flow rate from the canyons is less than the capacities of the canyon flow diversion system. PG estimates that the average combined dry-weather flow rate from the canyon flow diversion structures is approximately 0.6 MGD, based on data provided by IBWC. The treated effluent from the ITP is discharged into the Pacific Ocean via the SBOO. Refer to the *Baseline Conditions Summary: Technical Document* for additional details on the U.S.-side canyon flow diversion structures.

Flows in the International Collector that are not conveyed to the ITP are pumped by PB1-B to SAB Creek. PB1-B sometimes operates at reduced capacity due to insufficient power availability, in which case the ITP receives more influent flow. In 2020, the monthly average influent flow rate increased to as high as 29 MGD due to the operational constraint at PB1-B. The ITP does not have capacity to process and dispose of the increased solids when the influent flow exceeds the plant's design average daily flow capacity of 25 MGD. To avoid bypassing the excess wastewater and discharging it without treatment, the operators are forced to retain more solids in the secondary treatment process, which disrupts the activated sludge process and can degrade effluent quality.

Flows from PB1-A and PB1-B are conveyed to the SABTP and SAB Creek by two interconnected pipelines, referred to as the "parallel conveyance pipelines." When the SABTP is not operating, the flows from PB1-A and PB1-B are mixed at a series of junction boxes along the parallel conveyance pipelines. The parallel conveyance pipeline also carries untreated wastewater from other pump stations in Tijuana:

- Matadero Pump Station (on the Mexico side of Smuggler's Gulch)
- Los Laureles 1 Pump Station (northern station on the Mexico side of Goat Canyon)
- Los Laureles 2 Pump Station (southern station on the Mexico side of Goat Canyon)
- Playas Pump Station (in the Playas de Tijuana coastal community)

South of the Playas de Tijuana Community, the SABTP was designed to provide treatment for 25 MGD of untreated wastewater in the parallel conveyance pipelines using a series of lagoons (Arcadis 2019). However, the plant has fallen into disrepair (most aeration equipment is non-functional) and is operating at a reduced capacity and discharging poorly treated wastewater into SAB Creek. PG estimates that an average of 35.5 MGD of water is discharged from the parallel conveyance pipelines to SAB Creek. On average, the discharges to the Pacific Ocean via SAB Creek consist of 28.2 MGD of untreated wastewater, plus a combined total of 8.7 MGD of the Arturo Herrera WWTP effluent, the La Morita WWTP effluent, and river water from the Alamar River, which are diverted at PB-CILA. PG's evaluation of discharges at SAB Creek indicate that high loadings of organic matter, suspended solids, nutrients, and pathogenic microorganisms enter the Pacific Ocean via SAB Creek. When ocean currents carry this contaminated water northward, significant water quality problems occur in the San Diego area, as discussed in Section 1.2.3 below.

According to the 2020 Baja California state government and CESPT report *Proyecto de Construcción y Rehabilitación de la PTAR San Antonio de los Buenos*, SAB Creek also conveys approximately 1.8 MGD of untreated wastewater from local communities to the Pacific Ocean (MAV and CEISA 2020). The Tecolote–La Gloria WWTP was designed to treat the flows from the local communities and to accommodate future population growth but has been partially constructed and remains offline at the time of this report. For the purpose of this analysis, PG assumed the Tecolote–La Gloria flows of untreated wastewater being discharged to the Pacific Ocean via SAB Creek to be zero.

1.2.3 Beaches in San Diego County

Beaches in the County of San Diego are regularly required to close due to untreated wastewater discharges to the Pacific Ocean via SAB Creek and the Tijuana River. The County of San Diego monitors the ocean water for fecal indicator bacteria (FIB), and beaches are closed if the concentration of FIB exceeds EPA's limit for the estimated illness rate of 32 primary contact recreators per 1,000 primary contact recreators, known as the beach action value (USEPA 2012).

The 2020 Scripps Institution of Oceanography modeling efforts examined the frequency and sources of FIB concentrations above EPA's beach action value (referred to hereafter as "FIB exceedances") at beaches along the U.S. and Mexican coasts. The model determined that these concentrations are mostly caused by the untreated wastewater discharges to the Pacific Ocean via SAB Creek that are transported to U.S. beaches by northward ocean currents, referred to as "south swells." For this analysis, PG focused on frequency of FIB exceedances at Imperial Beach. The Scripps model showed that similar improvements can be expected at other beaches along the Pacific Coast as well (Feddersen et al. 2020). However, the frequency and duration of actual beach closures implemented by the County of San Diego may differ from the frequency of FIB exceedances projected using the Scripps model.

The Scripps model estimated that FIB exceedances at Imperial Beach occur an average of 14% of the year (1,210 hours/year), and 70% of the exceedances are caused by discharges from SAB Creek (Feddersen et al. 2020). During the dry tourist season (May 22–September 8), the Scripps study found that FIB exceedances at Imperial Beach occur 24% of the time (636 hours/year) and are almost exclusively caused by untreated wastewater discharges at SAB Creek during this period. The modeling also evaluated the effects to U.S. beaches from reducing the untreated wastewater discharges from SAB Creek to the Pacific Ocean and diverting river flows. The model estimated that these changes to the Pacific Ocean discharges would reduce the frequency of FIB exceedances at Imperial Beach. The modeling indicated that reductions to the discharges into the Pacific Ocean would be particularly effective at reducing the frequency of exceeding these beach action values during the tourist season because that is when the majority of south-to-north flowing currents occur. Refer to Appendix B for more information about how EPA used the Scripps results to project the impacts of each alternative.

1.2.4 Canyons

West of downtown Tijuana, there are three canyons—Smuggler's Gulch, Goat Canyon, and Yogurt Canyon—that traverse the U.S.-Mexico border and convey flows to the Tijuana River Valley and Tijuana River Estuary. Smuggler's Gulch drains into the Tijuana River, while Goat and Yogurt Canyons drain into the Tijuana River Estuary.

Smuggler's Gulch and Goat Canyon are the largest of the three canyons and have similar water quality challenges. Untreated wastewater in these canyons is collected by the Tijuana sanitary sewer system and pumped to SABTP via pump stations in each canyon. However, some untreated wastewater goes uncollected or escapes the system and flows down the canyons and through culverts into the U.S. The wastewater then collects in surface pools on the U.S. side of the border where it is intercepted and routed to the ITP for treatment via the U.S.-side canyon flow diversion structures. U.S. Customs and Border Protection (CBP) agents conduct operations in and around the U.S.-side canyon flow diversion structures and are exposed to the pooled wastewater. Discussions with Veolia (the contract operators of the canyon flow diversion structures) and CBP agents indicated that the flows of untreated wastewater emanating from Smuggler's Gulch and Goat Canyon appear to have increased in recent years.

Sediment and trash loads from stormwater runoff in the canyons have also caused environmental issues in the Tijuana River Valley and Tijuana River Estuary in the past. Sediment basins and trash booms were constructed in 2005 on the U.S. side of Goat Canyon and are effective at capturing sediment and trash (HDR 2020). Trash booms were installed in Smuggler's Gulch in 2018 on the U.S. side of the border, and a new sediment and trash control structure was constructed on the Mexico side of the border in 2020. California State Parks has recently observed a trash capture efficiency of at least 75% in the trash booms located in Goat Canyon. Additionally, the County of San Diego recently received funding to construct a sediment basin on the U.S. side of the border in Smuggler's Gulch. As with other infrastructure in the Tijuana River watershed, long-term O&M costs for the existing infrastructure remain a challenge in both canyons.

Yogurt Canyon is the smallest of the three canyons and is closest to the coast. The 2020 HDR report estimated that the drainage area of Yogurt Canyon is about 11% the size of the Smuggler's Gulch drainage area, and transboundary flows are not a major water quality concern to the Tijuana River Estuary or the Pacific Ocean (HDR 2020). The primary concern with transboundary flows from Yogurt Canyon is flooding on Monument Road during wet weather events. When this flooding occurs, it cuts off access to the Friendship Park of the Californias and southern portions of the Border Field State Park.

2. THE ALTERNATIVES ANALYSIS PROCESS

The AAA, developed by EPA in 2015 and revised in 2020, provides a broadly applicable, systematic, replicable, and transparent method to score and compare the performance of alternatives and communicate decision-making with stakeholders. The scores from the AAA were used to rank alternatives based on EPA's key goals for the USMCA project investment: public health and community livability, stewardship of public resources, ecological protection, and system resiliency. Out of the four key goals, fifteen criteria were developed with stakeholder input to measure factors such as environmental impacts, energy demands, effects on government operations and the general public, costs (e.g., capital, annual O&M, and 40-year life cycle costs incurred by the U.S. and Mexico), implementation timelines, O&M responsibilities, and capacity to accommodate population growth. The maximum possible total score that an alternative could receive for this analysis is 480. PG and EPA used the AAA to narrow a set of 13 alternatives down to three final alternatives and applied the criteria of the AAA as the basis for further assessment of the three final alternatives. Refer to Appendix C for the complete list of alternatives, scoring criteria, and AAA scores.

2.1 Initial Alternatives

PG combined the projects and sub-projects evaluated in the *Feasibility Analysis Technical Memoranda* (listed in Appendix D) into logical groupings, called alternatives, based on their individual purposes, impacts, and localized benefits. PG also identified several add-on projects, generally smaller in scope, that can be considered auxiliary to the larger projects and can be incorporated based on available funding.

PG developed an initial set of alternatives by examining combinations of projects and sub-projects that are feasible to construct, operate, and pair with other projects. Through this process, PG identified an initial set of 39 alternatives for consideration. The list of the 39 alternatives with their capital and 40-year life cycle costs is provided in Appendix C.

2.2 Initial Screening Process and Cost Constraints

In order to narrow down the list of 39 potential alternatives that would be scored through the AAA, PG screened the alternatives through a set of four environmental performance metrics. Evaluation of the environmental performance metrics consisted of BOD_5 load reduction to both the Tijuana River and SAB Creek, sediment load reduction in the Tijuana River, and reduction of days with transboundary flows in the Tijuana River.

PG eliminated alternatives with redundant projects or incompatible elements (e.g., exceedance of the SBOO discharge capacity). Alternatives that included Project 9, using the South Bay Water Reclamation Plant for wastewater treatment, were removed from consideration because, shortly after developing the 39 alternatives, the City of San Diego determined that it was not economically feasible to sell the plant due to of the cost of modifying infrastructure to reroute wastewater to Point Loma for treatment.

EPA and PG then reviewed the remaining alternatives to identify solutions that either 1) achieve moderate improvements across all areas of impact or 2) maximize the improvements to at least one specific area of impact while achieving at least modest improvements to other areas.

EPA also provided the following guidance on cost constraints to apply to the alternatives. This guidance and the resulting assumptions provided necessary parameters to complete the alternatives analysis; the analysis assumptions do not reflect or imply final funding levels or agreements by the U.S. or Mexico. Note that these constraints are assumptions made for the alternatives analysis; the final cost sharing agreement will be negotiated between the U.S. and Mexico.

- The U.S. would fund 100% of the capital cost of infrastructure constructed in the U.S. and 50% of the capital cost of infrastructure constructed in Mexico.
- EPA assumed that USMCA funding would be supplemented with some EPA Border Water Infrastructure Program (BWIP) funding for a total of $325 million: $300 million of USMCA funds plus $25 million of BWIP funding. This funding can be spent on infrastructure in both the U.S. and Mexico with the following constraints and adjustments.
- The majority of the $300 million of USMCA funds (at least 93%, or $279 million) would be available for capital funding including planning, design, and construction for U.S.-side projects.
- The remainder of the USMCA funds (up to 7%, or $21 million) would be available for capital funding for Mexico-side projects including planning, design, and construction.
- The $25 million of BWIP funding represents additional U.S. capital contribution that may be used in Mexico. This results in $46 million—$21 million in USMCA funds plus $25 million of BWIP funds—available from the U.S. toward Mexico-side projects.
- Mexico-side projects would include a 100% (dollar per dollar) match from Mexico, which is not part of the USMCA or BWIP funding.
- Capital cost of alternatives can go up to 10% above the available funding due to contingencies in the project cost estimates. This results in a cost cap of $357.5 million ($325 million × 110%) for the maximum U.S. contribution, and $50.6 million ($46 million × 110%) for the maximum Mexico-side contribution.
- O&M costs would be covered 100% by the country in which the infrastructure is located, with the following exceptions:
  - Untreated wastewater at the ITP would follow the current ITP cost share agreement: 18% contribution by Mexico and 82% by the U.S. This percentage could change based on cost-share negotiations with Mexico.
  - Binational conveyance projects, including the PB-CILA conveyance line to the APTP, ITP effluent reuse, and the new canyon gravity conveyance system, would be funded by Mexico.

Although the majority of alternatives were bound by the cost constraints, one alternative (I) was created as a comprehensive solution to mitigate water quality issues in the Tijuana River watershed and account for future growth. This alternative was not bound by the cost constraints listed above.

PG and EPA used the results of the initial screening process and the cost constraints to narrow the 39 alternatives down to an initial set of nine alternatives, shown in Table 2-1. These nine alternatives are listed with estimated capital and life cycle costs in Appendix C. Individual project descriptions are available in Table 1-1.

Table 2-1. Nine Alternatives Evaluated Using the AAA

Alternative	Project Components
A	1 (U.S.-side river diversion and APTP of 163 MGD), 2 (convey Mexico-side diversion flow to APTP), 4 (U.S. canyon flow diversion structure upgrades), 6 (main channel trash booms), 7 (Rodriguez Dam reuse).
B	1 (U.S.-side river diversion and APTP of 100 MGD), 2 (convey Mexico-side diversion flow to APTP), 4 (U.S. canyon flow diversion structure upgrades), 5 ($13.5 million for rehabilitating targeted collectors in Tijuana), 6 (main channel trash booms), 7 (Rodriguez Dam reuse), 8 (new 10 MGD SABTP).
C	1 (U.S.-side river diversion and APTP of 100 MGD), 3 (ITP expansion to 30 MGD), 4 (U.S. canyon flow diversion structure upgrades), 6 (main channel trash booms).
D	1 (U.S.-side river diversion and APTP of 60 MGD), 3 (ITP expansion to 40 MGD), 4 (U.S. canyon flow diversion structure upgrades), 6 (main channel trash booms).
E	1 (U.S.-side river diversion and APTP of 35 MGD), 2 (convey Mexico-side diversion flow to APTP), 3 (ITP expansion to 40 MGD), 4 (U.S. canyon flow diversion structure upgrades), 5 ($13.5 million for rehabilitating targeted collectors in Tijuana), 6 (main channel trash booms).
F	2 (convey Mexico-side diversion flow to 35 MGD APTP), 3 (ITP expansion to 45 MGD), 4 (U.S. canyon flow diversion structure upgrades), 6 (main channel trash booms), 7 (Rodriguez Dam reuse).
G	2 (convey Mexico-side diversion flow to 35 MGD APTP), 3 (ITP expansion to 40 MGD), 4 (U.S. canyon flow diversion structure upgrades), 6 (main channel trash booms), 8 (new 10 MGD SABTP).
H	3 (ITP expansion to 50 MGD), 4 (U.S. canyon flow diversion structure upgrades and conveyance to ITP), 5 ($13.5 million for rehabilitating targeted collectors in Tijuana), 6 (main channel trash booms), 7 (Rodriguez Dam reuse).
I*	1 (U.S.-side river diversion and APTP of 60 MGD), 2 (convey Mexico-side diversion flow to APTP), 3 (ITP expansion to 60 MGD), 4 (U.S. canyon flow diversion structure upgrades and conveyance to ITP), 5 ($50 million for rehabilitating targeted collectors in Tijuana), 6 (main channel trash booms), 7 (Rodriguez Dam reuse), 8 (new 10 MGD SABTP).

* Alternative I was created as a comprehensive solution to mitigate water quality issues and was not bound by the cost constraints.

2.3 Augmented Alternatives Analysis

2.3.1 AAA Round 1

Next, the nine alternatives in Table 2-1 were scored using the AAA. The results of the first round of AAA scoring[2] along with the 40-year life cycle cost and cost effectiveness are provided in Table 2-2 below with more detail available for each alternative in Appendix C. Through the first two rounds of AAA, PG calculated each alternative's total 40-year life cycle costs as the sum of each of its project components' 40-year life cycle costs.

[2] Truckloads of trash disposal were not included in the scoring of AAA metric 1.1.2a, which considers the increase in truck traffic required for sediment and sludge disposal generated at the APTP as data on trash loading were not available at the time of scoring. A correlation between sediment quantities and trash loadings in the main channel trash booms is discussed in Section 1.2.1.3, and this report includes estimates of truckloads required for the disposal of trash collected for O&M and other metrics.

Table 2-2. AAA Round 1 Scores

	Alternative								
	A	B	C	D	E	F	G	H	I
Total score	**190**	**200**	**179**	**188**	**220**	**219**	**204**	**264**	**287**
Total 40-year life cycle cost ($ rounded to millions)	906	994	967	1,098	1,001	1,084	1,176	940	1,881
Cost effectiveness*	21	20	19	17	22	20	17	28	15

* Cost effectiveness is calculated by total score × 100/40-year life cycle cost (in millions).

Alternatives E, H, and I received the highest total scores, with Alternative F one point behind E. Alternatives E and H had the highest cost effectiveness scores, indicating the greatest benefits relative to cost. Alternative I received the highest total score with its high performance in mitigating water quality issues in the Tijuana River watershed and its ability to account for future growth but had the lowest cost effectiveness score.

2.3.2 AAA Round 2

PG, in collaboration with EPA, refined the top-scoring Round 1 alternatives within the context of the AAA, making subtle adjustments while staying within the cost constraints listed in Section 2.2. To ensure the evaluation appropriately focused on the impacts and benefits of the highest dollar infrastructure investment projects (Projects 1, 2, and 3), Alternatives B, E, and F were altered to include Projects 5 and 7 and remove Project 8, and were then rescored accordingly for the second round. Other high-scoring alternatives were left unaltered, including Alternative H (as Projects 5 and 7 were already included), Alternative G (as it was very similar to Alternative F and included Project 8), and Alternative I (as it was not held to the same cost constraints as the other alternatives).

Therefore, PG evaluated the following modified iterations of three alternatives:

- Alternative B-2: Removing Project 8 (new 10 MGD SABTP) from Alternative B
- Alternative E-2: Adding Project 7 (Rodriguez Dam reuse) to Alternative E
- Alternative F-2: Adding Project 5 (rehabilitating targeted sewer collectors in Tijuana) to Alternative F

These three new alternatives (B-2, E-2, and F-2) were then scored through the AAA process. The Round 1 scores of Alternatives B, E, and F with their modified iterations from Round 2 are listed below in Table 2-3. Alternative B-2 scored lower than Alternative B due to its lower performance of reducing discharge out of SAB Creek and an increase in the estimated frequency of FIB exceedances at Imperial Beach during the tourist season. Alternative E-2 scored the same as Alternative E because the benefits to CBP due to the reduction of transboundary flows from Project 7 were offset by the resulting increased concentration of untreated wastewater in transboundary flows near minority and low-income communities. Alternative F-2 scored higher than Alternative F, primarily due to higher reductions in days of transboundary flows and untreated wastewater in the Tijuana River. Ultimately, Alternative E-2 was chosen for further assessment over Alternatives F and F-2 as Alternative E-2 better responded to several stakeholders’ desire for a U.S.-side river diversion. Alternative H continued to score the highest within budget, even with the consideration of the new iterative alternatives, and was chosen as the second alternative to go forward into Round 3.

Table 2-3. AAA Round 2 Scores

	Alternative											
	A	**B**	**B-2**	**C**	**D**	**E**	**E-2**	**F**	**F-2**	**G**	**H**	**I**
Total score	**190**	**200**	**163**	**179**	**188**	**220**	**220**	**219**	**242**	**204**	**264**	**287**
Total 40-year life cycle cost ($ rounded to millions)	906	994	773	967	1,098	1,001	1,035	1,084	1,098	1,176	940	1,881
Cost effectiveness*	21	20	21	19	17	22	21	20	22	17	28	15

* Cost effectiveness is calculated by total score × 100/40-year life cycle cost (in millions).

2.3.3 AAA Round 3

Based on EPA guidance, PG then modified Alternative I by adding a Project 3 sub-project (ITP effluent conveyance for potential reuse in Mexico), reducing the amount of funding for Project 5 to match the other alternatives, and reducing the Project 8 SABTP capacity from 10 MGD to 5 MGD to more accurately provide the level of treatment needed to treat the Playas flows in 2050. This modified alternative, Alternative I-2, was the only new alternative scored in Round 3.

In the AAA Round 3 evaluation, PG refined the costs of Alternatives E-2 and H from the previous rounds, moving from the sum of each of the project components to comprehensive costs that realized savings when combining projects within an alternative. This resulted in optimized total capital, O&M, and life cycle costs for the three alternatives evaluated in Round 3 compared to the previous two rounds. The AAA scores of Alternatives E-2 and H also increased between Rounds 2 and 3 due to slight changes to both alternatives' impacts on AAA criteria resulting from additional analysis and revised assumptions. Alternative E-2's predicted impacts on BOD_5 reduction in the Tijuana River improved and Alternative H's predicted net change in energy use improved, resulting in increased points in their respective criteria.

After considering the scores, estimated costs and benefits, and the constraints discussed in Section 2.2 of the total 13 alternatives from the three rounds, EPA directed PG to move Alternatives E-2, H, and I-2 forward into the final assessment. The scores of the three final alternatives are listed in Table 2-4 below. PG determined that either Alternative E-2 or H could be expanded into Alternative I-2 should more funding become available and has provided phasing considerations in Section 4.7.

Table 2-4. AAA Round 3 Scores

	Alternative		
	E-2	**H**	**I-2**
Total score	**230**	**269**	**297**
Total 40-year life cycle cost ($ rounded to millions)	951	817	1,652
Cost effectiveness*	24	33	18

* Cost effectiveness is calculated by total score × 100/40-year life cycle cost (in millions).

3. ASSESSMENT OF THE THREE FINAL ALTERNATIVES

PG further evaluated the impacts, costs, and implementation considerations of each of the three final alternatives that were identified using the AAA process. The impacts of each alternative were evaluated by comparing the current conditions discussed in Section 1.2 to the conditions expected after the alternative would be implemented. PG evaluated the impacts of the alternatives using the methods detailed in Appendix B. The implementation costs associated with each final alternative are based on the individual USMCA project cost estimates developed as part of the feasibility analyses. PG's focus was on identifying technical or regulatory challenges that may affect the ability to implement or maintain each alternative, and how these challenges may affect the performance and long-term operation of each alternative.

3.1 Alternative E-2

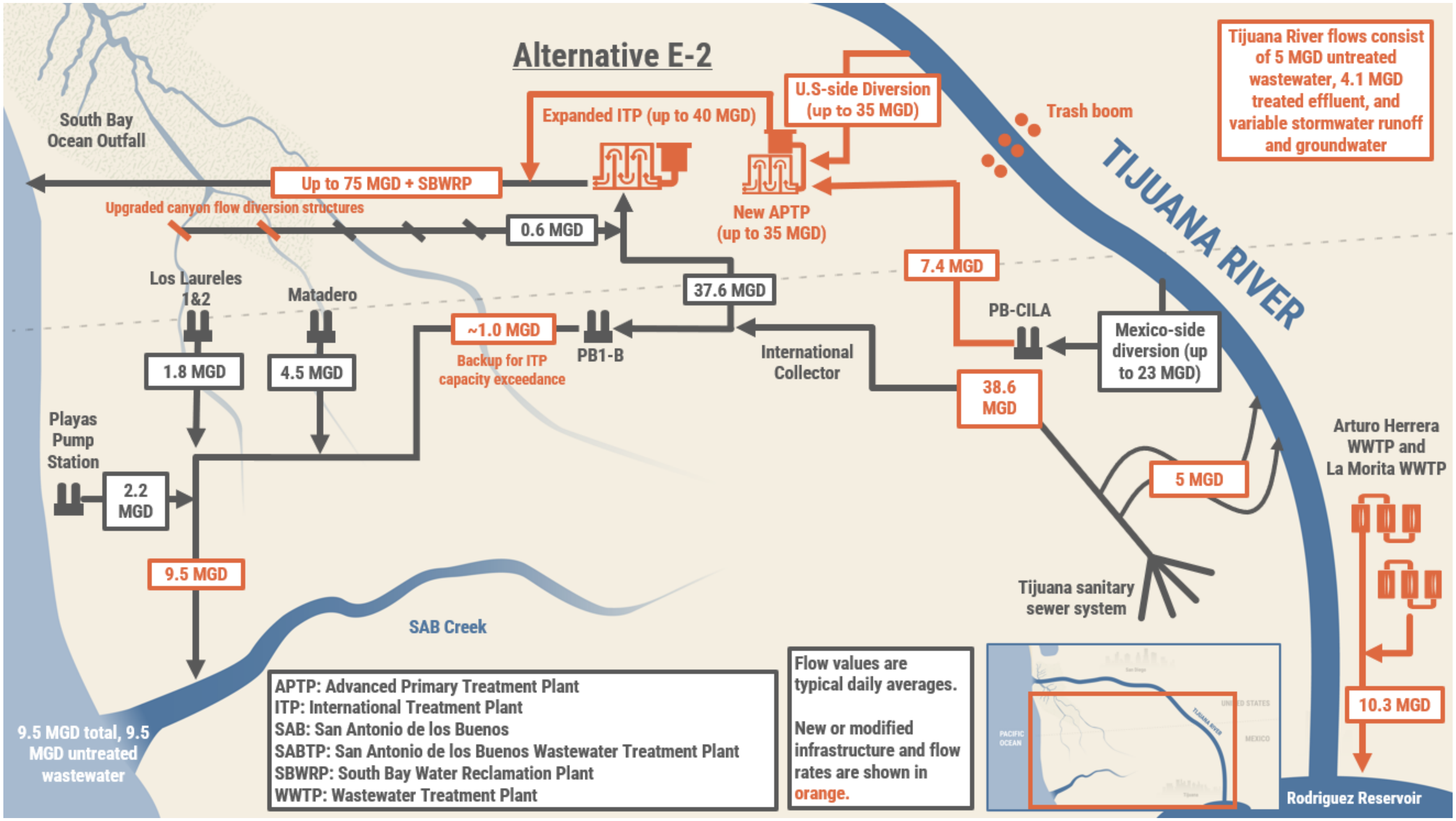
3.1.1 Alternative E-2 Description

Alternative E-2 would increase the capacity of the ITP by 60% to 40 MGD to treat wastewater flows from the International Collector, including additional wastewater collected by rehabilitated sewer collectors in Tijuana. Alternative E-2 would also provide advanced primary treatment for Tijuana River flows diverted at PB-CILA and at a new U.S.-side river diversion. Alternative E-2 would reduce transboundary flows by removing treated effluent from the Arturo Herrera and La Morita WWTPs from the river and rehabilitating sewer collectors in Tijuana to prevent leaks of untreated wastewater. By essentially eliminating flows pumped from PB-CILA and the International Collector to the SAB Creek outfall, Alternative E-2 would reduce discharges of untreated wastewater to SAB Creek, which is predicted to reduce beach closures during northward currents in the Pacific Ocean. Alternative E-2 would also upgrade the canyon flow diversion structures to reduce pooling of untreated wastewater in Goat Canyon and Smuggler's Gulch. Trash booms installed in the main channel as part of Alternative E-2 would remove trash from transboundary flows. The majority of the infrastructure built as part of Alternative E-2 would be located in the U.S. Alternative E-2 is composed of the following infrastructure project elements, presented in descending order according to estimated capital cost:

- **Expand the ITP to treat an average daily flow of 40 MGD (USMCA Project 3).** Currently, the ITP is undersized to treat all the wastewater in the International Collector. Expanding it to treat an average daily flow rate of 40 MGD would enable the plant to treat all current wastewater flows in the International Collector and wastewater that would be collected by rehabilitated sewer collectors in Tijuana. The expanded ITP is unlikely to have any reserve capacity for future population growth. The treated effluent would be discharged to the Pacific Ocean via the SBOO.
- **Construct a new U.S.-side 35 MGD diversion and APTP to divert and treat transboundary flows from the Tijuana River (USMCA Project 1).** Currently, contaminated river flows that are not diverted at PB-CILA flow across the U.S.-Mexico border and into the Tijuana River Valley. A new U.S.-side diversion system and APTP would divert and treat up to 35 MGD of river flows when the river's flow rate is under 60 MGD. The treated effluent would be discharged to the Pacific Ocean via the SBOO. The U.S.-side diversion would provide redundancy as a backup diversion to PB-CILA while also providing more diversion capacity. The U.S.-side diversion would only operate when PB-CILA is shut off.

- **Construct new infrastructure to convey treated effluent from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam (USMCA Project 7).** Currently, treated effluent from these two treatment plants, totaling approximately 10.3 MGD, is discharged into the Tijuana River. Rerouting the already-treated effluent to Rodriguez Dam would free up downstream pumping and treatment capacity in the system while also providing a source of water that could be beneficially reused by Mexico in the future.
- **Rehabilitate targeted sewer collectors in Tijuana (USMCA Project 5).** Currently, an estimated average of 10 MGD of untreated wastewater flows into the Tijuana River from damaged sewer collectors and other sources. Alternative E-2 includes $13.5 million for sewer collector rehabilitation in Tijuana. Based on information from NADB and CESPT, EPA estimated that this level of rehabilitation would prevent 5 MGD of wastewater from escaping the collection system, thus allowing it to be conveyed to the expanded ITP for treatment.
- **Rehabilitate and extend the existing force main to redirect flows from PB-CILA to the APTP (USMCA Project 2).** Currently, river water that is diverted at PB-CILA is conveyed to PB1-A, then ultimately discharged at SAB Creek. The rehabilitated and extended force main would redirect diverted river water from PB-CILA to the APTP. Redirecting the diverted river water would reduce untreated wastewater discharges from SAB Creek and allow PB1-A to be decommissioned.
- **Install trash booms in the Tijuana River main channel on the U.S. side to capture trash in the river (USMCA Project 6).** Currently, wet-weather flow events convey heavy loadings of trash across the U.S.-Mexico border via the Tijuana River main channel. Installing trash booms in the main channel, similar to those currently installed at Smuggler's Gulch and Goat Canyon, would reduce the volume of trash that the river conveys into the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean.
- **Regrade and modify the U.S.-side canyon flow diversion structures at Smuggler's Gulch and Goat Canyon (USMCA Project 4).** Currently, the canyon flow diversion structures allow dry-weather transboundary flows of untreated wastewater to pool before flowing into the conveyance that leads to the ITP. These pools of wastewater create odors, vector breeding grounds, and safety hazards for CBP agents who patrol and maintain the international border. Regrading and modifying the canyon flow diversion structures would reduce pooling at the grates, enabling easier and safer maintenance. Modifications would include grated low-flow channels that would allow CBP agents to traverse the collector approach pads without direct exposure to untreated wastewater.

Refer to the applicable *Feasibility Analysis Technical Memoranda* for more detail about the projects that constitute Alternative E-2. Figure 3-1, below, displays the estimated flow conditions in the Tijuana River Valley with Alternative E-2 implemented.



Not to scale; locations are approximated.

Figure 3-1. Alternative E-2 Flow Diagram

3.1.2 Alternative E-2 Projected Impacts

3.1.2.1 Tijuana River Main Channel

The new U.S.-side river diversion system would increase the capture of main channel flows relative to what PB-CILA currently captures. Redirecting the effluent from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment and rehabilitating targeted sewer collectors would further reduce transboundary flows and pollutant loadings that enter the U.S. via the Tijuana River.

The estimated impacts on transboundary flows in the Tijuana River main channel for Alternative E-2 are shown in Table 3-1 below. PG estimated these impacts using the methods described in Section B.3 of Appendix B.

Table 3-1. Impacts of Alternative E-2 on Tijuana River Main Channel Transboundary Flows

Parameter of Transboundary Flow in Tijuana River	Current Conditions*	With Alternative E-2 Implemented
Flow days (days/year)	153	55
Percent reduction	*N/A*	*64%*
Flow volume (million gallons/year)	17,500	15,000
Percent reduction	*N/A*	*14%*
BOD_5 load (tons/year)	1,670	326
Percent reduction	*N/A*	*80%*
Sediment load (tons/year)	187,000	185,000
Percent reduction	*N/A*	*1%*

* "Current conditions" are based on data from January 1, 2016, through December 31, 2019, and therefore do not reflect the upgrades to PB-CILA that commenced in 2020.

PG estimates that Alternative E-2 would reduce the number of days per year with transboundary flow from the current average of 153 days to 55 days. PG assumes the upgraded PB-CILA would continue to shut off when flows in the river exceed 1,000 L/s (approximately 23 MGD), the shutoff threshold specified in PB-CILA's current operational protocol. The U.S.-side diversion would divert up to 35 MGD of river water and would operate at local river flow rates up to 60 MGD. Therefore, the U.S.-side diversion would provide redundancy as a backup diversion to PB-CILA while also providing more diversion capacity. River flows diverted in the U.S. would be pumped directly to the APTP for treatment. River flows diverted in Mexico would also be pumped to the new APTP in the U.S., rather than being left untreated and diverted to the coast via SAB Creek.

EPA estimated that rehabilitating targeted sewer collectors in Tijuana would reduce the flow rate of untreated wastewater into the river by an average of 5 MGD. Based on information from NADB and CESPT, PG estimates the conveyance line from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam would reduce the flow rate in the river by an average of 10.3 MGD. This combined 15.3 MGD reduction would lower the frequency of daily flow rates in the river that exceed the capacity of PB-CILA and the U.S.-side river diversion.

PG estimates that Alternative E-2 would reduce the average annual transboundary BOD_5 load in the river by 80%. The BOD_5 reduction in the river was estimated assuming that the rehabilitated collectors provide a 5 MGD reduction in untreated wastewater discharged to the river. Refer to Section 4.4.1 for a sensitivity analysis of the collector repairs' effect on the expected benefits of implementing Alternative E-2.

3.1.2.2 Discharges to the Pacific Ocean via SAB Creek

Alternative E-2 would reduce the flows and pollutant loadings discharged at SAB Creek by treating wastewater from the International Collector and the rehabilitated sewer collectors in Tijuana, and by diverting untreated river water to the APTP. Alternative E-2's estimated impacts on discharges to the Pacific Ocean via SAB Creek are presented in Table 3-2 below.

Table 3-2. Impacts of Alternative E-2 on Discharges to the Pacific Ocean via SAB Creek

Parameter of Discharges to the Pacific Ocean via SAB Creek	Current Conditions	With Alternative E-2 Implemented
Flow volume (million gallons/year)	13,100	3,500
Percent reduction	*N/A*	*73%*
BOD_5 load (tons/year)	17,200	5,800
Percent reduction	*N/A*	*66%*
Frequency of FIB exceedances at Imperial Beach during the tourist season (hours/year)*	636	235
Percent reduction	*N/A*	*63%*

* The frequency of FIB exceedances was estimated using the results of the Scripps study.

When Alternative E-2 is fully implemented, the discharges at SAB Creek would consist of untreated wastewater from the Mexico-side canyon pump stations, the Playas Pump Station, and the International Collector when the capacity of the ITP is exceeded. PG's analysis of the 2016–2019 flow data suggests there may be periods when the flow rate in the International Collector exceeds the capacity of the expanded ITP. Any flows that exceed the ITP's peak treatment capacity would be pumped from the International Collector to SAB Creek through the parallel conveyance pipelines via PB1-B[3] and discharged to the Pacific Ocean without treatment. Table 3-2 is based on the assumption that peak flows in the International Collector which exceed the expanded ITP's capacity would be pumped to SAB Creek.

PG used the BOD_5 loads shown in Table 3-2 to estimate that Alternative E-2 would reduce the average flow rate of untreated wastewater discharged to the Pacific Ocean via SAB Creek from 28 MGD to 9.5 MGD (refer to Appendix B, Equation 20). Based on these reduced discharges at SAB Creek and the Scripps study discussed in Section 1.2.3, EPA used the methods discussed in Section B.5 of Appendix B to estimate that Alternative E-2 would reduce the frequency of FIB exceedances at Imperial Beach by 63% during the tourist season.

Beach closures during the non-tourist season (September 9–May 21) can be caused by both untreated wastewater discharges at SAB Creek and transboundary flows in the Tijuana River. PG expects that Alternative E-2's 80% reduction in the BOD_5 load in transboundary flows in the Tijuana River and 66% reduction in the BOD_5 load to the Pacific Ocean via SAB Creek would reduce the frequency of beach closures during the non-tourist season. Further analysis should be done to quantify the impacts Alternative E-2 would have on beach closures during the non-tourist season.

3.1.2.3 Sediment Impacts

As Table 3-1 shows, PG estimates that implementing Alternative E-2 would reduce the annual transboundary sediment load in the Tijuana River main channel by 1%. Most of the annual

[3] For Alternative E-2, PB1-A is assumed to be decommissioned, and PB1-B would be used for pumping excess flows from the International Collector to SAB Creek.

sediment load enters the river in stormwater runoff during heavy rain events. The flow rates in the river that result from these heavy rain events are much higher than either diversion's shutoff threshold; therefore, Alternative E-2 would not significantly reduce the annual sediment load that is conveyed to the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean. Refer to Section B.3 of Appendix B for details about how PG estimated river sediment loads. Refer to Section 1.2.1.3 and the *Baseline Conditions Summary: Technical Document* for details about the flow and sediment transport characteristics of the Tijuana River.

3.1.2.4 Trash Impacts

The trash booms in the main channel would reduce the loading of trash conveyed to the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean via transboundary flows. Similar trash booms have been installed in Smuggler's Gulch and Goat Canyon and are effective at capturing trash, particularly floatable trash, that is transported across the border by stormwater. Trash booms have also been used to effectively capture trash in large rivers in Incheon City, South Korea, and Rio de Janeiro, Brazil (NOWPAP MERRAC 2008; Franz & Freitas 2011). Based on available information on the performance of the trash booms in Goat Canyon, PG assumed that the trash booms would trap 75% of the trash load in the main channel. PG applied this trapping efficiency to the annual trash load discussed in Section 1.2.1.3 (15,000 cubic yards) to estimate that the trash booms would capture 11,300 cubic yards of trash annually; this would equate to approximately 700 truckloads of trash per year.

As discussed in Section 1.2.1.3, the magnitude, frequency, and composition of trash loads in the Tijuana River is not well understood. More data are needed to better understand the annual trash loading in the main channel, more accurately estimate the environmental impacts, and more accurately estimate O&M costs for the trash booms.

3.1.2.5 Canyon Impacts

The regraded U.S.-side canyon flow diversion structures would allow dry-weather transboundary flows in the canyons to enter the drains without pooling. The grated low-flow channels would allow CBP agents to traverse the collectors without direct exposure to untreated wastewater. Alternative E-2 is not expected to affect sediment or trash loads in wet-weather flows in the canyons.

3.1.2.6 Effects on Government Operations

For this analysis, PG presumes that IBWC, the current owner of the ITP, will be responsible for operating and maintaining the expanded ITP, the APTP, the U.S.-side river diversion system, and the trash booms in the main channel. Refer to Section 3.1.4.3 for further discussion about the O&M activities and costs for which IBWC or another U.S.-side designee would be responsible.

Alternative E-2 is expected to benefit CBP operations at the canyons. The upgraded U.S.-side canyon flow diversion structures would support CBP's mission of securing the U.S.-Mexico border by reducing agents' exposure to hazards while patrolling and maintaining border infrastructure in the canyons. However, the U.S.-side river diversion and trash booms in the main channel may interfere with border security operations due to construction in the main channel, extraction and hauling of trash, and decreased visibility. CBP has also expressed concern that failure to adequately maintain the trash booms may hinder their efforts.

Alternative E-2 is expected to improve health and safety for U.S. Navy personnel at the Naval Training Center in San Diego by reducing untreated wastewater discharges from the Tijuana River and SAB Creek to the Pacific Ocean.

3.1.2.7 Effects on the Public

Alternative E-2 would result in safety-related and water quality–related public benefits in the U.S. including reduced risks to human health, restored use of recreational resources (beaches and parks in the Tijuana River Valley), and reduced odors. Potential economic benefits in coastal communities include increased property values, pedestrian traffic, and tourism due to reduced beach closures.

Alternative E-2 would also result in safety-related and water quality–related public benefits in the City of Tijuana. Rehabilitating and upgrading collectors in the city would reduce human exposure to untreated wastewater that escapes from the Tijuana sanitary sewer system. The reduction in untreated wastewater discharges at SAB Creek discussed in Section 3.1.2.2 would improve water quality at the beaches in Tijuana, potentially enhancing recreational and economic opportunities in the nearby coastal communities.

Alternative E-2 is not expected to have substantial construction-related effects on the public. Temporary effects in the U.S. would include increased traffic at the interchange between I-5 and Dairy Mart Road, which currently experiences delays due to congestion.

Alternative E-2 could result in localized, recurring negative effects on the public due to long-term operational changes and requirements. These effects could include odor impacts from the expanded ITP and new APTP; visual, odor, and disease vector impacts due to the consolidation of trash in the Tijuana River trash booms; noise and traffic impacts from frequent hauling of sludge and sediment from the new APTP (see Section 3.1.4.3); and occasional noise impacts from the removal and hauling of captured trash. These factors could affect property values in nearby communities.

The long-term U.S. public benefits described above are expected to primarily benefit coastal communities, which generally have fewer people of color and low-income populations than state averages. The temporary and long-term potential U.S. adverse effects described above are expected to primarily affect 1) communities near the interchange between I-5 and Dairy Mart Road (for traffic-related effects), which have more people of color and low-income populations than state averages, and 2) communities near the Tijuana River upstream of Dairy Mart Road, which have more people of color than state averages and a mixed prevalence of low-income populations relative to those averages.

The National Environmental Policy Act (NEPA) documentation (currently being developed by ERG and EPA) will provide a more in-depth assessment of the projects within Alternative E-2 and their short-term and long-term impacts on the general public.

3.1.2.8 Energy Consumption

PG estimated the net change in the energy requirements in the Tijuana River watershed by examining the energy needed for additional treatment units, pumping, and hauling waste, shown in Table 3-3 below. PG calculated the change in energy consumption using the methods outlined in Appendix B.

Table 3-3. Summary of Alternative E-2 Annual Energy Impacts

Energy Source and Description	Change in Annual Energy Requirements (kWh)	Change in Annual Energy Costs*
U.S. Energy Requirements		
Expanded ITP: Blowers, mixers, other mechanical equipment, heating for digesters, trucking energy for sediment/sludge disposal, and process control and auxiliary electrical equipment	12,500,000	$2,500,000
New 35 MGD APTP: Blowers, mixers, other mechanical equipment, trucking energy for sediment/sludge disposal, and process control and auxiliary electrical equipment	3,200,000	$640,000
U.S.-side diversion: Pumping requirements for the new U.S.-side diversion	166,000	$33,200
Trash booms: Trucking energy requirements to dispose of collected trash	233,000	$46,600
Change in U.S. annual energy requirements	**16,099,000**	**$3,219,800**
Mexico Energy Requirements		
PB-CILA: Reduction in total flows pumped by PB-CILA	-694,000	-$69,400
PB1-A/B: Reduction in flows being pumped at PB1-A and PB1-B	-19,100,000	-$1,910,000
New effluent pump station: Energy requirements to pump flows from Arturo Herrera and La Morita WWTPs to Rodriguez Dam	1,140,000	$114,000
Change in Mexico annual energy requirements**	**-18,654,000**	**-$1,865,400**
Total Energy Requirements		
Total change in annual energy requirements	**-2,555,000**	**$1,354,000**

* PG calculated energy costs by assuming a cost of electricity of $0.20 per kWh for infrastructure in the U.S. and $0.10 per kWh for infrastructure in Mexico.

** This number does not reflect the energy savings to Mexico involved in having to treat less wastewater at SABTP.

The increased U.S.-side energy requirements from the expanded ITP could be fully offset if equipment is installed to convert the methane produced in the digesters at the ITP into electrical power. The considerations for potential power generation using digester gases are discussed further in the Project 3 *Feasibility Analysis Technical Memorandum*.

3.1.2.9 Other Unquantified Impacts

By diverting a larger portion of wet-weather transboundary flows from the main channel (up to 35 MGD during river flow rates of up to 60 MGD), Alternative E-2 would reduce the frequency and volume of transboundary flows to the river's lower reaches during both the dry season and the wet season. Removing treated effluent from the Tijuana River in Mexico would further reduce this frequency. Reduced river flows and infiltration to groundwater in these areas could affect riparian vegetation and habitats in the Tijuana River Estuary.

3.1.3 Alternative E-2 Cost Analysis

The estimated implementation costs for Alternative E-2 are based on the individual project cost estimates PG developed as part of the *Feasibility Analysis Technical Memoranda* for Projects 1 through 10. Refer to Appendix B and the *Baseline Conditions Summary: Technical Document* for an in-depth description of PG's cost estimating procedures, degree of accuracy, and assumptions. The annual O&M costs shown below are annualized 40-year life cycle infrastructure cost estimates. All cost estimates are expressed in 2021 U.S. dollars. Refer to Section 2.2 for more details on the basis for the capital and O&M cost sharing structure shown in Table 3-4. Cost shares and splits are for analysis only, and do not represent government commitments.

Table 3-4. Alternative E-2 Implementation Cost Estimate

	U.S. Share	Mexico Share	Total
Capital Cost:	$ 344,000,000 (94%)	$ 22,900,000 (6%)	$ 366,900,000
Annual O&M Cost:	$ 13,000,000 (89%)	$ 1,600,000 (11%)	$ 14,600,000
40-Year Life Cycle Cost:	$ 862,600,000 (91%)	$ 87,900,000 (9%)	$ 950,500,000

Of the estimated $344 million U.S. share of capital cost for Alternative E-2, the U.S. would expend $321.1 million for infrastructure built in the U.S. and $22.9 million for infrastructure built in Mexico. Mexico would match the U.S. contribution, for a total of about $45.8 million spent on infrastructure in Mexico.

Alternative E-2 would reduce Mexican entities' O&M costs for several existing facilities. The estimated O&M costs displayed in Table 3-4 above do not account for these savings. Because river flows diverted at PB-CILA would be conveyed to the APTP, PB1-A could be decommissioned. Therefore, CESPT would no longer incur the cost of energy and other expenses associated with operating and maintaining PB1-A. As shown in Table 3-3, PG estimates that Mexico's annual energy cost savings from implementing Alternative E-2 would be approximately $1.9 million per year, which would help offset some of Mexico's share of the Alternative E-2 annual O&M costs. There would also be savings in labor and other O&M costs, but sufficient information regarding these costs was not available to PG. Also, the parallel conveyance pipelines would carry less flow, potentially creating the opportunity to decommission one of the pipelines and eliminate the cost of operating and maintaining it.

3.1.3.1 Opportunities for Capital Cost Savings

PG identified the U.S.-side diversion as a potential opportunity to reduce capital expenditure. The need for a U.S.-side diversion depends largely on the future reliability and operational protocol of the upgraded PB-CILA, along with the reduction of untreated wastewater discharges achieved by repairing the targeted collectors in Tijuana. If the upgraded PB-CILA diversion can reliably divert flows up to 35 MGD, the U.S.-side diversion may not provide additional benefits and could be eliminated from Alternative E-2.

For many WWTP expansion projects, the new treatment units can be installed as they become needed in response to population growth, thereby postponing some of the capital expenditure. However, PG expects that a phased expansion of the ITP would not be practical for Alternative E-2 because the full expanded 40 MGD capacity would be needed relatively soon. Additionally, PG did not identify any overlap in the equipment and infrastructure that would be constructed as part of the individual Alternative E-2 project elements. The engineering analyses that would be performed during the preliminary and final design efforts for Alternative E-2, if selected, may reveal new opportunities for capital cost savings.

The Project 6 cost estimate that PG used in the Alternative E-2 capital cost includes a trash boom in Stewart's Drain in addition to the main channel. However, this trash boom may not be necessary due to the existing grate at the ITP that provides trash screening for flows in Stewart's Drain. Therefore, some of the Alternative E-2 capital cost for trash booms may be able to be reallocated to other project components.

3.1.4 Alternative E-2 Implementation Considerations

3.1.4.1 Future Population Considerations

PG estimates that 38.2 MGD of wastewater would be received at the expanded ITP (40 MGD capacity) when Alternative E-2 is fully implemented. However, the flow rate in the International Collector is likely to exceed 40 MGD during some periods. Any flows that exceed the ITP's peak treatment capacity would be pumped from the International Collector to SAB Creek through the parallel conveyance pipelines via PB1-B[4] and discharged to the Pacific Ocean without treatment. Therefore, the ITP is unlikely to have any reserve capacity for future population growth. According to a 2020 study by NADB that examined the future treatment demands for the City of Tijuana based on population growth, the City of Tijuana is expected to generate an additional 14 MGD of untreated wastewater in the International Collector by 2050, compared to current conditions (NADB et al. 2020). Correspondence with NADB indicated that future population growth in Matadero Canyon and Los Laureles Canyon is likely to require 1 MGD of additional treatment. Additionally, NADB indicated that wastewater flows to the Playas Pump Station from coastal communities are expected to grow by approximately 20% (0.4 MGD) by 2050. A future ITP expansion, upgrades to one or more of the existing treatment plants in Mexico (Arturo Herrera, La Morita, or SABTP), or a new treatment plant(s) would be needed to treat the additional wastewater expected to be produced by the 2050 population.

The new conveyance line from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment would prevent treated effluent from mixing with the untreated wastewater that is discharged into the river and make it available for future water reuse. Additional treatment would be necessary for these flows to be reused as a potable source from the Rodriguez Dam impoundment. Refer to the Project 7 *Feasibility Analysis Technical Memorandum* for more details on the feasibility of reuse.

3.1.4.2 Implementation Timeline

The canyon flow diversion structure upgrades and trash booms have minimal interdependencies with other project elements, allowing flexibility with respect to the order in which they are constructed. Constructing the APTP, and the conveyance line from PB-CILA to the APTP, before constructing the U.S.-side diversion would allow the performance of the Mexico-side river infrastructure to be evaluated to determine if the U.S.-side diversion is needed. Other project elements in Alternative E-2 share operational interdependencies, but this does not affect the order in which they can be constructed. For example, the rehabilitation of targeted sewer collectors in Tijuana could likely take place before the ITP expansion (due to less burdensome design and permitting requirements) and would improve the water quality of the river. However, until there is capacity at the ITP to treat these additional flows of wastewater, they would be pumped to SAB Creek and discharged without treatment to the Pacific Ocean.

The ITP's potential treatment capacity is currently limited by a lack of solids processing and disposal capacity. Prioritizing expansion of the solids processing units may allow the ITP to treat up

[4] For Alternative E-2, either PB1-A or PB1-B would have sufficient capacity to handle the excess flows from the ITP. This provides the flexibility to select which pump station is used during the final design process. For this analysis, PB1-A is assumed to be decommissioned, and PB1-B would be used for pumping excess flows from the International Collector to SAB Creek.

to 5 MGD more wastewater from the International Collector while the rest of the plant is being expanded.

The implementation timeline of Alternative E-2 would be largely dependent on the environmental review and consultation processes for the individual project elements. Based on recent discussions with EPA, ERG anticipates the following timelines to prepare NEPA documentation for the project elements in Alternative E-2:

- Regrading and modifying the U.S.-side canyon flow diversion structures at Smuggler's Gulch and Goat Canyon is expected to require limited environmental review and could likely be implemented relatively quickly. Preparation of a NEPA categorical exclusion (CATEX) for this project element would take approximately six months to complete.
- Three project elements—1) ITP expansion, 2) rehabilitation of targeted sewer collectors in Tijuana, and 3) installation of a trash boom in the Tijuana River—are expected to be fully addressed in a Programmatic Environmental Impact Statement (EIS), which would take approximately one year to complete. Two additional project elements—1) construction of the APTP and 2) conveyance of river flows from PB-CILA to the APTP—could potentially be fully addressed in the Programmatic EIS (approximately one year) but may require a more detailed Tiered EIS (approximately two years, including the Programmatic EIS) to fully address the marine impacts of discharging 35 MGD of primary-treated effluent.
- The project to construct conveyance lines from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment would likely require more detailed analysis in a Tiered Environmental Assessment (EA) or EIS (approximately two years, including the Programmatic EIS) to fully address environmental, public health, and safety concerns.
- Construction of a 35 MGD U.S.-side river diversion would likely require more detailed analysis and consultation in a Tiered EIS (approximately two years, including the Programmatic EIS) to fully address likely adverse effects to protected resources, including wetlands.

Following completion of the NEPA review, most project elements in the U.S. are expected to require California Environmental Quality Act (CEQA) review and approval in the form of an Environmental Impact Report (EIR), which will be coordinated by one or more state or local agencies with discretionary approval authority. EPA intends to facilitate this process by preparing NEPA documents that address CEQA content requirements and can therefore be adopted by the state or local agencies.

Project elements in Mexico are expected to require additional review in the form of an EIS ("Manifestos de Impacto Ambiental" or "MIA"), subject to approval by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). EPA has not evaluated the timeline implications of MIA review for the USMCA project.

3.1.4.3 O&M Requirements

The estimated annual O&M costs associated with implementing Alternative E-2 are presented in Table 3-4. USMCA funding is only available for capital expenditures; therefore, the recurring costs associated with operating and maintaining the new and modified infrastructure constructed as part of Alternative E-2 would fall to the entities that are agreed upon before implementation. These O&M costs would include costs of equipment and materials for day-to-day operations and preventative maintenance, staff labor, energy and other utilities, waste disposal fees, equipment replacements at end of service life, and other costs associated with operating and maintaining water infrastructure. Refer to the *Baseline Conditions Summary: Technical Document* for more information about who is responsible for operating and maintaining existing infrastructure in the watershed.

For this analysis, the IBWC is presumed to be responsible for operating and maintaining the new U.S.-side river diversion, the new APTP, the expanded ITP, and the Tijuana River trash booms. The ITP's total annual O&M expenditures are expected to increase by about 52% (from $14.3 million to $21.7 million). The current staff of 25 people would need to be expanded to about 55 people (an increase of about 120%). The plant currently has four Grade V certified operators, two Grade IV certified operators, and two Grade III certified operators. PG estimates that IBWC would need to hire three more Grade IV certified operators and three more Grade III certified operators to operate the expanded ITP. In addition to the expanded ITP's operating requirements, IBWC would be responsible for operating and maintaining the 35 MGD APTP and U.S.-side river diversion, estimated to cost $6.7 million annually. PG estimates that these facilities would require a staff of about 25, including one Grade V certified operator, two Grade IV certified operators, and five Grade III certified operators. The O&M costs for the trash booms are estimated at $738,000 annually. The majority of the trash booms' O&M cost is for removing and disposing of waste collected by the trash booms and is dependent on the volume of trash that is collected. As discussed in Section 1.2.1.3, data on trash loads in the river are currently limited and more monitoring is needed to better estimate how much trash would require disposal.

IBWC's additional responsibilities would likely include furnishing trucks and drivers to haul solid waste from the APTP and the trash booms and covering the cost to dispose of the waste (landfill tipping fees). PG estimates that the APTP would require an average of 900 truck trips annually for sediment/sludge disposal. Additionally, PG estimates that an annual average of 700 truck trips would be needed to dispose of trash collected by the trash booms. In total, IBWC would be responsible for furnishing trucks and drivers for an estimated average of 1,600 additional truck trips annually. The costs for trucking and disposal are included in the estimated O&M increase for IBWC described above.

For this analysis, the current responsible agencies for O&M of infrastructure in Mexico were assumed to remain the same. CESPT is currently responsible for furnishing trucks and drivers to dispose of waste sludge from the ITP, and it is expected that CESPT would retain this responsibility if Alternative E-2 is implemented. The ITP expansion would reduce the number of truck trips annually for solids disposal from 2,900 to 2,700 due to the installation of the anaerobic digesters. The expanded ITP would produce more solids, but the increase in solids is partially offset by the installation of anaerobic digesters, which would destroy about half of the sludge solids. CESPT would continue to be responsible for maintaining the entire sanitary collection system in Tijuana, including the rehabilitated sewer collectors. However, CESPT would see an overall reduction in O&M responsibilities because untreated wastewater that currently must be pumped to SAB Creek would instead flow by gravity to the ITP.

CESPT would likely be responsible for O&M of all water reuse infrastructure downstream of the Arturo Herrera and La Morita WWTP discharges. Once in the reservoir, the water would fall under the jurisdiction of the Comisión Nacional del Agua (CONAGUA) for treatment and distribution. Under contract from CESPT, CILA would remain responsible for operating PB-CILA. The overall flow that is pumped by PB-CILA would be reduced, but PB-CILA would operate more frequently.

3.1.4.4 Implementation Challenges

This section provides a summary of the implementation challenges associated with Alternative E-2. Further analysis of how these challenges impact all three final alternatives is discussed in Section 4.4.

The impacts of Alterative E-2 on transboundary river flows depend on the effectiveness of the collector repairs at reducing untreated wastewater discharges to the Tijuana River. PG evaluated the impacts of Alternative E-2 based on EPA's estimate that rehabilitating targeted sewer collectors in Tijuana would reduce the average flow of wastewater into the Tijuana River from 10 MGD to 5 MGD. However, limited data are available regarding the effectiveness of collector repairs at reducing wastewater discharges into the river, and sustaining this reduction would require increased O&M in Mexico. Alternative E-2 would reduce untreated wastewater flows from entering the river, which would reduce energy requirements at PB-CILA to help offset the increased O&M costs for the sanitary sewer system.

Information about the structural condition of Rodriguez Dam, as well as available capacity in the impoundment, was not available to PG. Therefore, a comprehensive evaluation of the dam must be performed to ensure that it is structurally able to withstand the increased water levels that may result from the WWTP discharges to the dam impoundment area. If the dam is unable to hold the WWTP discharges, these flows would remain in the river, resulting in decreased performance of Alternative E-2. Section 4.4.2 explores the impacts of each final alternative with and without rerouting the WWTP effluents to the Rodriguez Dam impoundment.

PG evaluated the impacts of Alternative E-2 using a shutoff threshold of 60 MGD (river flow rate) for the U.S.-side diversion. Operating the U.S.-side diversion to partially divert flows at higher river flow rates would provide additional reductions to the total volume and pollutant loading of transboundary flows but would increase the O&M costs of the plant. Section 4.4.3 discusses the benefits gained by operating the U.S.-side diversion at increased river flow rates. Although sediment and trash data for the Tijuana River are currently limited, it is clear that increased flow rates bring increased sediment and trash loadings. Therefore, operating the river diversion at higher flow rates will result in higher O&M costs at the U.S.-side river diversion and APTP due to increased sediment and trash disposal, as well as increased wear and tear on pumping and treatment equipment. The *Feasibility Analysis Technical Memoranda* for Project 1 and Project 6 further discuss the implementation challenges associated with the diversion, as well as the steps required to ensure the design would be capable of handling the high flow rates and sediment quantities in the river.

The APTP would require a National Pollutant Discharge Elimination System (NPDES) permit to discharge effluent from the SBOO. Correspondence with the Regional Water Quality Control Board (RWQCB) indicated that the APTP would be required to meet advanced primary effluent limits; however, those effluent limits have not been finalized. The expanded ITP would require a modification to its current NPDES permit to discharge the increased volume of effluent from the SBOO. It is expected that the permit would continue to require the ITP's effluent to meet secondary treatment standards.

3.2 Alternative H

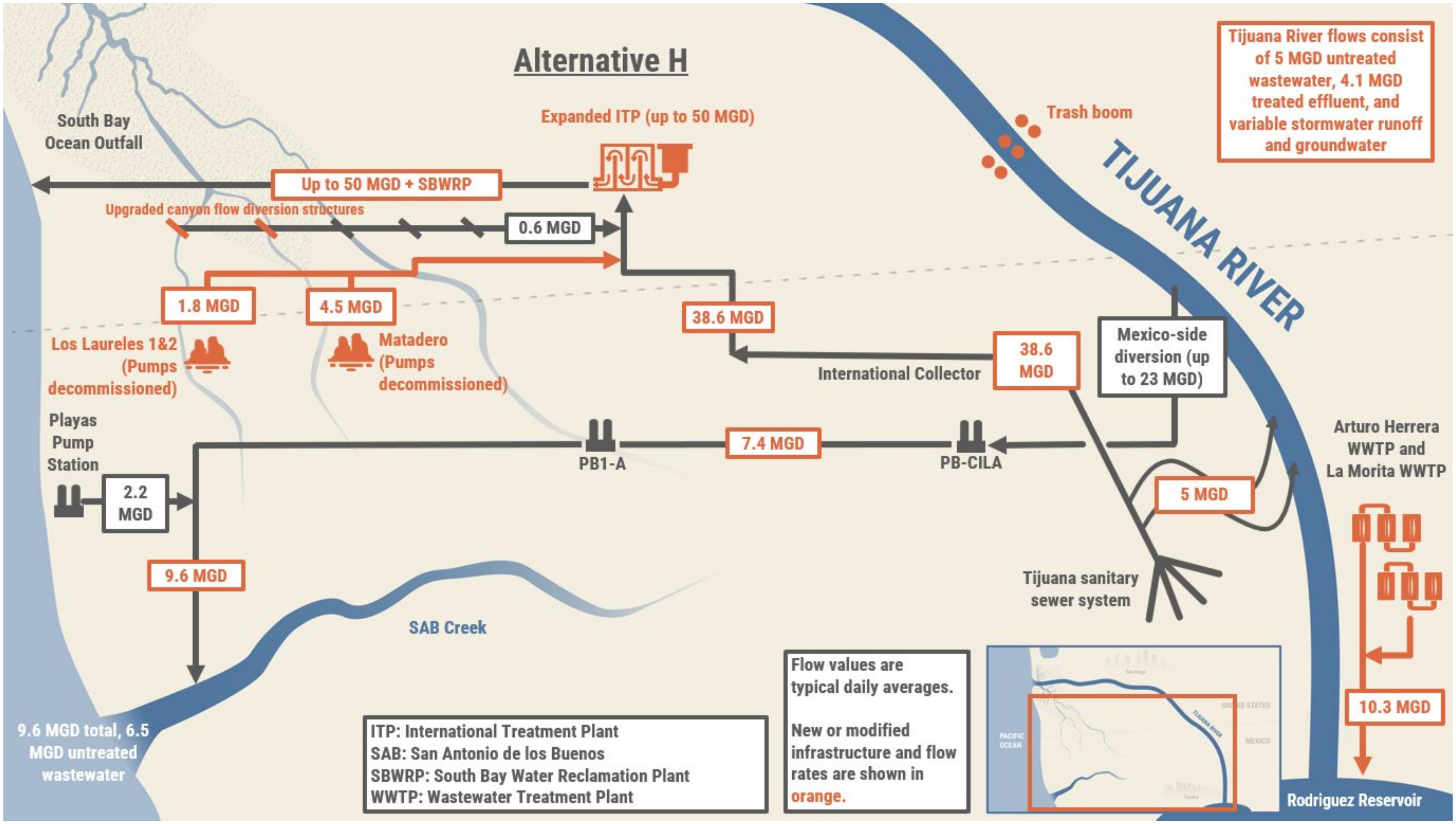
3.2.1 Alternative H Description

Alternative H would double the capacity of the ITP to 50 MGD to treat flows of wastewater from the International Collector (including additional wastewater collected by rehabilitated sewer collectors in Tijuana) and the decommissioned canyon pump stations. No U.S.-side river diversion is included in Alternative H, although transboundary flows would be reduced by removing treated effluent from the river and rehabilitating sewer collectors in Tijuana to prevent leaks of untreated wastewater. Implementing Alternative H would reduce discharges of untreated wastewater to SAB Creek, which is predicted to reduce beach closures during northward currents in the Pacific Ocean. Alternative H would also upgrade the canyon flow diversion structures to reduce pooling of untreated wastewater in Goat Canyon and Smuggler's Gulch. Trash booms installed in the main channel as part of Alternative H would remove trash from wet-weather flows. The majority of the infrastructure built as part of Alternative H would be located in the U.S. Alternative H is composed of the following infrastructure project elements, presented in descending order according to estimated capital costs:

- **Expand the ITP to treat an average daily flow of 50 MGD (USMCA Project 3).** Currently, the ITP is undersized to treat all wastewater in the International Collector. Expanding the ITP to treat an average daily flow rate of 50 MGD would enable it to treat all current wastewater flows in the International Collector, the wastewater collected in the canyons in Mexico, and additional wastewater that would be collected by rehabilitated sewer collectors in Tijuana. The expanded plant is expected to have capacity for current and projected wastewater flows through 2030. The treated effluent would be discharged to the Pacific Ocean via the SBOO.
- **Construct a new gravity conveyance system to bring flows from the Los Laureles 1, Los Laureles 2, and Matadero Pump Stations to the ITP for treatment (USMCA Project 4).** Currently, wastewater flows from these pump stations are conveyed to the SABTP, where they receive little or no treatment before being discharged into the Pacific Ocean. Decommissioning the pump stations and constructing a new gravity conveyance system to bring these flows to the ITP for treatment would decrease the flow rate of untreated wastewater discharged at SAB Creek. Additionally, the new gravity lines would operate more reliably than the existing pump stations, which may reduce flows of untreated wastewater that escape the pump stations and flow into the U.S.
- **Construct new infrastructure to convey treated effluent from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam (USMCA Project 7).** Currently, treated effluent from these two treatment plants (totaling approximately 10.3 MGD) is discharged into the river. Rerouting the already-treated effluent to Rodriguez Dam would free up downstream pumping and treatment capacity in the system while also providing a source of water that could be beneficially reused by Mexico in the future.
- **Rehabilitate targeted sewer collectors in Tijuana (USMCA Project 5).** Currently, an estimated average of 10 MGD of untreated wastewater flows into the Tijuana River from damaged sewer collectors and other sources. Alternative H includes $13.5 million for sewer collector rehabilitation in Tijuana. Based on information from NADB and CESPT, EPA estimated that this level of rehabilitation would prevent 5 MGD of wastewater from escaping the collection system, thus allowing it to be conveyed to the expanded ITP for treatment.

- **Install trash booms in the Tijuana River main channel on the U.S. side to capture trash in the river (USMCA Project 6).** Currently, wet-weather flow events convey heavy loadings of trash across the U.S.-Mexico border via the Tijuana River main channel. Installing trash booms in the main channel, similar to those currently installed at Smuggler's Gulch and Goat Canyon, would reduce the volume of trash that the river conveys into the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean.
- **Regrade and modify the U.S.-side canyon flow diversion structures at Smuggler's Gulch and Goat Canyon (USMCA Project 4).** Currently, the canyon flow diversion structures allow dry-weather transboundary flows of untreated wastewater to pool before flowing into the conveyance that leads to the ITP. These pools of wastewater create odors, vector breeding grounds, and safety hazards for CBP agents who patrol and maintain the international border. Regrading and modifying the canyon flow diversion structures would reduce pooling at the grates, enabling easier and safer maintenance. Modifications would include grated low-flow channels that would allow CBP agents to traverse the collector approach pads without direct exposure to untreated wastewater.

Refer to the applicable *Feasibility Analysis Technical Memoranda* for more detail about the project elements that constitute Alternative H. Figure 3-2, below, displays the estimated flow conditions in the Tijuana River Valley with Alternative H implemented.



Not to scale; locations are approximate.

Figure 3-2. Alternative H Flow Diagram

3.2.2 Alternative H Projected Impacts

3.2.2.1 Tijuana River Main Channel

Constructing the conveyance to redirect the effluent from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment and rehabilitating targeted sewer collectors would reduce transboundary flows and pollutant loadings that enter the U.S. via the Tijuana River.

The estimated impacts on transboundary flows in the Tijuana River main channel for Alternative H are shown in Table 3-5 below. PG estimated these impacts using the methods described in Section B.3 of Appendix B.

Table 3-5. Impacts of Alternative H on Tijuana River Main Channel Transboundary Flows

Parameter of Transboundary Flow in Tijuana River	Current Conditions*	With Alternative H Implemented
Flow days (days/year)	153	70
Percent reduction	*N/A*	*54%*
Flow volume (million gallons/year)	17,500	16,600
Percent reduction	*N/A*	*5%*
BOD_5 load (tons/year)	1,670	585
Percent reduction	*N/A*	*65%*
Sediment load (tons/year)	187,000	186,000
Percent reduction	*N/A*	*<1%*

* "Current conditions" are based on data from January 1, 2016, through December 31, 2019, and therefore do not reflect the upgrades to PB-CILA that commenced in 2020.

PG estimates that Alternative H would reduce the number of days per year with transboundary flow from the current average of 153 days to 70 days. PG assumed the upgraded PB-CILA would continue to shut off when flows in the river exceed 1,000 L/s (approximately 23 MGD), the shutoff threshold specified in PB-CILA's current operational protocol.

EPA estimated that rehabilitating targeted sewer collectors in Tijuana would reduce the flow rate of untreated wastewater into the river by an average of 5 MGD. Based on information from NADB and CESPT, PG estimates the conveyance line from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam would reduce the flow rate in the river by an average of 10.3 MGD. This combined 15.3 MGD reduction would lower the frequency of daily flow rates in the river that exceed the capacity of PB-CILA.

PG estimates that Alternative H would reduce the average annual transboundary BOD_5 load in the river flows by 65%. The BOD_5 reduction in the river was estimated assuming that the rehabilitated collectors provide a 5 MGD reduction in untreated wastewater. Refer to Section 4.4.1 for a sensitivity analysis of the collector repairs' effects on the expected benefits of implementing Alternative H.

3.2.2.2 Discharges to the Pacific Ocean via SAB Creek

Alternative H would reduce the flows and pollutant loadings discharged at SAB Creek by treating additional wastewater from the International Collector, the rehabilitated sewer collectors in Tijuana, and the decommissioned Mexico-side canyon pump stations. Alternative H's estimated impacts on discharges to the Pacific Ocean via SAB Creek are presented in Table 3-6.

Table 3-6. Impacts of Alternative H on Discharges to the Pacific Ocean via SAB Creek

Parameter of Discharges to the Pacific Ocean via SAB Creek	Current Conditions	With Alternative H Implemented
Flow volume (million gallons/year)	13,100	3,600
Percent reduction	*N/A*	*73%*
BOD_5 load (tons/year)	17,200	3,950
Percent reduction	*N/A*	*77%*
Frequency of FIB exceedances at Imperial Beach during the tourist season (hours/year)*	636	165
Percent reduction	*N/A*	*74%*

* The frequency of FIB exceedances was estimated using the results of the Scripps study.

When Alternative H is fully implemented, the discharges at SAB Creek would consist of diverted river water, untreated wastewater from the Playas Pump Station, and untreated wastewater from the International Collector when the capacity of the ITP is exceeded. PG's analysis of the 2016–2019 flow data suggests there may be periods when the flow rate in the International Collector exceeds the capacity of the ITP. Any flows that exceed the ITP's peak treatment capacity would be mixed with diverted river water, pumped from the International Collector to SAB Creek through the parallel conveyance pipelines via PB1-A,[5] and discharged to the Pacific Ocean without treatment. PG determined that implementing Project 5 and Project 7 as part of Alternative H would increase the frequency of river water discharges at SAB Creek. However, Alternative H would reduce the annual BOD_5 load in the diverted river water due to reduced wastewater escaping the Tijuana sanitary sewer system. Table 3-2 is based on the assumption that flows in the International Collector during certain months would exceed the expanded ITP's capacity and would be pumped to SAB Creek. PG used the BOD_5 loads shown in Table 3-2 to estimate that Alternative H would reduce the average flow rate of untreated wastewater discharged to the Pacific Ocean via SAB Creek from 28 MGD to 6.5 MGD (refer to Appendix B, Equation 20). Based on these reduced discharges at SAB Creek and the Scripps study discussed in Section 1.2.3, EPA used the methods discussed in Section B.5 of Appendix B to estimate that Alternative H would reduce the frequency of FIB exceedances at Imperial Beach by 74% during the tourist season.

Beach closures during the non-tourist season (September 9–May 21) can be caused by both untreated wastewater discharges at SAB Creek and transboundary flows in the Tijuana River. PG expects that Alternative H's 65% reduction in the BOD_5 load in transboundary flows in the Tijuana River and 77% reduction in the BOD_5 load to the Pacific Ocean via SAB Creek would reduce the frequency of beach closures during the non-tourist season. Further analysis should be done to quantify the impacts Alternative H would have on beach closures during the non-tourist season.

3.2.2.3 Sediment Impacts

As Table 3-5 shows, PG estimates that implementing Alternative H would reduce the annual transboundary sediment load in the Tijuana River main channel by less than 1%. Most of the annual sediment load enters the Tijuana River in stormwater runoff during heavy rain events. The flow rates in the river that result from these heavy rain events are much higher than PB-CILA's shutoff threshold; therefore, Alternative H would not significantly reduce the annual sediment load that is conveyed to the Tijuana River Valley, Tijuana River Estuary, and the Pacific Ocean. Refer to Section B.3 of Appendix B for details about how PG estimated river sediment loads. Refer to Section 1.2.1.3

[5] For Alternative H, PB1-B is assumed to be decommissioned, and PB1-A would be used for pumping diverted river water and excess flows from the International Collector to SAB Creek.

and the *Baseline Conditions Summary: Technical Document* for details about the flow and sediment transport characteristics of the Tijuana River.

3.2.2.4 Trash Impacts

The trash impacts of Alternative H are expected to be identical to those of Alternative E-2. See Section 3.1.2.4 for details.

3.2.2.5 Canyon Impacts

The regraded U.S.-side canyon flow diversion structures would allow dry-weather transboundary flows in the canyons to enter the drains without pooling. The grated low-flow channels allow CBP agents to traverse the collectors without direct exposure to untreated wastewater. Additionally, the new gravity conveyance lines from the decommissioned Mexico-side canyon pump stations to the ITP may reduce dry-weather transboundary flows in the canyons, further protecting CBP agents working in the canyons. Alternative H is not expected to affect sediment or trash loads in wet-weather flows in the canyons.

3.2.2.6 Effects on Government Operations

IBWC, the current owner of the ITP, will presumably be responsible for operating and maintaining the expanded ITP, the U.S. portion of the new canyon conveyance line, and the trash booms in the main channel. Refer to Section 3.1.4.3 for further discussion about the O&M activities and costs for which IBWC or another U.S.-side designee would be responsible.

Alternative H is expected to benefit CBP operations at the canyons. The upgraded U.S.-side canyon flow diversion structures would support CBP's mission of securing the U.S.-Mexico border by reducing agents' exposure to hazards while patrolling and maintaining border infrastructure in the canyons. However, the trash booms in the main channel may interfere with border security operations due to construction in the main channel, extraction and hauling of trash, and decreased visibility. CBP has also expressed concern that failure to adequately maintain the trash booms may hinder their efforts.

Alternative H is expected to improve health and safety for U.S. Navy personnel at the Naval Training Center in San Diego by reducing untreated wastewater discharges from the Tijuana River and SAB Creek to the Pacific Ocean.

3.2.2.7 Effects on the Public

Alternative H would result in safety-related and water quality–related public benefits in the U.S. including reduced risks to human health, restored use of recreational resources (beaches and, to a lesser extent, parks in the Tijuana River Valley), and reduced odor. Potential economic benefits in coastal communities include increased property values, pedestrian traffic, and tourism due to reduced beach closures.

Alternative H would also result in safety-related and water quality–related public benefits in the City of Tijuana. Rehabilitating and upgrading collectors in the city would reduce human exposure to untreated wastewater that escapes from the Tijuana sanitary sewer system. The reduction in untreated wastewater discharges at SAB Creek discussed in Section 3.2.2.2 would likely improve water quality at the beaches in Tijuana, potentially enhancing recreational and economic opportunities in the nearby coastal communities.

Alternative H is not expected to have substantial construction-related effects on the public. Temporary effects in the U.S. would include increased traffic at the interchange between I-5 and Dairy Mart Road, which currently experiences delays due to congestion, and potential closures of portions of Monument Road during construction of the conveyance line for canyon flows.

Alternative H could result in localized, recurring negative effects on the public due to long-term operational changes and requirements. These effects could include odor impacts from the expanded ITP; visual, odor, and disease vector impacts due to the consolidation of trash in the Tijuana River trash booms; and occasional noise impacts from the removal and hauling of captured trash. These factors could affect property values in nearby communities.

The long-term public benefits in the U.S. described above are expected to primarily benefit coastal communities, which generally have fewer people of color and low-income populations than state averages. The temporary and long-term potential U.S. adverse effects described above are expected to primarily affect 1) communities near the interchange between I-5 and Dairy Mart Road (for traffic-related effects), which have more people of color and low-income populations than state averages, and 2) communities near the Tijuana River upstream of Dairy Mart Road, which have more people of color than state averages and a mixed prevalence of low-income populations relative to those averages.

The NEPA documentation (currently being developed by ERG and EPA) will provide an in-depth assessment of the projects within Alternative H and their short-term and long-term impacts on the general public.

3.2.2.8 Energy Consumption

PG estimated the net change in the energy requirements in the Tijuana River watershed by examining the energy needed for additional treatment units, pumping, and hauling waste, shown in Table 3-7 below. PG calculated the change in energy consumption using the methods outlined in Appendix B.

Table 3-7. Summary of Alternative H Annual Energy Impacts

Energy Source and Description	Change in Annual Energy Requirements (kWh)	Change in Annual Energy Costs*
U.S. Energy Requirements		
Expanded ITP: Blowers, mixers, other mechanical equipment, heating for digesters, trucking energy for sediment/sludge disposal, and process control and auxiliary electrical equipment	19,000,000	$3,800,000
Trash booms: Trucking energy requirements to dispose of collected trash	233,000	$46,600
Change in U.S. annual energy requirements	**19,233,000**	**$3,846,600**
Mexico Energy Requirements		
PB-CILA: Reduction in total flows pumped by PB-CILA	-694,000	-$69,400
PB1-A/B: Reduction in flows being pumped at PB1-A and PB1-B	-14,000,000	-$1,400,000
Canyon pump stations: Decommissioning of Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations	-2,290,000	-$229,000
New effluent pump station: Energy requirements to pump flows from Arturo Herrera and La Morita WWTPs to Rodriguez Dam	1,140,000	$114,000
Change in Mexico annual energy requirements**	**-15,844,000**	**-$1,584,400**

Energy Source and Description	Change in Annual Energy Requirements (kWh)	Change in Annual Energy Costs*
Total Energy Requirements		
Total change in annual energy requirements	**3,389,000**	**$2,262,200**

* PG calculated energy costs by assuming a cost of electricity of $0.20 per kWh for infrastructure in the U.S. and $0.10 per kWh for infrastructure in Mexico.

** This number does not reflect the energy savings to Mexico involved in having to treat less wastewater at SABTP.

The increased U.S.-side energy requirements from the expanded ITP could be fully offset if equipment is installed to convert the methane produced in the digesters at the ITP into electrical power. The considerations for potential power generation using digester gases are discussed further in the Project 3 *Feasibility Analysis Technical Memorandum*.

3.2.2.9 Other Unquantified Impacts

By removing treated effluent from the Tijuana River in Mexico, Alternative H would reduce the frequency and volume of transboundary flows to the river's lower reaches, particularly during the dry season. Reduced river flows and infiltration to groundwater in these areas could affect riparian vegetation and habitats in the Tijuana River Estuary.

3.2.3 Alternative H Cost Analysis

The estimated implementation costs for Alternative H are based on the individual project cost estimates that PG developed as part of the *Feasibility Analysis Technical Memoranda* for Projects 1 through 10. Refer to Appendix B and PG's *Baseline Conditions Summary: Technical Document* for an in-depth description of PG's cost estimating procedures, degree of accuracy, and assumptions. The annual O&M costs displayed here are annualized 40-year life cycle infrastructure cost estimates. All cost estimates are expressed in 2021 U.S. dollars. Refer to Section 2.2 for more details on the basis of the capital and O&M cost sharing structure shown in Table 3-8. Cost shares and splits are for analysis only, and do not represent government commitments.

Table 3-8. Alternative H Implementation Cost Estimate

	U.S. Share	Mexico Share	Total
Capital Cost:	$ 335,500,000 (91%)	$ 32,500,000 (9%)	$ 368,000,000
Annual O&M Cost:	$ 9,000,000 (80%)	$ 2,300,000 (20%)	$ 11,300,000
40-Year Life Cycle Cost:	$ 694,000,000 (85%)	$ 123,100,000 (15%)	$ 817,100,000

Of the estimated total $335.5 million U.S. share of capital cost for Alternative H, the U.S. would expend $303.0 million for infrastructure built in the U.S. and $32.5 million for infrastructure built in Mexico. Mexico would match the U.S. contribution, for a total of about $65 million spent on infrastructure in Mexico.

Alternative H would reduce Mexican entities' O&M costs for several existing facilities. The estimated O&M costs displayed in Table 3-8 above do not account for these savings. Wastewater that is currently pumped to SAB Creek via PB1-B would be redirected to flow by gravity to the expanded ITP, so CESPT would no longer need to operate PB1-B. Therefore, CESPT would no longer incur the cost of energy and other expenses associated with operating and maintaining the pump station. Additionally, the wastewater that is currently pumped to SAB Creek from the Mexico-side canyon pump stations would flow by gravity to the ITP. As a result, the Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations could be decommissioned, eliminating the cost of operating and maintaining them. PG estimates that Mexico's annual energy cost savings from implementing Alternative H (shown in Table 3-7) would be approximately $1.6 million, which would help offset some of Mexico's share of the Alternative H annual O&M costs. Also, the parallel conveyance pipelines would carry less flow, potentially creating the opportunity to decommission one of the pipelines and eliminate the cost of operating and maintaining it.

3.2.3.1 Opportunities for Capital Cost Savings

For many WWTP expansion projects, the new treatment units can be installed as they become needed in response to population growth, thereby postponing some of the capital expenditure. However, PG expects that a phased expansion of the ITP would not be practical for Alternative H because the full expanded 50 MGD capacity would be needed relatively soon. Additionally, PG did not identify any overlap in the equipment and infrastructure that would be constructed as part of the individual Alternative H project elements. The engineering analyses that would be performed during the preliminary and final design efforts for Alternative H, if selected, may reveal new opportunities for capital cost savings.

The Project 6 cost estimate that PG used in the Alternative H capital cost includes a trash boom in Stewart's Drain in addition to the main channel. However, the Stewart's Drain trash boom may not be necessary due to the existing grate at the ITP that provides trash screening for flows in Stewart's Drain. Therefore, it may be possible to reallocate some of the Alternative H capital cost for trash booms to other project components.

3.2.4 Alternative H Implementation Considerations

3.2.4.1 Future Population Considerations

PG estimates that 45.5 MGD of wastewater would be received at the expanded ITP (50 MGD capacity) when Alternative H is fully implemented. Therefore, the expanded ITP would have an additional 5 MGD of reserve capacity to accommodate future population growth in Tijuana. According to a 2020 study by NADB, the 5 MGD of additional reserve capacity at the ITP would accommodate future populations up to 2030 (NADB-EPA-CESPT 2020). The NADB report predicts that by 2050, the population growth in the City of Tijuana would generate an additional 14 MGD of untreated wastewater in the International Collector compared to current conditions. Correspondence with NADB indicated that future population growth in Smuggler's Gulch and Goat Canyon is likely to require 1 MGD of additional treatment. Additionally, NADB indicated that wastewater flows to the Playas Pump Station from coastal communities are expected to grow by approximately 20% (0.4 MGD) by 2050. An additional ITP expansion, upgrades to one or more of the existing treatment plants in Mexico (Arturo Herrera, La Morita, or SABTP), or a new treatment plant would be needed to treat the additional wastewater expected to be produced in 2050.

The new conveyance line from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam would prevent treated effluent from mixing with the untreated wastewater that is discharged into the river and make it available for future water reuse. Additional treatment would be necessary for these flows to be reused as a potable resource from the Rodriguez Dam impoundment. Refer to the Project 7 *Feasibility Analysis Technical Memorandum* for more details on the feasibility of reuse.

3.2.4.2 Implementation Timeline

The canyon flow diversion structure upgrades and trash booms have minimal interdependencies with other project elements, allowing flexibility with respect to the order in which they are constructed. Other project elements in Alternative H share operational interdependencies, but this does not affect the order in which they can be constructed. For example, construction of the conveyance line from the canyon pump stations in Mexico to the ITP could likely take place before the ITP expansion is completed (due to less burdensome design and permitting requirements). However, until there is capacity at the ITP to treat these additional flows of wastewater, the untreated wastewater from the canyon pump stations would continue to be pumped to SAB Creek and discharged without treatment to the Pacific Ocean. Similarly, the targeted sewer collector rehabilitations in Tijuana can likely take place before the ITP expansion and would improve the water quality of the river. However, until there is capacity at the ITP to treat these additional flows of wastewater, they would be pumped to SAB Creek and discharged without treatment to the Pacific Ocean.

The ITP's potential treatment capacity is currently limited by a lack of solids processing and disposal capacity. Prioritizing expansion of the solids processing units may allow the ITP to treat up to 5 MGD more wastewater from the International Collector while the rest of the plant is being expanded.

The implementation timeline of Alternative H would be largely dependent on the environmental review and consultation processes for the individual project elements. Based on recent discussions with EPA, ERG anticipates the following timelines to prepare NEPA documentation for the project elements in Alternative H:

- As discussed in Section 3.1.4.2, NEPA documentation for the U.S.-side canyon flow diversion structure upgrades at Smuggler's Gulch and Goat Canyon could likely be implemented relatively quickly (approximately six months).
- Four project elements—1) ITP expansion, 2) rehabilitation of targeted sewer collectors in Tijuana, 3) construction of the conveyance system to send flows from the Mexico-side canyon pump stations to the ITP for treatment, and 4) installation of a trash boom in the Tijuana River—are expected to be fully addressed in a Programmatic EIS, which would take approximately one year to complete.
- The project to construct conveyance lines from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment would likely require more detailed analysis in a Tiered EA or EIS (approximately two years, including the Programmatic EIS) to fully address environmental, public health, and safety concerns.

As discussed in Section 3.1.4.2, most project elements in the U.S. are expected to require a CEQA EIR following completion of the NEPA review. EPA intends to facilitate this process by preparing NEPA documents that address CEQA content requirements and can therefore be adopted by the state or local agencies.

Project elements in Mexico are expected to require additional review in the form of a MIA, subject to approval by SEMARNAT. EPA has not evaluated the timeline implications of MIA review for the USMCA project.

3.2.4.3 O&M Requirements

The estimated annual O&M costs associated with implementing Alternative H are presented in Table 3-8. USMCA funding is only available for capital expenditures; therefore, the recurring costs associated with operating and maintaining the new and modified infrastructure constructed as part of Alternative H would fall to the entities that are agreed upon prior to implementation. These O&M costs would include costs of equipment and materials for day-to-day operations and preventative maintenance, staff labor, energy and other utilities, waste disposal fees, equipment replacements at end of service life, and other costs associated with operating and maintaining water infrastructure. Refer to the *Baseline Conditions Summary: Technical Document* for more information about who is responsible for operating and maintaining existing infrastructure in the watershed.

For this analysis, the IBWC is presumed to be responsible for operating and maintaining the expanded treatment plant, the U.S. portion of the new canyon conveyance line, and the Tijuana River trash booms. The ITP's total annual O&M expenditures are expected to increase by about 75% (from $14.3 million to $25 million). The current staff of 25 people would need to be expanded to about 65 people (an increase of about 140%). The plant currently has four Grade V certified operators, two Grade IV certified operators, and two Grade III certified operators. PG estimates that IBWC would need to hire four more Grade IV certified operators and four more Grade III certified operators to operate the expanded ITP. IBWC would also be responsible for maintaining the U.S. section of the conveyance line from the canyon pump stations to the ITP and the main channel trash booms. PG estimates that the combined annual O&M cost for these two project elements would be $800,000. The majority of the trash booms' O&M cost is for removing and disposing of waste collected by the trash booms and is dependent on the volume of trash that is collected. As discussed in Section 1.2.1.3, data on trash loads in the river are currently limited and more monitoring in the river is needed to better estimate how much trash would require disposal.

IBWC's additional responsibilities would likely include furnishing trucks and drivers to haul solid waste from the trash booms and covering the cost to dispose of the waste (landfill tipping fees). PG estimates the trash booms would require an annual average of 700 truck trips to dispose of collected trash from the trash booms. The costs for trucking and disposal are included in the estimated increase in O&M costs for IBWC described above.

For purposes of this analysis, the current responsible agencies for O&M of infrastructure in Mexico were assumed to remain the same. CESPT is currently responsible for furnishing trucks and drivers to dispose of waste sludge from the ITP, and it is expected that CESPT would retain this responsibility. PG estimates that the ITP expansion would increase the number of truck trips annually for solids disposal from 2,900 to 3,200. The expanded ITP would produce more solids, but the increase in solids is partially offset by the installation of anaerobic digesters, which would destroy about half of the sludge solids.

CESPT is expected to be responsible for operating and maintaining the portion of the new canyon gravity conveyance system that is located in Mexico. Additionally, CESPT would continue to maintain the entire sanitary collection system in Tijuana, including the rehabilitated collectors. CESPT is also expected to be responsible for O&M of all water reuse infrastructure downstream of the Arturo Herrera and La Morita WWTP discharges. Once in the reservoir, the water would fall under CONAGUA's jurisdiction for treatment and distribution. However, CESPT would see an overall reduction in O&M responsibilities because untreated wastewater that currently must be pumped to SAB Creek would instead flow by gravity to the ITP.

Under contract from CESPT, CILA would remain responsible for operating PB-CILA. The overall flow pumped to PB-CILA would be reduced, but PB-CILA would operate more frequently.

3.2.4.4 Implementation Challenges

This section provides a summary of the implementation challenges associated with Alternative H. Further analysis of how these challenges impact all three final alternatives are discussed in Section 4.4.

The impacts of Alterative H on transboundary river flows and discharges to the Pacific Ocean via SAB Creek are dependent on the effectiveness of the collector repairs at reducing untreated wastewater discharges to the Tijuana River. PG evaluated the impacts of Alternative H based on EPA's estimate that rehabilitating targeted sewer collectors in Tijuana would reduce the average flow of wastewater into the Tijuana River from 10 MGD to 5 MGD. However, limited data are available regarding the effectiveness of collector repairs at reducing wastewater discharges into the river, and sustaining this reduction would require increased O&M in Mexico. Alternative H would reduce untreated wastewater flows from entering the river, which would reduce energy requirements at PB-CILA and PB1-A to help offset the increased O&M costs for the sanitary sewer system.

Information about the structural condition of Rodriguez Dam, as well as available capacity in the impoundment, was not available to PG. Therefore, a comprehensive evaluation of the dam must be performed to ensure that it is structurally able to withstand the increased water levels that may result from the WWTP discharges to the dam impoundment area. If the dam is unable to hold the WWTP discharges, these flows would remain in the river, resulting in decreased performance of Alternative H. Section 4.4.2 explores the impacts of each final alternative with and without rerouting the WWTP effluents to the Rodriguez Dam impoundment.

PG evaluated the impacts of Alternative H using a shutoff threshold of 23 MGD for PB-CILA, as specified in the current operational protocol. The recent upgrades to PB-CILA are expected to enable up to the 35 MGD of river flows to be diverted, but the operational protocol of PB-CILA would have to be modified to operate at flow rates above 23 MGD.

The expanded ITP would require a modification to its current NPDES permit to discharge the increased volume of effluent from the SBOO. It is expected that the permit would continue to require the ITP's effluent to meet secondary treatment standards.

3.3 Alternative I-2

3.3.1 Alternative I-2 Description

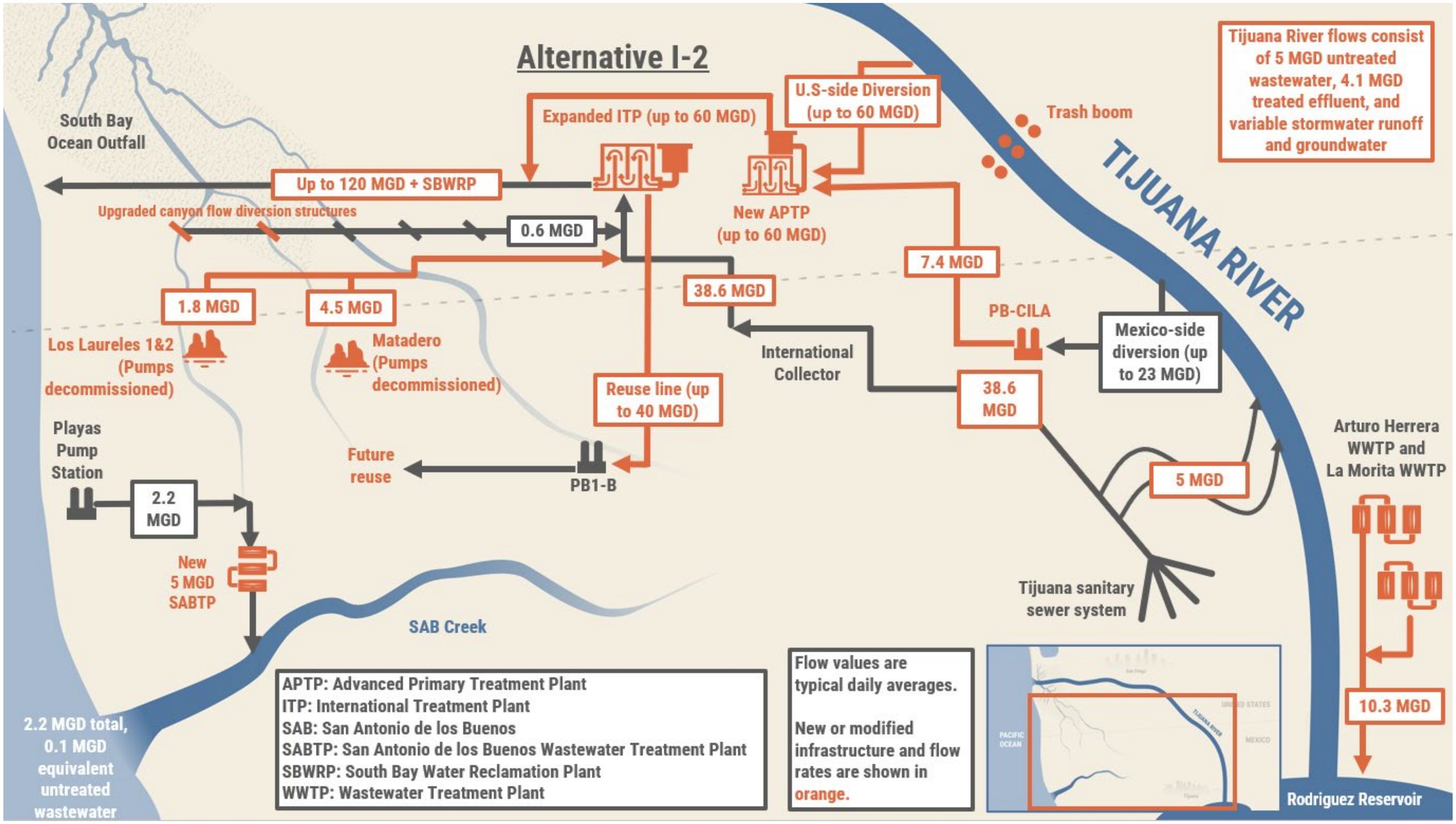
Alternative I-2 would treat all wastewater flows that are currently discharged untreated to the Pacific Ocean via SAB Creek and would minimize the flows of untreated wastewater in the Tijuana River. The expanded ITP and the new SABTP would have a combined capacity to accommodate current wastewater flows and future wastewater flows from population growth in the City of Tijuana through approximately 2050. Alternative I-2 also provides advanced primary treatment for Tijuana River flows diverted at PB-CILA and at a new U.S.-side river diversion. It would reduce transboundary flows by removing treated effluent from the Arturo Herrera and La Morita WWTPs from the river and rehabilitating sewer collectors in Tijuana to prevent leaks of untreated wastewater. By eliminating flows from PB-CILA and the International Collector to the SAB Creek outfall, Alternative I-2 would eliminate discharges of untreated wastewater to SAB Creek, which is predicted to reduce beach closures during northward currents in the Pacific Ocean. Alternative I-2 would also upgrade the canyon flow diversion structures to reduce pooling of untreated wastewater in Goat Canyon and Smuggler's Gulch. Adding trash booms would remove trash from wet-weather flows in the main channel. The majority of the infrastructure of Alternative I-2 is in the U.S. Alternative I-2 is composed of the following infrastructure project elements, presented in descending order of estimated capital costs:

- **Expand the ITP to treat an average daily flow of 60 MGD (USMCA Project 3).** Currently, the ITP is undersized to treat all the wastewater in the International Collector. Expanding the ITP to treat an average daily flow rate of 60 MGD would enable it to treat all current wastewater flows in the International Collector, wastewater that would be collected by the repaired and improved collection system in Tijuana, and wastewater collected in the canyons in Mexico. The expanded plant is expected to have capacity for current and projected wastewater flows through 2050. The treated effluent would be discharged to the Pacific Ocean via the SBOO.
- **Construct a new 60 MGD diversion and APTP to divert and treat transboundary flows from the Tijuana River (USMCA Project 1).** Currently, contaminated river flows that are not diverted at PB-CILA flow across the U.S.-Mexico border and into the Tijuana River Valley. A new U.S.-side diversion system and APTP would divert and treat up to 60 MGD of river flows when the river's flow rate is under 120 MGD. The treated effluent would be discharged to the Pacific Ocean via the SBOO. The U.S.-side diversion would provide redundancy as a backup diversion to PB-CILA while also providing more diversion capacity. The U.S.-side diversion would only operate when PB-CILA is shut off.
- **Construct a new treatment plant at the site of the SABTP (USMCA Project 8).** Currently, the SABTP is not fully equipped to provide secondary treatment to the flows conveyed to the plant and is in disrepair. Constructing a new 5 MGD plant in place of the existing SABTP would treat wastewater flows from the Playas Pump Station.
- **Construct a new gravity conveyance system to bring flows from the Los Laureles 1, Los Laureles 2, and Matadero Pump Stations to the ITP for treatment (USMCA Project 4).** Currently, wastewater flows from these pump stations are conveyed to the SABTP, where they receive little or no treatment before being discharged into the Pacific Ocean. Decommissioning the pump stations and constructing a new gravity conveyance system to bring these flows to the ITP for treatment would decrease the flow rate of untreated wastewater discharged at SAB Creek. Additionally, the new gravity lines would operate more reliably than the existing pump stations, which may reduce flows of untreated wastewater that escape the pump stations and flow into the U.S.
- **Construct new infrastructure to convey treated effluent from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam (USMCA Project 7).** Currently, treated effluent from these two treatment plants (totaling approximately 10.3 MGD) is discharged into the river. Rerouting the already-treated effluent to the Rodriguez Dam impoundment would free up downstream pumping and treatment capacity in the system while also providing a source of water that could be beneficially reused by Mexico in the future.
- **Rehabilitate targeted sewer collectors in Tijuana (USMCA Project 5).** Currently, an estimated average of 10 MGD of untreated wastewater flows into the Tijuana River from damaged sewer collectors and other sources. Alternative I-2 includes $13.5 million for sewer collector rehabilitation in Tijuana. Based on information from NADB and CESPT, EPA estimated that this level of rehabilitation would prevent 5 MGD of wastewater from

escaping the collection system, thus allowing it to be conveyed to the expanded ITP for treatment.

- **Construct a new effluent pumping station and force main to convey effluent from the ITP to PB1-B for future reuse (USMCA Project 3).** Currently, all effluent from the ITP is discharged to the Pacific Ocean via the SBOO. Entities in Mexico have expressed interest in reusing the effluent from the ITP to help satisfy increasing water demands. Constructing a new effluent pump station and force main from the ITP to PB1-B would return the effluent to Mexico for potential reuse options.
- **Rehabilitate and extend the existing force main to redirect flows from PB-CILA to the APTP (USMCA Project 2).** Currently, river water that is diverted at PB-CILA is conveyed to PB1-A, then ultimately discharged at SAB Creek. The rehabilitated and extended force main would redirect diverted river water from PB-CILA to the APTP. Redirecting the diverted river water would reduce untreated wastewater discharges from SAB Creek and allow PB1-A to be decommissioned.
- **Install trash booms in the Tijuana River main channel on the U.S. side to capture trash in the river (USMCA Project 6).** Currently, wet-weather flow events convey heavy loadings of trash across the U.S.-Mexico border via the Tijuana River main channel. Installing trash booms in the main channel, similar to those currently installed at Smuggler's Gulch and Goat Canyon, would reduce the volume of trash that the river conveys into the Tijuana River Valley, the Tijuana River Estuary, and the Pacific Ocean.
- **Regrade and modify the U.S.-side canyon flow diversion structures at Smuggler's Gulch and Goat Canyon (USMCA Project 4).** Currently, the canyon flow diversion structures allow dry-weather transboundary flows of untreated wastewater to pool before flowing into the conveyance that leads to the ITP. These pools of wastewater create odors, vector breeding grounds, and safety hazards for CBP agents who patrol and maintain the international border. Regrading and modifying the canyon flow diversion structures would reduce pooling at the grates, enabling easier and safer maintenance. Modifications would include grated low-flow channels that would allow CBP agents to traverse the collector approach pads without direct exposure to untreated wastewater.

Refer to the applicable *Feasibility Analysis Technical Memoranda* for more detail about the project elements that constitute Alternative I-2. Figure 3-3, below, displays the estimated flow conditions in the Tijuana River Valley with Alternative I-2 fully implemented.



Not to scale; locations are approximate.

Figure 3-3. Alternative I-2 Flow Diagram

3.3.2 Alternative I-2 Projected Impacts

3.3.2.1 Tijuana River Main Channel

The new U.S.-side river diversion system would increase the capture of main channel flows relative to what PB-CILA currently captures. Redirecting the effluent from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment and rehabilitating targeted sewer collectors would further reduce transboundary flows and pollutant loadings that enter the U.S. via the Tijuana River.

The estimated impacts on transboundary flows in the Tijuana River main channel for Alternative I-2 are shown in Table 3-9 below. PG estimated these impacts using the methods described in Section B.3 of Appendix B.

Table 3-9. Impacts of Alternative I-2 on Tijuana River Transboundary Flows

Parameter of Transboundary Flow in Tijuana River	Current Conditions*	With Alternative I-2 Implemented
Flow days (days/year)	153	36
Percent reduction	*N/A*	*76%*
Flow volume (million gallons/year)	17,500	13,800
Percent reduction	*N/A*	*21%*
BOD_5 load (tons/year)	1,670	214
Percent reduction	*N/A*	*87%*
Sediment load (tons/year)	187,000	184,000
Percent reduction	*N/A*	*2%*

* "Current conditions" are based on data from January 1, 2016, through December 31, 2019, and therefore do not reflect the upgrades to PB-CILA that commenced in 2020.

PG estimates that Alternative I-2 would reduce the number of days per year with transboundary flow from the current average of 153 days to 36 days. PG assumed the upgraded PB-CILA would continue to shut off when flows in the river exceed 1,000 L/s (approximately 23 MGD), the shutoff threshold specified in PB-CILA's current operational protocol. The U.S.-side diversion would divert up to 60 MGD of river water and would operate at local river flow rates up to 120 MGD. Therefore, the U.S.-side diversion would provide redundancy as a backup diversion to PB-CILA while also providing more diversion capacity. River flows diverted in the U.S. would be pumped directly to the APTP for treatment. River flows diverted in Mexico would also be pumped to the new APTP in the U.S., rather than being left untreated and diverted to the coast via SAB Creek.

EPA estimated that rehabilitating targeted collectors in Tijuana would reduce the flow rate of untreated wastewater into the river by an average of 5 MGD. Based on information from NADB and CESPT, PG estimates the conveyance line from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam would reduce the flow rate in the river by an average of 10.3 MGD. This combined 15.3 MGD reduction would lower the frequency of daily flow rates that exceed the capacity of the upgraded PB-CILA and the U.S.-side river diversion.

PG estimates that Alternative I-2 would reduce the average annual transboundary BOD_5 load in the river by 87%. The BOD_5 reduction in the river was estimated assuming that the rehabilitated collectors provide the estimated 5 MGD reduction in untreated wastewater discharged to the river. Refer to Section 4.4.1 for a sensitivity analysis of the collector repairs on the expected benefits of implementing Alternative I-2.

3.3.2.2 Discharges to the Pacific Ocean via SAB Creek

Alternative I-2 would reduce the flows and pollutant loadings discharged at SAB Creek by treating wastewater from the International Collector, the Mexico-side canyon pump stations, and the untreated wastewater that is removed from the river as a result of targeted collector rehabilitations. Alternative I-2's estimated impacts on discharges to the Pacific Ocean via SAB Creek are presented in Table 3-10.

Table 3-10. Impacts of Alternative I-2 on Discharges to the Pacific Ocean via SAB Creek

Parameter of Discharges to the Pacific Ocean via SAB Creek	Current Conditions	With Alternative I-2 Implemented
Flow volume (million gallons/year)	13,100	800
Percent reduction	*N/A*	*94%*
BOD_5 load (tons/year)	17,200	54
Percent reduction	*N/A*	*>99%*
Frequency of FIB exceedances at Imperial Beach during the tourist season (hours/year)*	636	32
Percent reduction	*N/A*	*>95%*

* The frequency of FIB exceedances was estimated using the results of the Scripps study.

Alternative I-2 is expected to provide treatment for all the diverted river water and untreated wastewater from the ITP, the canyons, and the coastal communities up to 2050. The discharges at SAB Creek would only consist of treated effluent from the new SABTP (an average daily flow rate of approximately 2.2 MGD). The effluent discharged from the new SABTP is expected to be high quality (96% reduction in BOD_5 concentration and 96.5% reduction in total suspended solids).

PG used the BOD_5 loads shown in Table 3-2 to estimate that Alternative I-2 would reduce the average flow rate of untreated wastewater discharged to the Pacific Ocean via SAB Creek from 28 MGD to 0.1 MGD[6] (refer to Appendix B, Equation 20). Based on these reduced discharges at SAB Creek and the Scripps study discussed in Section 1.2.3, EPA used the methods discussed in Section B.5 of Appendix B to estimate that Alternative I-2 would reduce the frequency of FIB exceedances at Imperial Beach by approximately 95% during the tourist season.

Beach closures during the non-tourist season (September 9–May 21) can be caused by both untreated wastewater discharges at SAB Creek and transboundary flows in the Tijuana River. PG expects that Alternative I-2's 87% reduction in the BOD_5 load in transboundary flows in the Tijuana River and 99% reduction in the BOD_5 load to the Pacific Ocean via SAB Creek would reduce the frequency of beach closures during the non-tourist season. Further analysis should be done to quantify the impacts Alternative I-2 would have on beach closures during the non-tourist season.

3.3.2.3 Sediment Impacts

As Table 3-9 shows, PG estimates that implementing Alternative I-2 would reduce the annual transboundary sediment load in the Tijuana River main channel by 2%. Most of the annual sediment load enters the river in stormwater runoff during heavy rain events. The flow rates in the river that result from these heavy rain events are much higher than either diversion's shutoff threshold; therefore, Alternative I-2 would not significantly reduce the annual sediment load that is

[6] Flows discharged into SAB Creek would consist of approximately 2.2 MGD of secondary treated effluent, which would have a BOD_5 load equivalent to approximately 0.1 MGD of untreated wastewater.

conveyed to the Tijuana River Valley, Tijuana River Estuary and the Pacific Ocean. Refer to Section B.3 of Appendix B for details about how PG estimated river sediment loads. Refer to Section 1.2.1.3 and the *Baseline Conditions Summary: Technical Document* for details about the flow and sediment transport characteristics of the Tijuana River.

3.3.2.4 Trash Impacts

The trash impacts of Alternative I-2 are expected to be identical to those of Alternatives E-2 and H. See Section 3.1.2.4 for details.

3.3.2.5 Canyon Impacts

The canyon impacts of Alternative I-2 are expected to be identical to those of Alternative H. See Section 3.2.2.5 for details.

3.3.2.6 Effects on Government Operations

Alternative I-2's effects on government operations are expected to be similar to those of Alternative E-2. See Section 3.1.2.6 for details.

3.3.2.7 Effects on the Public

Alternative I-2 would result in safety-related and water quality–related public benefits in the U.S. including reduced risks to human health, restored use of recreational resources (beaches and parks in the Tijuana River Valley), and reduced odor. Potential economic benefits in coastal communities include increased property values, pedestrian traffic, and tourism due to reduced beach closures.

Alternative I-2 would also result in safety-related and water quality–related public benefits in the City of Tijuana. Rehabilitating and upgrading collectors in Tijuana would reduce human exposure to untreated wastewater that escapes from the Tijuana sanitary sewer system. The reduction in untreated wastewater discharges at SAB Creek discussed in Section 3.3.2.2 would improve water quality at the beaches in Tijuana, potentially enhancing recreational and economic opportunities in the nearby coastal communities.

Alternative I-2 is not expected to have substantial construction-related effects on the public. Temporary effects in the U.S. would include increased traffic at the interchange between I-5 and Dairy Mart Road, which currently experiences occasional delays due to congestion, and potential closures of portions of Monument Road during construction of the conveyance line for canyon flows.

Alternative I-2 could result in localized, recurring negative effects on the public due to long-term operational changes and requirements. These effects could include odor impacts from the expanded ITP and new APTP; visual, odor, and disease vector impacts due to the consolidation of trash in the Tijuana River trash booms; noise and traffic impacts from frequent hauling of sludge and sediment from the new APTP (see Section 3.3.4.3); and occasional noise impacts from the removal and hauling of captured trash. These factors could affect property values in nearby communities.

The long-term public benefits in the U.S. described above are expected to primarily benefit coastal communities, which generally have fewer people of color and low-income populations than state averages. The temporary and long-term potential U.S. adverse effects described above are expected to primarily affect 1) communities near the interchange between I-5 and Dairy Mart Road (for traffic-related effects), which have more people of color and low-income populations than state averages, and 2) communities near the Tijuana River upstream of Dairy Mart Road, which have more people of color than state averages and a mixed prevalence of low-income populations relative to those averages.

The NEPA documentation (currently being developed by ERG and EPA) will provide a more in-depth assessment of the projects within Alternative I-2 and their short-term and long-term impacts on the general public.

3.3.2.8 Energy Consumption

PG estimated the net change in the energy requirements in the Tijuana River watershed by examining the additional energy needed for additional treatment units, pumping, and hauling waste, shown in Table 3-11. PG calculated the change in energy consumption using the methods outlined in Appendix B.

Table 3-11. Summary of Alternative I-2 Annual Energy Impacts

Energy Source and Description	Change in Annual Energy Requirements (kWh)	Change in Annual Energy Costs*
U.S. Energy Requirements		
Expanded ITP: Blowers, mixers, other mechanical equipment, heating for digesters, trucking energy for sediment/sludge disposal, and process control and auxiliary electrical equipment	25,500,000	$5,100,000
New 60 MGD APTP: Blowers, mixers, other mechanical equipment, trucking energy for sediment/sludge disposal, and process control and auxiliary electrical equipment	3,910,000	$782,000
New U.S.-side river diversion: Pumping requirements for the new U.S.-side diversion	305,000	$61,000
Trash booms: Trucking energy requirements to dispose of collected trash	233,000	$46,600
Change in U.S. annual energy requirements	**29,948,000**	**$5,989,600**
Mexico Energy Requirements		
PB-CILA: Reduction in total flows pumped by PB-CILA	-694,000	-$69,000
PB1-A/B: Reduction in flows being pumped at PB1-A and PB1-B	-19,800,000	-$1,980,000
Canyon pump stations: Decommissioning of Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations	-2,290,000	-$229,000
New effluent pump station: Energy requirements to pump flows from Arturo Herrera and La Morita WWTPs to Rodriguez Dam	1,140,000	$114,000
SABTP: Energy Requirements to treat flows from the Playas Pump Station	6,120,000	$612,000
Change in Mexico annual energy requirements**	**-15,524,000**	**-$1,552,400**
Total Energy Requirements		
Total change in annual energy requirements	**14,424,000**	**$4,437,200**

* PG calculated energy costs by assuming a cost of electricity of $0.20 per kWh for infrastructure in the U.S. and $0.10 per kWh for infrastructure in Mexico.

** This number does not reflect the energy savings to Mexico involved in having to treat less wastewater at SAB.

The increased U.S.-side energy requirements from the expanded ITP could be fully offset if equipment is installed to convert the methane produced in the digesters at the ITP into electrical power. The considerations for potential power generation using digester gases are discussed further in the Project 3 *Feasibility Analysis Technical Memorandum*.

3.3.2.9 Other Unquantified Impacts

By diverting a significant portion of wet-weather transboundary flows from the main channel (up to 60 MGD during river flow rates of up to 120 MGD), Alternative I-2 would reduce the frequency and volume of transboundary flows to the river's lower reaches during both the dry season and wet season. Removing treated effluent from the Tijuana River in Mexico would further reduce this frequency. Reduced river flows and infiltration to groundwater in these areas could affect riparian vegetation and habitats in the Tijuana River Estuary.

3.3.3 Alternative I-2 Cost Analysis

The estimated implementation costs for Alternative I-2 are based on the individual project cost estimates PG developed as part of the *Feasibility Analysis Technical Memoranda* for Projects 1 through 10. Refer to Appendix B and the *Baseline Conditions Summary: Technical Document* for an in-depth description of PG's cost estimating procedures, degree of accuracy, and assumptions. The annual O&M costs shown below are annualized 40-year life cycle infrastructure cost estimates. All cost estimates are expressed in 2021 U.S. dollars. Refer to Section 2.2 for more details on the basis of the capital and O&M cost sharing structure shown in Table 3-12. Cost shares and splits are for analysis only, and do not represent government commitments.

Table 3-12. Alternative I-2 Implementation Cost Estimate

	U.S. Share	Mexico Share	Total
Capital Cost:	$ 561,200,000 (89%)	$ 66,100,000 (11%)	$ 627,300,000
Annual O&M Cost:	$ 20,300,000 (79%)	$ 5,300,000 (21%)	$ 25,600,000
40-Year Life Cycle Cost:	$ 1,374,00,000 (83%)	$ 278,000,000 (17%)	$ 1,652,000,000

Of the estimated total $561.2 million U.S. share of capital cost for Alternative I-2, the U.S. would expend $495.1 million for infrastructure built in the U.S. and $66.1 million for infrastructure built in Mexico. Mexico would match the U.S. contribution, for a total of about $132.2 million spent on infrastructure in Mexico.

Alternative I-2 would reduce Mexican entities' O&M costs for several existing facilities. The estimated O&M costs displayed in Table 3-12 above do not account for these savings. Because river flows diverted at PB-CILA would be conveyed to the APTP, PB1-A could be decommissioned. Therefore, CESPT would no longer incur the cost of energy and other expenses associated with operating and maintaining PB1-A. As shown in Table 3-11, PG estimates that Mexico's annual energy cost savings from implementing Alternative I-2 would be approximately $1.6 million per year, which would help offset some of Mexico's share of the Alternative I-2 annual O&M costs. There would also be savings in labor and other O&M costs, but sufficient information regarding these costs was not available to PG. Wastewater that is currently pumped to SAB Creek via PB1-B would be redirected to flow by gravity to the expanded ITP. However, CESPT would need to continue operating PB1-B for reuse and would therefore continue to incur the cost of energy and other O&M costs associated with operating PB1-B. Also, a section of one of the two parallel conveyance pipelines would continue to be required to transport flows from the Playas Pump Station to the SABTP. The other pipeline would be repurposed to convey treated effluent. Therefore, a section of one of the parallel conveyance pipelines could be decommissioned thereby eliminating the cost of operating and maintaining it.

3.3.3.1 Opportunities for Capital Cost Savings

Because of common project components shared between the alternatives, Alternative E-2 or H could be the initial phase of Alternative I-2 if it were fully implemented, helping to spread out the capital investment over time. See Section 4.7 for more details.

The Project 6 cost estimate that PG used in the Alternative I-2 capital cost includes a trash boom in Stewart's Drain in addition to the main channel. However, this trash boom may not be necessary due to the existing grate at the ITP that provides trash screening for flows in Stewart's Drain. Therefore, some of the Alternative I-2 capital cost for trash booms may be able to be reallocated to other project components.

3.3.4 Alternative I-2 Implementation Considerations

3.3.4.1 Future Population Considerations

PG estimates that 45.5 MGD of wastewater would be received at the expanded ITP (60 MGD capacity) when Alternative I-2 is fully implemented. Therefore, the expanded ITP would have an additional 15 MGD of reserve capacity to accommodate future population growth in Tijuana. According to a 2020 study by NADB that examined the future treatment demands for the City of Tijuana based on population growth, the city is predicted to need an additional 14 MGD of untreated wastewater treatment by 2050 (NADB et al. 2020). Additionally, correspondence with NADB indicated that future population growth in Smuggler's Gulch and Goat Canyon is likely to require 1 MGD of additional treatment. Therefore, the ITP is projected to use its full 60 MGD of capacity to treat the increased wastewater from Tijuana in 2050.

PG estimates that the new 5 MGD SABTP would treat approximately 2.2 MGD of flows from the Playas Pump Station under current conditions. Correspondence with NADB indicated that wastewater flows from the station are expected to grow by approximately 20% (0.4 MGD) by 2050. Therefore, the new SABTP would be able to treat all the Playas flows in 2050 and would have 2.4 MGD of reserve capacity.

The new conveyance line from the Arturo Herrera and La Morita WWTPs to Rodriguez Dam would prevent the treated effluent from mixing with the untreated wastewater that is discharged into the river and make it available for future water reuse. Additional treatment would be necessary for these flows to be reused as a potable resource from the Rodriguez Dam impoundment. Refer to the USMCA Project 7 *Feasibility Analysis Technical Memorandum* for more details on the feasibility of reusing the WWTP effluents. Additionally, secondary treated effluent from the expanded ITP will be available for reuse in Mexico; refer to the Project 3 *Feasibility Analysis Technical Memorandum* for additional details.

3.3.4.2 Implementation Timeline

The canyon flow diversion structure upgrades and trash booms have minimal interdependencies with other project elements, allowing flexibility with respect to the order in which they are constructed. Constructing the APTP, and the conveyance from PB-CILA to the APTP, before constructing the U.S.-side river diversion could allow for improved collection and treatment of transboundary flows while avoiding review and permitting delays associated with the U.S.-side diversion. Other project elements in Alternative I-2 share operational interdependencies, but this does not affect the order in which they can be constructed. For example, construction of the conveyance line from the canyon pump stations in Mexico to the ITP could likely take place before the ITP expansion is completed (due to less burdensome design and permitting requirements). However, until there is capacity at the ITP to treat these additional flows of wastewater, the untreated wastewater flows from the canyon pump stations would continue to be pumped to SAB Creek and discharged without treatment to the Pacific Ocean. Similarly, targeted sewer collector rehabilitations in Tijuana can likely take place before the ITP expansion and would improve the water quality of the river. However, until there is capacity at the ITP to treat these additional flows of wastewater, they would be pumped to SAB Creek and discharged without treatment to the Pacific Ocean.

The ITP's potential treatment capacity is currently limited by a lack of solids processing and disposal capacity. Prioritizing expansion of the solids processing units may allow the ITP to treat up to 5 MGD more wastewater from the International Collector while the rest of the plant is being expanded.

The implementation timeline of Alternative I-2 would be largely dependent on the environmental review and consultation processes for the individual project elements. Based on recent discussions with EPA, ERG anticipates the following timelines to prepare NEPA documentation for the project elements in Alternative I-2:

- As discussed in Section 3.1.4.2, NEPA documentation for the U.S.-side canyon flow diversion structure upgrades at Smuggler's Gulch and Goat Canyon could likely be implemented relatively quickly (approximately six months).
- Four project elements—1) ITP expansion, 2) rehabilitation of targeted sewer collectors in Tijuana, 3) construction of the conveyance system to send Mexico canyon flows to the ITP for treatment, and 4) installation of a trash boom in the Tijuana River—are expected to be fully addressed in a Programmatic EIS, which would take approximately one year to complete. Two additional project elements—1) construction of an initial phase of the APTP to treat river flows from PB-CILA and 2) conveyance of river flows from PB-CILA to the APTP—could potentially be fully addressed in the Programmatic EIS (approximately one year) but may require a more detailed Tiered EIS (approximately two years, including the Programmatic EIS) to fully address the marine impacts of discharging 35 MGD of primary-treated effluent.
- Two project elements—1) conveyance of treated ITP effluent for potential Mexico-side reuse and 2) construction of a new plant at the SABTP site—would likely require more detailed analysis in a Tiered EA (up to approximately two years, including the Programmatic EIS) to fully address environmental, public health, and safety concerns.
- The project to construct conveyance lines from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment would likely require more detailed analysis in a Tiered EA or EIS (approximately two years, including the Programmatic EIS) to fully address environmental, public health, and safety concerns.
- Two project elements—1) full construction of the APTP to a capacity of 60 MGD and 2) construction of a 60-MGD U.S.-side river diversion—would require more detailed analysis and consultation in a Tiered EIS (approximately two years) to fully address the marine impacts of discharging 60 MGD of primary-treated effluent and the likely adverse effects to protected resources, including wetlands, riparian habitat, and special-status species.

As discussed in Section 3.1.4.2, most project elements in the U.S. are expected to require a CEQA EIR following completion of the NEPA review. EPA intends to facilitate this process by preparing NEPA documents that address CEQA content requirements and can therefore be adopted by the state or local agencies.

Project elements in Mexico are expected to require additional review in the form of a MIA, subject to approval by SEMARNAT. EPA has not evaluated the timeline implications of MIA review for the USMCA project.

3.3.4.3 O&M Requirements

The estimated annual O&M costs associated with implementing Alternative I-2 are presented in Table 3-12. USMCA funding is only available for capital expenditures; therefore, the recurring costs associated with operating and maintaining the new and modified infrastructure constructed as part of Alternative I-2 would fall to the entities that are agreed upon prior to implementation. These O&M costs would include costs of equipment and materials for day-to-day operations and preventative maintenance, staff labor, energy and other utilities, waste disposal fees, equipment replacements at end of service life, and other costs associated with operating and maintaining water infrastructure. Refer to the *Baseline Conditions Summary: Technical Document* for more information about who is responsible for operating and maintaining existing infrastructure in the watershed.

For this analysis, the IBWC is presumed to be responsible for operating and maintaining the new U.S.-side river diversion, the new APTP, the expanded ITP, the U.S. portion of the new canyon conveyance line, and the Tijuana River trash booms. The ITP's total annual O&M expenditures are expected to increase by more than 100% (from $14.3 million to $29 million). The current staff of 25 people would need to be expanded to about 75 people (an increase of about 200%). The plant currently has four Grade V certified operators, two Grade IV certified operators, and two Grade III certified operators. PG estimates that IBWC would need to hire five more Grade IV certified operators and five more Grade III certified operators to operate the expanded ITP. The 60 MGD APTP and U.S.-side diversion O&M costs are estimated at $7.9 million annually. In addition to meeting the expanded ITP's operating requirements, IBWC would be responsible for operating and maintaining the 60 MGD APTP and U.S.-side river diversion. PG estimates that these facilities would require a staff of about 40 people, including one Grade V certified operator, two Grade IV certified operators, and eight Grade III certified operators. IBWC would also be responsible for maintaining the U.S. section of the conveyance line from the canyon pump stations to the ITP and the main channel trash booms. PG estimates that the combined annual O&M cost for these two project elements would be $800,000. The majority of the trash booms' O&M cost is for removing and disposing of waste collected by the trash booms and is dependent on the volume of trash that is collected. As discussed in Section 1.2.1.3, data on trash loads in the river are currently limited and more monitoring in the river is needed to better estimate how much trash would require disposal.

IBWC's additional responsibilities would likely include furnishing trucks and drivers to haul solid waste from the APTP and the trash booms and covering the cost to dispose of the waste (landfill tipping fees). PG estimates that the APTP would require an average 1,200 truck trips annually for sediment/sludge disposal. Additionally, PG estimates that 700 truck trips would be needed annually to dispose of trash from the trash booms. In total, IBWC would be responsible for furnishing trucks and drivers for 1,900 additional truck trips. The costs for trucking and disposal are included in the estimated O&M increase for IBWC described above.

For purposes of this analysis, the current responsible agencies for O&M of infrastructure in Mexico were assumed to remain the same. CESPT is currently responsible for furnishing trucks and drivers to dispose of waste sludge from the ITP, and it is expected that CESPT would retain this responsibility. PG estimates that the ITP expansion would increase the number of truck trips annually for solids disposal from 2,900 to 3,200. The expanded ITP would produce more solids, but the increase in solids is partially offset by the installation of anaerobic digesters, which destroy about half of the sludge solids. The sludge production from the ITP would increase over time as the plant receives more wastewater from population growth in Tijuana. By 2050, PG estimates that the expanded ITP would require 3,600 truck trips annually to dispose of the increased volume of solids.

CESPT is expected to be responsible for operating and maintaining the portion of the new canyon gravity conveyance system that is located in Mexico. Additionally, CESPT would continue to maintain the entire sanitary collection system in Tijuana, including the rehabilitated collectors. CESPT is also expected to be responsible for O&M of all water reuse infrastructure downstream of the Arturo Herrera and La Morita WWTP discharges. Once in the reservoir, the water would fall under CONAGUA's jurisdiction for treatment and distribution. However, CESPT would see an overall reduction in O&M responsibilities because untreated wastewater that currently must be pumped to SAB Creek would instead flow by gravity to the ITP.

Under contract from CESPT, CILA would remain responsible for operating PB-CILA. The overall flow that is pumped to PB-CILA would be reduced, but PB-CILA would operate more frequently.

3.3.4.4 Implementation Challenges

This section provides a summary of the implementation challenges associated with Alternative I-2. Further analysis of how these challenges impact all three final alternatives are discussed in Section 4.4.

The impacts of Alterative I-2 on transboundary river flows are dependent on the effectiveness of the collector repairs at reducing untreated wastewater discharges to the Tijuana River. PG evaluated the impacts of Alternative I-2 based on EPA's estimate that rehabilitating targeted sewer collectors in Tijuana would reduce the average flow of wastewater into the Tijuana River from 10 MGD to 5 MGD. However, limited data are available regarding the effectiveness of the collector repairs at reducing the untreated wastewater discharges into the river, and sustaining this reduction would require increased O&M in Mexico. Alternative I-2 would reduce untreated wastewater flows from entering the river, which would reduce energy requirements at PB-CILA, which could help offset the increased O&M costs for the sanitary sewer system.

Information about the structural condition of Rodriguez Dam, as well as available capacity in the impoundment, was not available to PG. Therefore, a comprehensive evaluation of the dam must be performed to ensure that it is structurally able to withstand the increased water levels that may result from the WWTP discharges to the dam impoundment area. If the dam is unable to hold the WWTP discharges, these flows would remain in the river, resulting in decreased performance of Alternative I-2. Section 4.4.2 explores the impacts of each final alternative with and without rerouting the WWTP effluents to the Rodriguez Dam impoundment.

PG evaluated the impacts of Alternative I-2 using a shutoff threshold of 120 MGD (river flow rate) for the U.S.-side diversion. Operating the U.S.-side diversion to partially divert flows at higher river flow rates would provide additional reductions to the total volume and pollutant loading of transboundary flows but would increase the O&M costs of the plant. Section 4.4.3 discusses the benefits gained by operating the U.S.-side diversion at increased river flow rates. Although sediment and trash data for the Tijuana River are currently limited, it is clear that increased flow rates bring increased sediment and trash loadings. Therefore, operating the river diversion at higher flow rates will result in higher O&M costs at the U.S.-side river diversion and APTP due to increased sediment and trash disposal, as well as increased wear and tear on pumping and treatment equipment. The *Feasibility Analysis Technical Memoranda* for Project 1 and Project 6 further discuss the implementation challenges associated with the diversion, as well as the steps required to ensure the design would be capable of handling the high flow rates and sediment quantities in the river.

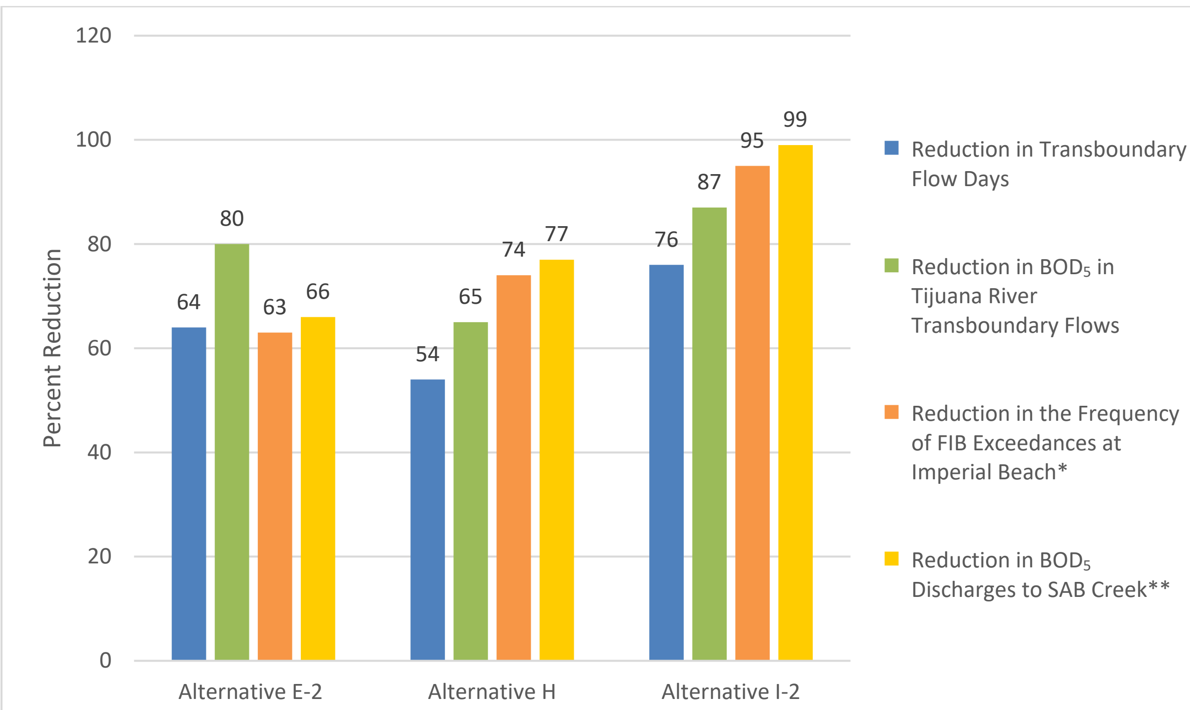
The APTP would require an NPDES permit to discharge effluent from the SBOO. Correspondence with the RWQCB indicated that the APTP would be required to meet advanced primary effluent limits; however, those effluent limits have not been finalized. The expanded ITP would require a modification to its current NPDES permit to discharge the increased volume of effluent from the SBOO. It is expected that the permit would continue to require the ITP's effluent to meet secondary treatment standards.

4. DISCUSSION

This section compares the environmental benefits, costs, O&M requirements, future considerations, and implementation challenges and timelines for the three final alternatives. This section also discusses how either Alternative E-2 or Alternative H could be expanded to Alternative I-2 if more funding becomes available in the future.

4.1 Water Quality Impacts

PG used the estimated impacts of each of the three final alternatives discussed in Section 3 to compare each alternative. The estimated impacts on transboundary flow days, annual BOD_5 load in the Tijuana River, frequency of FIB exceedances at Imperial Beach and annual BOD_5 load in discharges to the Pacific Ocean via SAB Creek are shown in Figure 4-1.



* "FIB Exceedances" refers to fecal indicator bacteria concentrations that exceed EPA's beach action value.

** Discharges into San Antonio de los Buenos Creek (SAB Creek) enter the Pacific Ocean 6 miles south of the border, affecting U.S. beaches when there are northward currents, which occur predominantly during the tourist season (Feddersen et al. 2020).

Figure 4-1. Comparison of Each Alternative's Water Quality Impacts

4.1.1 Tijuana River Transboundary Flows

PG evaluated each alternative's impacts on water quality in the Tijuana River by comparing how each alternative would affect the annual number of transboundary flow days and the annual BOD_5 load. As Figure 4-1 shows, Alternative E-2 would provide a greater reduction in transboundary flow days (64% versus 54%) and BOD_5 loading (80% versus 65%) in the Tijuana River than Alternative H. This is attributable to the new 35 MGD U.S.-side river diversion system and APTP included in Alternative E-2 but not in Alternative H. The U.S.-side diversion included in Alternative E-2 would allow for up to 35 MGD of flow to be diverted from the Tijuana River at flow rates up to 60 MGD in the river. Alternative H is limited to the 23 MGD diverted from the Tijuana River by PB-CILA, but these flows would remain untreated and discharged at SAB Creek.

Alternative I-2 provides the largest reduction to transboundary flows and BOD_5 load (76% and 87%, respectively) because it includes a 60 MGD U.S.-side diversion and APTP that can operate at flows in the river up to 120 MGD.

4.1.2 Beaches in San Diego County

As discussed in Section 1.2.3, the Scripps modelling concluded that FIB exceedances at Imperial Beach during the tourist season (May 22–September 8) are a result of untreated wastewater discharged to the Pacific Ocean via SAB Creek. Therefore, PG compared the impacts of each alternative on beaches in San Diego County using two parameters: the estimated reduction in BOD_5 load in discharges to the Pacific Ocean via SAB Creek and the estimated reduction in frequency of FIB exceedances at Imperial Beach.

As Figure 4-1 shows, PG estimates that Alternative H provides a greater reduction in the annual BOD_5 load discharged to the Pacific Ocean via SAB Creek than Alternative E-2 (77% versus 66%). EPA estimated that Alternative H would also provide a greater reduction in the frequency of FIB exceedances at Imperial Beach during the tourist season compared to Alternative E-2 (74% versus 63%). Both Alternative E-2 and Alternative H would treat most of the untreated wastewater that is conveyed to the International Collector, as well as another 5 MGD that would be conveyed to the International Collector due to the rehabilitated sewer collectors. Alternative H would also treat canyon flows that are currently pumped to the Pacific Ocean via SAB Creek untreated. Alternative E-2 treats river flows diverted at PB-CILA during dry weather that are currently pumped to the Pacific Ocean via SAB Creek untreated. However, with both alternatives, there may be occasional periods where flows from the International Collector exceed the capacity of the ITP and would be pumped to SAB Creek.

Alternative I-2 provides a greater reduction than either Alternative E-2 or Alternative H in frequency of FIB exceedances at Imperial Beach during the tourist season, as well as BOD_5 load discharged to the Pacific Ocean via SAB Creek. As shown in Figure 4-1, Alternative I-2 would reduce the BOD_5 load in discharges to the Pacific Ocean via SAB Creek by 99% and would reduce the frequency of FIB exceedances at Imperial Beach during the tourist season by approximately 95%. Alternative I-2 treats all diverted river water, all wastewater conveyed by the International Collector, and wastewater collected in the canyons. Alternative I-2 also treats wastewater collected at the Playas Pump Station, which is currently discharged to the Pacific Ocean via SAB Creek and would not be captured for treatment by either Alternative E-2 or Alternative H.

During the non-tourist season (September 9–May 21), FIB exceedances at Imperial Beach are caused by both transboundary flows in the Tijuana River and discharges to the Pacific Ocean via SAB Creek. PG expects that both Alternative E-2 and Alternative H would be effective at reducing the frequency of FIB exceedances at Imperial Beach during the non-tourist season because they both reduce the BOD_5 loads in both transboundary flows in the Tijuana River and discharges to the Pacific Ocean via SAB Creek. PG expects that Alternative I-2 would provide a greater reduction to the frequency of FIB exceedances at Imperial Beach than either Alternative E-2 of Alternative H because it provides a larger reduction to the BOD_5 load in both sources. Further analysis should be done to quantify how the impacts of all three alternatives would affect the frequency of FIB exceedances at Imperial Beach during the non-tourist season.

4.1.3 Common Impacts for All Three Alternatives

PG identified other benefits that all three final alternatives would provide. They each include trash booms in the Tijuana River main channel, which PG estimates would reduce trash loads that are currently conveyed by the Tijuana River to the Tijuana River Valley and the Tijuana River Estuary by about 75%. All three also include regrading and modifying the U.S.-side canyon collectors' intake approach pads to minimize untreated wastewater pooling and installing metal grates above the flow path of the wastewater to minimize CBP exposure to the pools of wastewater. PG determined that none of the three alternatives would significantly reduce the sediment load in the river. Alternatives E-2 and H would reduce sediment in transboundary flows by about 1%, and Alternative I-2 would reduce the annual sediment load by about 2%.

4.2 O&M Requirements

All three alternatives are expected to increase the O&M requirements on the U.S. side of the border, which include energy, staffing, and truck trip requirements. These increases are summarized in Table 4-1 below.

Table 4-1. Comparison of the Estimated Annual O&M Requirements in the U.S for the Three Final Alternatives

O&M Parameter	Alternative E-2	Alternative H	Alternative I-2
Increase in U.S.-side energy requirements	16,100 MWh	19,200 MWh	29,900 MWh
Additional staffing requirements	55 new staff, including 14 certified operators	40 new staff, including 8 certified operators	90 new staff, including 21 new operators
Net increase in U.S. truck trips for disposal of sediment/sludge and trash	1,600 trips	700 trips	1,900 trips

As shown in Table 4-1, Alternative E-2 would require less energy than Alternative H, but more new staff to operate the new APTP and more truck trips to dispose of sediment/sludge and trash. Alternative H would require more energy than Alternative E-2 due to the larger ITP expansion that is included. Alternative I-2 would require more energy, more staff, and more truck trips to dispose of sediment/sludge and trash than both Alternative E-2 or Alternative H.

The current operational protocol of PB-CILA was formalized under Minute 320 of the 1944 U.S.–Mexico "Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande" treaty and includes a 1,000 L/s (about 23 MGD) shutoff threshold (IBWC 2015). The upgraded PB-CILA is expected to have the capacity to divert up to 35 MGD of flows from the river and increasing the shutoff threshold of PB-CILA would reduce the O&M requirements of the U.S.-side diversion. The operational protocol of PB-CILA would need to be revised to allow the pump station to operate up to its new capacity.

4.3 Alternative Costs

The total estimated capital, O&M, and 40-year life cycle costs of the three final alternatives are compared in Table 4-2.

Table 4-2. Comparison of the Estimated Costs for the Three Final Alternatives

Cost Parameter	Alternative E-2	Alternative H	Alternative I-2
Total capital costs	**$366,900,000**	**$368,000,0000**	**$627,300,000**
U.S. share of capital costs	*$344,000,000*	*$335,500,000*	*$561,200,000*
Mexico share of capital costs	*$22,900,000*	*$32,500,000*	*$66,100,000*
Total O&M costs	**$14,600,000**	**$11,300,000**	**$25,600,000**
U.S. share of O&M costs	*$13,000,000*	*$9,000,000*	*$20,300,000*
Mexico share of O&M costs	*$1,600,000*	*$2,300,000*	*$5,300,000*
Total 40-year life cycle costs	**$950,500,000**	**$817,100,000**	**$1,652,000,000**
U.S. share of life cycle costs	*$862,600,000*	*$694,000,000*	*$1,374,000,000*
Mexico share of life cycle costs	*$87,900,000*	*$123,100,000*	*$278,000,000*

Both Alternative E-2 and Alternative H have capital costs that are within the budgetary constraints discussed in Section 2.2. Alternative I-2 exceeds the cost constraints discussed in Section 2.2 on both the U.S. side and the Mexico side of the border. The majority of funding for all three alternatives would be spent on infrastructure built in the U.S. Excluding Mexico's contribution, Alternative I-2 would require an additional $269.3 million for U.S.-side and Mexico-side projects compared to the current USMCA and supplemental funding of $358 million (including the 10% contingency) as shown in Section 2.2.

As shown in Table 4-2, the O&M costs in both the U.S. and Mexico are higher for Alternative E-2 than for Alternative H. This is primarily due to the new U.S.-side diversion and APTP included in Alternative E-2 but excluded from Alternative H. Alternative I-2 has a higher O&M cost than either Alternative E-2 or Alternative H primarily because of the larger treatment facilities that are included. Alternative I-2 includes a 60 MGD APTP (versus 35 MGD for Alternative E-2) and a 35 MGD expansion of the ITP (versus 25 MGD for Alternative H), as well as the new 5 MGD SABTP in Mexico. All three final alternatives would require long-term funding sources for O&M to be secured before they are implemented.

All alternatives are expected to reduce pumping requirements on the Mexico side of the border. The energy and maintenance requirements for the new pump station from Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment would be more than offset by reductions in the pumping requirements across the rest of the Mexican system. The cost savings associated with these energy reductions are not included in Mexico's estimated annual O&M share in Table 4-2.

As shown in Table 3-3 in Section 3.1.2.8, Alternative E-2 would reduce the pumping energy requirements of PB1 and PB-CILA. Overall, Alternative E-2 would reduce the annual O&M pumping costs in Mexico by $1.9 million.

As shown in Table 3-7 in Section 3.2.2.8, Alternative H would eliminate the pumping requirements at the canyon pump stations and would reduce the pumping requirements for PB1 and PB-CILA. Overall, Alternative H would reduce the annual O&M pumping costs in Mexico by $1.6 million.

As shown in Table 3-11 in Section 3.3.2.8, Alternative I-2 would eliminate pumping requirements at PB1 (unless used for reuse) and the canyon pump stations. Alternative I-2 would also reduce the pumping requirements at PB-CILA. Alternative I-2 would require energy to pump wastewater collected at the Playas Pump Station to the SABTP. Overall, Alternative I-2 would reduce the annual O&M pumping costs in Mexico by $1.6 million.

4.4 Implementation Considerations

The impacts of all three final alternatives depend on how infrastructure in Mexico is operated and maintained on a long-term basis, as well as on other factors and unknowns. Specifically, each alternative's performance could be affected by long-term maintenance of the upgraded collectors, the actual operational protocols of the river diversions, and the availability of capacity in the Rodriguez Dam impoundment to receive additional flows. Additionally, PG identified NPDES permitting for the APTP and securing a long-term source of O&M funding as challenges that need to be addressed before implementing any of the three alternatives.

4.4.1 Impacts of Collector Repairs in Mexico

The water quality impacts of all three alternatives shown in Figure 4-1 depend on the collector upgrades in Mexico (Project 5) reducing untreated wastewater discharges into the river. PG estimated the impacts of each alternative using EPA's assumption that Project 5 would reduce the untreated wastewater discharged into the river from an average of 10 MGD to an average of 5 MGD. This assumption is based on the effectiveness of past collector repair projects and is discussed further in Appendix B. However, data are limited on how effective rehabilitating targeted collectors would be at reducing untreated wastewater discharges to the Tijuana River. Additionally, sustaining a 5 MGD reduction in the long-term would necessitate increased maintenance in Mexico. If the repairs and maintenance are not proactively continued, the collectors are likely to revert to the current conditions or worsen over time.

Due to the uncertainties associated with the collector repairs, PG performed a sensitivity analysis on the four parameters shown in Figure 4-1 (reductions of transboundary flow days, annual BOD_5 load in the Tijuana River, frequency of FIB exceedance at Imperial Beach during the tourist season, and annual BOD_5 load in discharges to the Pacific Ocean via SAB Creek) to determine how the three final alternatives would be affected if Project 5 was not effective at reducing untreated wastewater discharges in the river, or repairs and maintenance were not proactively continued. Table 4-3 compares the impacts of all three alternatives if the average flow of untreated wastewater in the Tijuana River remains at 10 MGD to the impacts presented in Figure 4-1.

Table 4-3. Comparison of Water Quality Impacts With and Without a 5 MGD Reduction from Project 5

Parameter	Alternative E-2	Alternative H	Alternative I-2
Percent Reduction in Transboundary Flow Days			
With a 5 MGD reduction	64%	54%	76%
Without reduction	60%	48%	74%
Net change	**-4%**	**-6%**	**-2%**
Percent Reduction in Annual BOD_5 Load in Transboundary River Flows			
With a 5 MGD reduction	80%	65%	87%
Without reduction	57%	27%	73%
Net change	**-23%**	**-38%**	**-14%**
Percent Reduction in the Frequency of FIB Exceedance at Imperial Beach			
With a 5 MGD reduction	63%	74%	95%
Without reduction	63%	61%	95%
Net change	**0%**	**-13%**	**0%**
Percent Reduction in Annual BOD_5 Load in Discharges to the Pacific Ocean via SAB Creek			
With a 5 MGD reduction	66%	77%	99%
Without reduction	66%	65%	99%
Net change	**0%**	**-12%**	**0%**

As Table 4-3 shows, PG estimates that Alternative E-2 would be more effective than Alternative H in reducing transboundary flow days (60% versus 48%) and annual BOD_5 loads in transboundary river flows (57% versus 27%) if untreated wastewater discharges are not reduced in the river. Additionally, the impacts of Alternative E-2 on the annual BOD_5 load in discharges to the Pacific Ocean via SAB Creek and the frequency of FIB exceedances at Imperial Beach are not affected if untreated wastewater discharges are not reduced in the river. In contrast, the impacts of Alternative H on the annual BOD_5 load in discharges to the Pacific Ocean via SAB Creek and the frequency of FIB exceedances at Imperial Beach are adversely affected if untreated flows in the river remain at approximately 10 MGD. If the untreated wastewater flows in the river remain at approximately 10 MGD, Alternative E-2 would be more effective than Alternative H at reducing the average annual BOD_5 loads discharged to the Pacific Ocean via SAB Creek (66% versus 65%), and more effective at reducing the frequency of FIB exceedances at Imperial Beach (63% versus 61%).

Alternative I-2 is less affected than either Alternative E-2 or Alternative H if untreated wastewater discharges from Mexico's collectors into the river remain at about 10 MGD. As shown in Table 4-3, PG estimates that Alternative I-2 would reduce transboundary flow days by 72% and would reduce the annual BOD_5 load in transboundary river flows by 73% if untreated wastewater discharges are not reduced in the river. Similar to Alternative E-2, the impacts of Alternative I-2 on the frequency of FIB exceedances at Imperial Beach and the annual BOD_5 load in discharges to the Pacific Ocean via SAB Creek are not affected by the untreated wastewater flows in the river.

4.4.2 Rodriguez Dam Impoundment

All three alternatives include constructing a conveyance line to convey treated effluent from the Arturo Herrera and La Morita WWTPs into the Rodriguez Dam impoundment for reuse (Project 7). However, this would require a comprehensive evaluation of the dam to ensure that it is structurally able to handle the increased water levels that may result from the WWTP discharges to the dam impoundment area. If the dam is determined not suitable to contain higher water levels, effluent from both plants would likely continue to be discharged into the Tijuana River.

Table 4-4, below, shows the impacts of all three alternatives on transboundary flows if structural conditions at Rodriguez Dam prevent construction of the conveyance line.

Table 4-4. Comparison of Water Quality Impacts With and Without Project 7

Parameter	Alternative E-2	Alternative H	Alternative I-2
Percent Reduction in Transboundary Flow Days			
With Project 7	64%	54%	76%
Without Project 7	56%	48%	72%
Net change	**-8%**	**-6%**	**-4%**
Percent Reduction in Annual BOD_5 Load in Transboundary River Flows			
With Project 7	80%	65%	87%
Without Project 7	76%	60%	86%
Net change	**-4%**	**-5%**	**-1%**

As shown in Table 4-4, both Alternative E-2 and Alternative H are less effective at reducing transboundary flow days and the annual BOD_5 load in transboundary flows if Project 7 cannot be implemented. Alternative E-2 would remain more effective than Alternative H at reducing transboundary flow days (56% versus 48%) and annual BOD_5 loads in transboundary river flows (76% versus 60%). The impacts of Alternative I-2 on transboundary flows and the annual BOD_5 load in the river are less dependent on Project 7 than either Alternative E-2 or Alternative H. As shown in Table 4-4, PG estimates that Alternative I-2 would reduce transboundary flow days by 72% and would reduce the annual BOD_5 load in transboundary river flows by 86% if Project 7 cannot be implemented.

4.4.3 Operational Protocol of the River Diversions

The projected impacts of all three alternatives on the Tijuana River depend on the operational protocol of PB-CILA or the U.S.-side diversion. Operating either diversion at higher river flow rates would further reduce the annual BOD_5 load in the river but would increase O&M costs.

For Alternative E-2, the reduction in the annual BOD_5 load in transboundary flows is dependent on the shutoff flowrate of the U.S.-side diversion. PG evaluated the impacts of Alternative E-2 assuming that the 35 MGD U.S.-side diversion would shut off at river flow rates above 60 MGD. Figure 4-2 shows the reduction in BOD_5 load in transboundary flows provided by Alternative E-2 as a function of the shutoff value of the U.S.-side diversion.

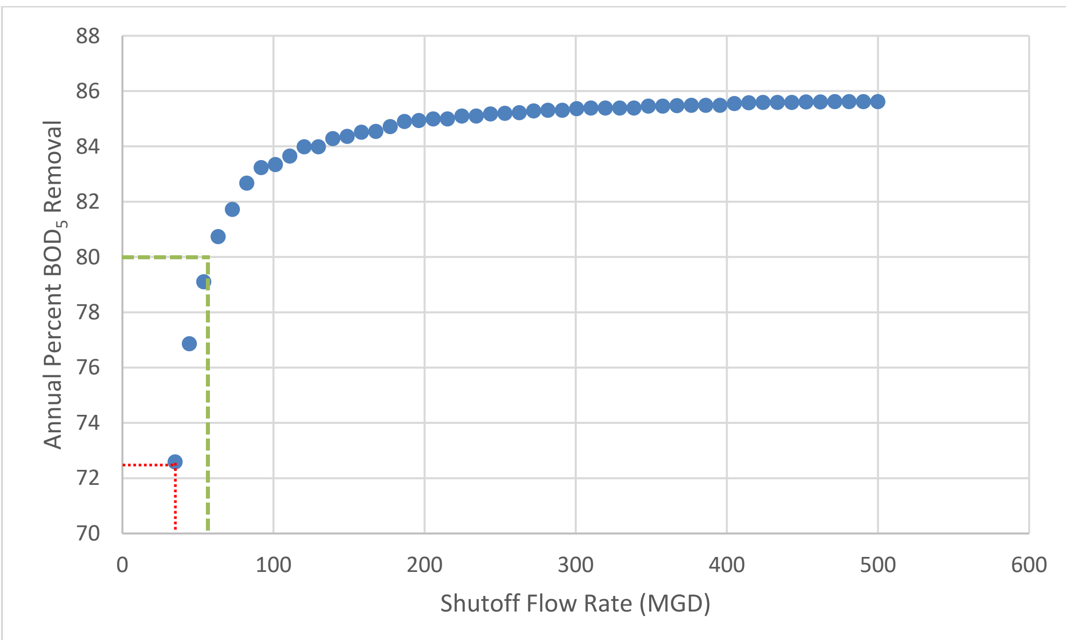


Figure 4-2. Effectiveness of Alternative E-2 at Reducing the Annual BOD_5 Load in Transboundary Flows Versus the Shutoff Flow Rate of the U.S.-Side Diversion

Figure 4-2 shows that operating the U.S.-side diversion at river flow rates up to the diversion capacity of 35 MGD (versus 60 MGD) would lower the estimated reduction in BOD_5 load in transboundary flows from 80% to about 73%. Figure 4-2 also shows that increasing Alternative E-2's U.S.-side diversion shutoff threshold provides a diminishing return in BOD_5 removal; even operating the U.S.-side river diversion when flows in the river are as high as 500 MGD cannot achieve more than approximately 86% BOD_5 removal annually.

Alternative H does not include a U.S.-side river diversion. Therefore, Alternative H's reduction in the annual BOD_5 load is affected by the operational protocol of PB-CILA. The current operational protocol of PB-CILA was negotiated between the U.S. and Mexico and includes a 23 MGD shutoff threshold (IBWC 2015). The upgraded PB-CILA is expected to have capacity to divert up to 35 MGD of flows from the river. If the operational protocol for PB-CILA is modified to allow PB-CILA to divert 35 MGD of flows, then Alternative H would achieve similar effects to those shown in Figure 4-2 of the 35 MGD U.S.-side diversion in Alternative E-2. If PB-CILA's shutoff threshold is increased to 35 MGD, PG estimates that Alternative H would reduce the frequency of transboundary flows in the main channel by 64% (compared to 54% with the current operational protocol), and the annual BOD_5 load in the river would be reduced by 73% (compared to 65% with the current operational protocol). However, operating PB-CILA more frequently once Alternative H is fully implemented would increase the annual BOD_5 load discharged to the Pacific Ocean via SAB Creek because the diverted river water would not be treated.

While Alternative E-2 and Alternative I-2 include a U.S.-side diversion, Alternative H relies solely on the Mexico-side diversion to reduce the frequency, volume, and pollutant loadings in transboundary flows. PG estimated the impacts of Alternative H assuming that the recent upgrades to PB-CILA's pumps and pretreatment systems would operate reliably once Alternative H is fully implemented. However, Alternative H would not be as effective at reducing the number of transboundary flow days or the annual BOD_5 load in the river if the pump station continues to experience reliability challenges.

For Alternative I-2, the reduction in the annual BOD_5 load in transboundary flows is also dependent on the maximum river flow rate at which the U.S.-side diversion would operate. PG evaluated the impacts of Alternative E-2 assuming that the 60 MGD U.S.-side diversion would shut off at flow rates above 120 MGD. Figure 4-3 shows the reduction in BOD_5 load in transboundary flows provided by Alternative I-2 as a function of the shutoff value of the U.S.-side diversion.

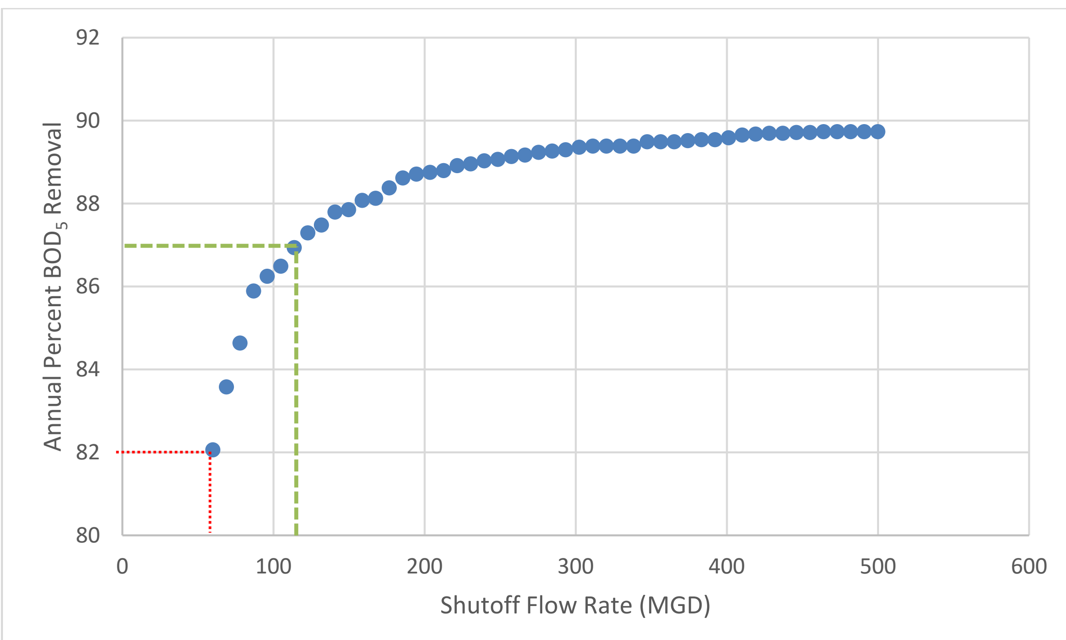


Figure 4-3. Effectiveness of Alternative I-2 at Reducing the Annual BOD_5 Load in Transboundary Flows Versus the Shutoff Flow Rate of the U.S.-Side Diversion

Figure 4-3 shows that operating the U.S.-side diversion at flow rates up to 60 MGD (versus 120 MGD) would lower the estimated reduction in BOD_5 load in transboundary flows from 87% to 82%. Figure 4-3 also shows that increasing Alternative I-2's U.S.-side diversion shutoff threshold provides a diminishing return in BOD_5 removal; even operating the U.S.-side river diversion when flows in the river are as high as 500 MGD cannot achieve more than approximately 90% BOD_5 removal annually.

For all three alternatives, the operational protocol of the diversion would be finalized before operation begins. A cost/benefit analysis should be performed when the operational protocol for the U.S.-side diversion (included in Alternative E-2 and Alternative I-2) is developed to establish a shutoff flow rate that optimizes the impacts on transboundary flows relative to financial and operational constraints. The operational protocol should be based on collected data on transboundary flows at the IBWC gauge (with the upgraded PB-CILA fully implemented), CESPT flow source data, new monitoring data, and available O&M funding to establish a shutoff flow rate that optimizes the impacts on transboundary flows relative to financial and operational constraints. Any new operational protocol for PB-CILA would likely have to be renegotiated with Mexico.

4.4.4 NPDES Permitting

The APTP for both Alternative E-2 and Alternative I-2 would require obtaining an NPDES permit before commencing discharges out the SBOO. The RWQCB indicated that effluent from a publicly owned wastewater treatment plant that treats diverted river water from the Tijuana River and discharges it from the SBOO would be required to meet advanced primary effluent limits. However, the RWQCB has not yet finalized these effluent limits. If the final effluent limits for the new APTP are more stringent than advanced primary effluent limits, then the plant would need to provide a level of treatment to the river water higher than advanced primary. This would substantially increase the capital and O&M costs of Alternatives E-2 and Alternative I-2.

All three alternatives would require a modification to the NPDES permit for the ITP prior to completion of the expansion. PG expects that the permit modification for any of the three proposed ITP expansions would include effluent limits based on secondary treatment standards, consistent with the ITP's current effluent limits.

4.4.5 O&M Funding Sources

Dedicated annual funding for long-term operation and maintenance is a critical factor to ensure the projected benefits described in this report are realized, regardless of which alternative is constructed. No funding source for O&M currently exists and identifying O&M sources should be a key priority as the alternatives move through the environmental review process.

4.5 Future Considerations

As discussed in Sections 3.1.4.1 and 3.2.4.1, Alternative E-2 is unlikely to have any reserve capacity once fully implemented, while Alternative H would provide reserve wastewater treatment capacity for population growth in Tijuana until about 2030. After 2030, the future wastewater flows are expected to exceed the capacity of the expanded ITP for Alternative H. Alternative I-2 is expected to have sufficient reserve treatment capacity to accommodate population growth through 2050. Section 4.7 discusses how either Alternative E-2 or Alternative H could be upgraded to Alternative I-2 to serve future populations as needed.

All three alternatives include constructing a conveyance line to convey an average of 10.3 MGD of treated effluent from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment. This could provide Mexico with a future water reuse resource. Alternative I-2 also includes constructing a new pump station to convey up to 40 MGD of treated effluent from the ITP to PB1-B for potential future reuse.

4.6 Implementation Timeline

All three alternatives share many project elements: upgrading the U.S.-side canyon flow diversion structures, repairing targeted collectors in Tijuana, installing the trash booms in the main channel, and constructing the conveyance line from the Arturo Herrera and La Morita WWTPs. PG expects the project elements that are shared to have similar implementation timelines. However, Alternative E-2 or Alternative I-2 may take longer to fully implement than Alternative H because Alternative E-2 and Alternative I-2 include constructing a new APTP, discharge of advanced primary treated effluent, construction within the river channel, and partial diversion of wet-weather flows.

PG does not expect that the difference in scale of the ITP expansion between any of the alternatives would significantly affect the implementation timeline of the project. The new conveyance line from the decommissioned Mexico-side canyon pump stations to the ITP included in both Alternative H and Alternative I-2 could be constructed before, after, or during the ITP expansion.

As discussed in Sections 3.1.4.2, 3.2.4.2, and 3.3.4.2, the timelines for the NEPA, CEQA, and consultation processes are expected to be similar for all three final alternatives. The various project elements that constitute the three final alternatives have timelines between six months and two years to complete the environmental review processes. However, the environmental review process for Alternative H may take less time than the review processes for Alternatives E-2 or I-2 because it includes fewer project elements that require a Tiered EIS.

4.7 Phasing Alternative E-2 or H into Alternative I-2

If Alternative E-2 or Alternative H were implemented as an initial phase of Alternative I-2, some specific items would need to be considered during the final design process. Additionally, if Alternative E-2 or Alternative H are intended to be expanded to Alternative I-2, then the capital cost estimates for initially implementing Alternative E-2 and Alternative H should be amended to include any upsized infrastructure.

A phased expansion of the ITP could be planned to postpone some of the capital costs associated with the 60 MGD plant that would be constructed as part of Alternative I-2. The phased expansion of the ITP is not expected to affect the environmental review process. During the first plant expansion to 40 MGD (Alternative E-2) or 50 MGD (Alternative H), underground equipment and conveyances can be sized to accommodate a second expansion to 60 MGD. Aboveground treatment units could be configured to ultimately have a 60 MGD capacity, but only those modules required to achieve the 40 or 50 MGD capacity (for Alternative E-2 or Alternative H, respectively) would need to be constructed in the initial expansion phase. The remaining modules could be delayed until they are needed to respond to growth in Tijuana. For example, the ITP would ultimately require six 700-horsepower blowers for a design flow of 60 MGD, but would only require five 700-horsepower blowers for the 40 or 50 MGD designs. The internal blower building and exterior delivery piping to convey air from a sixth 700-horsepower blower to future aerobic reactors could be constructed beneath the new blower building and stubbed out during the first plant expansion. This would prevent major disruption to the blower building foundation when the sixth blower is added in the future. Then, as additional capacity becomes necessary over time, new treatment units can be constructed without a need to upgrade any subsurface or building infrastructure.

4.7.1 Alternative E-2

After Alternative E-2 is implemented, the largest remaining sources of untreated wastewater discharges into the Pacific Ocean would be the Matadero, Los Laureles 1, and Los Laureles 2 canyon pump stations in western Tijuana. Therefore, the logical first priority for growing Alternative E-2 into Alternative I-2 would be constructing conveyances from these canyon pump stations to the ITP and expanding the ITP to treat the additional flows. Depending on the rate of population growth in Tijuana, the ITP could be expanded in 10 MGD increments, first to 50 MGD and then again to 60 MGD, as wastewater loads increase. This phased approach could provide "right-sized" facilities to minimize both capital and O&M expenditures as wastewater loads grow. The second largest remaining source of untreated wastewater discharges into the Pacific Ocean would be from the Playas Pump Station. Therefore, the second priority for phasing Alternative E-2 into Alternative I-2 would be to construct the new 5 MGD SABTP to treat the Playas Pump Station flows.

Alternative E-2 is estimated to reduce the annual BOD_5 load in the Tijuana River by 80%. Therefore, expansion of the new U.S.-side river diversion and APTP is a lower priority than mitigating the discharges of untreated wastewater into the Pacific Ocean via SAB Creek, but expansion of these facilities may become a higher priority if the frequency and/or water quality of transboundary flows in the main channel worsen in the future. Like the ITP expansion process discussed above, the diversion channel, intake pool, and pipeline to the APTP should be initially constructed to accommodate the full 60 MGD capacity, but pumps can be added as they are needed. The APTP initially should be constructed for the 35 MGD peak daily flow rate. Later (when capital funds are available), the APTP can be expanded to 60 MGD peak daily flow rate. Piping and stub-outs to and from the future treatment units should be constructed initially as part of Alternative E-2. The effluent return line to PB1-B can be constructed at any time based on demand for reclaimed water in Tijuana.

4.7.2 Alternative H

Alternative H would not provide any treatment for transboundary river flows or river water diverted at PB-CILA. Therefore, a logical first priority for phasing Alternative H into Alternative I-2 would be to construct the APTP and conveyance line from PB-CILA to the APTP. The U.S.-side river diversion system could then be added later. The APTP and U.S.-side river diversion system can either be constructed to divert and treat 60 MGD immediately, or to divert and treat 35 MGD of flows initially and then expanded to 60 MGD in the future. The second largest remaining source of untreated wastewater discharges into the Pacific Ocean would be from the Playas Pump Station. Therefore, the second priority for phasing Alternative H into Alternative I-2 would be to construct the new 5 MGD SABTP. The expansion of the ITP from 50 MGD to 60 MGD can be constructed as necessary to accommodate population growth in Tijuana, as described above. The effluent return line to PB1-B can be constructed at any time based on demand for reclaimed water in Tijuana.

4.8 Additional Projects for Consideration

PG identified 10 additional projects that were not all fully considered in the analysis but could provide further benefits. These projects can be considered as next steps to the implementation of an alternative, or to provide near-term benefits while the alternative is being implemented.

4.8.1 ITP

- To offset the increased power requirements at the expanded ITP, power generation equipment could be installed to convert the methane produced in the proposed anaerobic digesters at the ITP into electrical power. Power-generating facilities are challenging and expensive to maintain due to the need to frequently replace equipment that is worn out by the biogas. An analysis of power generation, air permitting requirements, and the life cycle cost of the power generation equipment should be performed to determine whether adding power generation to the anaerobic digesters at the ITP is viable. Refer to the Project 3 *Feasibility Analysis Technical Memorandum* for more details about potential power generation from anaerobic digestion at the expanded ITP.

- As an addition to the ITP expansion for Alternative E-2 and Alternative H, a pump station and force main could be constructed to convey secondary treated effluent to Mexico for beneficial reuse (note that Alternative I-2 includes the effluent pump station and force main). PG analyzed this potential project as sub-project 2 in the Project 3 *Feasibility Analysis Technical Memorandum*. As presented in the conceptual design, the force main would connect to PB1-B so that the effluent could be distributed to customers using the parallel conveyance pipelines. Alternatively, the new pump station may remain offline until Mexico is ready to receive the effluent. A full-scale re-use project in Mexico has yet to be proposed but may entail pump station and conveyance repairs/modifications, additional treatment, and means of distribution to customers.

4.8.2 Canyons

- Currently, untreated wastewater in Matadero Canyon and Los Laureles Canyon that is not collected in the sanitary sewer system flows down the canyons and across the border. Constructing additional collectors in the canyons on the Mexico side of the border could capture the wastewater and direct it to the existing Mexico-side pump stations. This would eliminate the pools of untreated wastewater in the U.S.-side canyon flow diversion structures and may allow the U.S.-side pump stations that currently pump canyon flows to the ITP to be decommissioned. The wastewater from the canyon collectors in Mexico would be conveyed to the ITP if combined with the existing conveyance system from Mexico to the U.S. The ITP already treats these flows, so the captured flows would not affect the plant's available capacity.
- Correspondence with California State Parks identified flooding of Monument Road as the primary concern in Yogurt Canyon. The flooding cuts off access to the Friendship Park of the Californias, a popular recreational area. PG evaluated raising the elevation of Monument Road out of the floodplain as the best solution in the Project 6 *Feasibility Analysis Technical Memorandum*. PG estimates that it would cost $2.9 million to raise Monument Road high enough to not flood during a 100-year flood event.
- During a site visit to the ITP, PG identified potential improvements at Stewart's Drain and the canyon flow diversion structures that could improve the quality of wet weather transboundary flows that enter the river and estuary while also enhancing border security during wet weather events. In short, automatic bar screens could be installed immediately downstream from the existing security grates. The automatic bar screens could efficiently remove trash from wet-weather flows without being blinded. The bar screens may also serve as a secondary security barrier, maintaining border security when the primary security grates are lifted due to surges of wet-weather flow. PG anticipates these improvements to be relatively low-cost for the provided benefits. As a next step, a conceptual design, cost estimate, and feasibility analysis could be developed for these improvements.

4.8.3 Mexico

- During a site visit to the PB1 pump station in Tijuana, PG learned that a lack of adequate power supply is the station's main operational restraint. Because PB1 acts as a bottleneck in the Tijuana River diversion system, the system might be able to operate more reliably if a new power supply line were constructed from the ITP to the PB1 pump station.
- As previously described, Alternatives I-2, H, or E-2 would reroute the La Morita and Arturo Herrera WWTP effluents to the Rodriguez Dam impoundment. Once in the reservoir, the water would be available to Mexico for indirect potable reuse, which may entail infiltration, groundwater extraction, additional treatment, and means of distribution to customers.
- The flows of untreated wastewater that originate in the Playas de Tijuana coastal community and are discharged to the Pacific Ocean via SAB Creek could be eliminated with a new secondary WWTP, built in place of the existing lagoon treatment plant at the SABTP (USMCA Project 8). If this new facility were properly operated and maintained in conjunction with Alternative H or E-2, impacts along the Pacific Coast, including at beaches in the U.S., could be dramatically improved. For this reason, an improved SABTP appears to be a logical next step for either Alternative E-2 or Alternative H. Note that Alternative I-2 includes the new SABTP, but Alternatives E-2 and H do not.
- Source control strategies could be implemented in Tijuana to reduce the loadings of sediment, tires, and trash in transboundary flows in the Tijuana River and Goat Canyon (USMCA Project 10). These strategies may include but are not limited to paving roads, collecting and recycling waste tires, public education and outreach programs, land stabilization projects, and green infrastructure.

4.8.4 O&M

- The sediment load in the Tijuana River during wet-weather flows remains a concern. As discussed in Section 1.2.1.3, PG estimates that 187,000 tons of sediment are conveyed by the Tijuana River across the border annually. PG evaluated restoring the main channel as part of the Project 6 *Feasibility Analysis Technical Memorandum* and determined that it would trap 146,000 tons (78%) of the sediment load in the river annually. However, PG did not include the channel restoration in the alternatives process due to the high O&M costs to maintain the channel, which PG estimated at $10 million annually. The Nelson Sloan Quarry was identified as a site that may allow for cheaper sediment disposal, which is the greatest O&M expense. If the annual O&M costs are reduced and funding becomes available, restoring and maintaining the channel would be effective at reducing sediment that is deposited into the estuary.

5. CONCLUSION

This report presents an assessment of three infrastructure alternatives that will mitigate chronic transboundary wastewater flows in the Tijuana River and Pacific Ocean coastal waters. Alternative E-2 and Alternative H are within the available budget appropriated by the USMCA implementing legislation and other available federal funding sources, whereas Alternative I-2—the most comprehensive alternative with the greatest environmental impact—is over budget. There are advantages and disadvantages to implementing either Alternative E-2 or Alternative H over the other:

- Alternative E-2 is expected to be more effective than Alternative H at mitigating the effects of transboundary wastewater flows in the Tijuana River. The analysis shows that Alternative E-2 reduces more transboundary flow days (64% versus 54%) and BOD_5 load, a surrogate for untreated wastewater, in the river (80% versus 65%) compared to Alternative H. Alternative H's improvements in water quality are more dependent than Alternative E-2's on sanitary sewer system collector upgrades reducing the untreated wastewater discharges in the river, and on reliable operation of PB-CILA, which would increase the O&M requirements. The expanded ITP is unlikely to have any reserve capacity for future population growth.
- Alternative H is expected to be more effective than Alternative E-2 at mitigating the effects of transboundary wastewater flows that enter the U.S. via the Pacific Ocean. The primary advantage of Alternative H is that it reduces more BOD_5 load in discharges to the Pacific Ocean via SAB Creek (77% versus 66%), than Alternative E-2. Because discharges at SAB Creek impact Imperial Beach mainly during the summer months when south swells carry ocean currents northwards, Alternative H is also expected to have a larger reduction in the frequency of FIB exceedances at Imperial Beach during tourist season compared to Alternative E-2 (74% versus 63%). The expansion of the ITP in Alternative H is expected to accommodate population growth up to 2030.

Alternative I-2 is expected to provide the greatest environmental benefit of all alternatives by mitigating the effects of transboundary wastewater through the river and the ocean and by accommodating projected population growth through the year 2050. The analysis shows that Alternative I-2 is expected to reduce transboundary flow days in the river by 76% and the BOD_5 load in the river by 87%. The analysis also shows that Alternative I-2 would reduce the frequency of FIB exceedance at Imperial Beach by approximately 95% and reduce the BOD_5 load in discharges to the Pacific Ocean via SAB Creek by 99%. However, its estimated capital cost is nearly double that of the other two alternatives.

The projected environmental benefits described in this report assume successful implementation and long-term O&M of the individual projects that make up each alternative. Identifying funding sources should be a key priority as the alternatives move through the environmental review process. The analysis estimates that Alternative H would cost less to operate and maintain than Alternative E-2 on a yearly basis ($11.2 million versus $14.6 million) and in the long-term. This is mainly because Alternative H has one wastewater treatment component (the expansion of the ITP), whereas Alternative E-2 has two (the new APTP and an ITP expansion). Alternative E-2 would also need more staffing and more disposal of waste material. Alternative I-2 would cost much more for annual O&M ($25.6 million) than the other two alternatives.

Whether Alternative E-2 or Alternative H is ultimately constructed with USMCA funding, the chosen alternative can be designed and constructed to facilitate future expansion, including additional project components, such as those found in Alternative I-2.

6. SUGGESTED NEXT STEPS

PG has identified the following next steps for consideration once an alternative has been chosen for implementation.

6.1 Technical Steps

- **Collect more data on transboundary flow conditions (wastewater indicator(s), sediment, trash) to inform the final design.** As described throughout this report, as well as in the *Feasibility Analysis Technical Memoranda* and the *Baseline Conditions Summary: Technical Document,* limited water quality data exist for wet-weather flow conditions in the Tijuana River. Therefore, PG developed and analyzed conceptual designs for the proposed projects and alternatives based on a variety of assumptions. The final design for the selected alternative would be improved if it were based on new and robust monitoring data.
- **Collect more information on PB-CILA operations to inform the final design.** There is uncertainty about how PB-CILA will be operated in the future due to recent upgrades and the potential construction of a U.S.-side river diversion. PG developed and analyzed conceptual designs for the proposed projects and alternatives based on the available data for the Tijuana River, which do not include PB-CILA diverting river water at its higher shutoff threshold. The final design for the selected alternative would be improved with updated performance data on the PB-CILA upgrades.
- **Rerun the Scripps model with updated flow and water quality parameters for each alternative.** The Scripps model shows the importance of reducing discharges of untreated wastewater into SAB Creek in order to improve water quality at beaches in the U.S. To quantify these impacts more precisely, the Scripps model could be rerun using the initial conditions expected for each alternative during the tourist season (May 22–September 8) and the non-tourist season (September 9–May 21).
- **Conduct feasibility analyses on additional projects identified in Section 4.8, if any are to be potentially implemented in the short term.** PG identified 10 projects that could provide additional benefits to alternatives. These projects can be considered as next steps to the implementation of an alternative, or to provide near-term benefits while the alternative is being implemented.
- **Conduct field-based assessments of the sanitary collection system in Tijuana in order to prioritize certain collectors for rehabilitation.** Currently, both NADB and CESPT keep records of priority collector projects and their estimated costs. These projects should be evaluated to quantify the impacts that each project would have on untreated wastewater discharges into the Tijuana River.
- **Conduct a structural assessment of Rodriguez Dam to determine the available capacity, as well as quantify losses to predict the time it would take to fill the reservoir more accurately.** As mentioned in Section 4.4.2, information about the structural condition of Rodriguez Dam and the available capacity in the impoundment were not available to PG. This information is needed to determine if the reservoir can receive and store the effluents from the Arturo Herrera and La Morita WWTPs.

6.2 Administrative Steps

- **Determine and secure sources for O&M funding.** The benefits of the final alternative cannot be attained unless all new and existing infrastructure is properly operated and maintained in the long-term. At the time of this analysis, no O&M funding sources had been identified. As Section 4.4.5 notes, identifying O&M funding sources should be a key priority moving through the environmental review process.
- **Coordinate with Mexico to plan projects and agree on cost-share and responsibilities.** The U.S. and Mexico need to examine project interdependencies and determine the projects that would be constructed. The U.S. and Mexico existing cost-share agreement can be assessed with regard to future responsibilities.
- **Initiate the NEPA EIS and CEQA coordination for all three final alternatives, including regulatory consultations.** To date, EPA has published a Notice of Intent to prepare a NEPA EIS, concluded public scoping for the EIS, initiated various informal interagency coordination efforts, and prepared an Environmental Information Document for the 10 projects evaluated in the *Feasibility Analysis Technical Memoranda*. EPA should move forward with NEPA for the three final alternatives; coordinate with state agencies to identify relevant CEQA triggers and establish the most time-efficient path forward for addressing CEQA requirements (e.g., ensure the EIS incorporates CEQA-required analyses); and initiate informal regulatory consultations for fast-tracked components of the alternative to be implemented (e.g., pursuant to Section 7 of the Endangered Species Act).

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APPENDIX A: OPINION OF PROBABALE COSTS

Project	Sub-project	Estimated Capital Cost	Estimated 40-year Life Cycle Cost	Average Total Annual O&M (2021 Dollars)	40 Year O&M
1	U.S.-side river diversion system to pump a peak daily flow rate of 35 MGD, shuts off at 60 MGD	$17,200,000	$28,000,000	$270,000	$10,800,000
	U.S.-side river diversion system to pump a peak daily flow rate of 60 MGD, shuts off at 120 MGD	$26,700,000	$41,000,000	$357,500	$14,300,000
	U.S.-side river diversion system to pump a peak daily flow rate of 100 MGD	$37,800,000	$57,000,000	$480,000	$19,200,000
	U.S.-side river diversion system to pump a peak daily flow rate of 163 MGD	$41,200,000	$63,000,000	$545,000	$21,800,000
	APTP designed for a peak daily flow rate of 35 MGD	$72,900,000	$280,000,000	$5,177,500	$207,100,000
	APTP designed for a peak daily flow rate of 60 MGD	$92,400,000	$390,000,000	$7,440,000	$297,600,000
	APTP designed for a peak daily flow rate of 100 MGD	$160,400,000	$496,000,000	$8,390,000	$335,600,000
	APTP designed for a peak daily flow rate of 163 MGD	$202,900,000	$640,000,000	$10,927,500	$437,100,000

= Sub-project partially or fully located in Mexico

Project	Sub-project	Estimated Capital Cost	Estimated 40-year Life Cycle Cost	Average Total Annual O&M (2021 Dollars)	40 Year O&M
2	A conveyance line that runs from PB-CILA across the border to the headworks of the newly constructed treatment train proposed in Project 1 (35 MGD)	$11,500,000	$12,300,000	$20,000	$800,000
	A new diversion and conveyance line that runs from PB-CILA across the border to the headworks of the newly constructed treatment train proposed in Project 1 (60 MGD)	$45,500,000	$49,900,000	$110,000	$4,400,000
	New treatment facility to continuously treat diverted river water from PB-CILA (35 MGD)	$72,900,000	$373,000,000	$7,502,500	$300,100,000
	New treatment facility to continuously treat diverted river water from PB-CILA (60 MGD)	$92,400,000	$440,000,000	$8,690,000	$347,600,000
3	Increase ITP Average Daily Design Flow Rate to 40 MGD	$227,000,000	$510,000,000	$7,075,000	$283,000,000
	Increase ITP Average Daily Design Flow Rate to 50 MGD	$299,000,000	$700,000,000	$10,025,000	$401,000,000
	Increase ITP Average Daily Design Flow Rate to 55 MGD	$353,000,000	$860,000,000	$12,675,000	$507,000,000
	Increase ITP Average Daily Design Flow Rate to 60 MGD	$372,000,000	$940,000,000	$14,200,000	$568,000,000
	Construct a Pump Station and Pipeline to Convey Treated Effluent from the Expanded ITP to Mexico	$12,400,000	$26,000,000	$340,000	$13,600,000

(shaded) = Sub-project partially or fully located in Mexico

Project	Sub-project	Estimated Capital Cost	Estimated 40-year Life Cycle Cost	Average Total Annual O&M (2021 Dollars)	40 Year O&M
4	Decommissioning the El Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system	$30,800,000	$35,900,000	$127,500	$5,100,000
	Upgrading the U.S.-side wastewater collection structures at Smuggler's Gulch and Goat Canyon	$435,000	$600,000	$4,125	$165,000
5	Rehabilitating targeted collector pipelines as identified by CESPT	$149,000,000	Not evaluated	Not evaluated	Not evaluated
	Extend wastewater collection facilities into developed but unsewered areas	$756,000,000	Not evaluated	Not evaluated	Not evaluated
	Rehabilitate or replace the existing local pump stations.	$84,000,000	Not evaluated	Not evaluated	Not evaluated
	Rehabilitate or replace the existing local sanitary sewer system.	Billions of dollars; precise costs not evaluated	Not evaluated	Not evaluated	Not evaluated
	Expand the Tijuana sanitary sewer system to account for future growth				
	Expanding the treatment capacity in Tijuana to treat the additional wastewater captured by the sanitary system				

= Sub-project partially or fully located in Mexico

Project	Sub-project	Estimated Capital Cost	Estimated 40-year Life Cycle Cost	Average Total Annual O&M (Current Dollars)	40 Year O&M
6	Restoration of the Tijuana River Main Channel sediment basin between the US/Mexico border and Dairy Mart Road to its original configuration by removing accumulated sediment	$49,600,000	$380,000,000	$8,260,000	$330,400,000
	Sediment basin located on the US-side of the border at Smuggler's Gulch (in channel)	$2,400,000	$32,200,000	$745,000	$29,800,000
	Sediment basin located on the US-side of the border at Smuggler's Gulch (in and off channel combined)	$7,600,000	$38,500,000	$772,500	$30,900,000
	In-channel sediment basin on the Mexico-side of the border at Smuggler's Gulch	$1,100,000	$8,500,000	$185,000	$7,400,000
	US-side pilot channel in Yogurt Canyon	$3,300,000	$3,500,000	$5,000	$200,000
	US-side modification to Monument Road just east of International Friendship Park	$2,900,000	$3,200,000	$7,500	$300,000
	Installation of trash booms in the Tijuana River Main Channel	$3,600,000	$33,100,000	$737,500	$29,500,000
	Installation of trash booms in Smuggler's Gulch	$420,000	$1,400,000	$24,500	$980,000
7	Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, all new infrastructure	$36,900,000	$50,200,000	$332,500	$13,300,000
	Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, reuse some existing infrastructure	$20,700,000	$34,000,000	$332,500	$13,300,000
	Piping of treated wastewater from La Morita and Arturo Herrera WWTPs directly to the SBOO	$77,900,000	$79,000,000	$27,500	$1,100,000

= Sub-project partially or fully located in Mexico

Project	Sub-project	Estimated Capital Cost	Estimated 40-year Life Cycle Cost	Average Total Annual O&M (Current Dollars)	40 Year O&M
8	Upgrade the SAB plant to properly treat reduced flows coming from Playas and direct vicinity of the SAB plant (5 MGD)	$43,300,000	$121,000,000	$1,942,500	$77,700,000
9	Use the SBWRP at its current design capacity and layout with solids pumped to Point Loma for processing	$51,600,000	$681,000,000	$15,735,000	$629,400,000
	Use the SBWRP at its current design capacity (15 MGD) but construct a new onsite solids processing chain	$105,000,000	$759,000,000	$16,350,000	$654,000,000
	Expand the SBRWP to a design capacity of 30 MGD (average daily flow), including a new onsite solids processing train	$274,000,000	$1,200,000,000	$23,150,000	$926,000,000
10	Road paving	Unlike the cost impact analysis for the other nine projects, Project 10 does not provide estimates for the construction, operation, and maintenance of specific infrastructure or BMPs. See Project 10 Feasibility Analysis for further details.		--	--
	Trash and tire collection, processing, and disposal			--	--
	Public education, outreach, and participation programs			--	--
	Land stabilization			--	--
	Green infrastructure			--	--

= Sub-project partially or fully located in Mexico

APPENDIX B: METHODS OF ANALYSIS

B.1. INTRODUCTION

Appendix B provides an overview of the factors, quantitative methods, and constraints that PG used to evaluate the impacts, costs, and implementation considerations of each alternative. Specifically, Appendix B discusses how PG evaluated the following:

1. Costs and impacts of Project 5 (targeted rehabilitation of sewer collectors in Tijuana)
2. Impacts of each alternative on transboundary flows in the Tijuana River
3. Impacts of each alternative on flow streams in the Tijuana wastewater collection system
4. Impacts of each alternative on beaches in San Diego County
5. Energy requirements of each alternative
6. Opinions on probable costs for each alternative

PG used the common variables and abbreviations throughout this appendix that are summarized in Table B-1.

Table B-1. Summary of Commonly Used Variables and Definitions

Parameter	Definition
C	concentration
E	energy
$\dot{m}$	BOD_5 and TSS load (mass flow rate)
p	percent
P	proportion
ρ	density
$\dot{Q}$	volumetric flow rate
t	time
V	volume
w	work (per unit mass)

The *Feasibility Analysis Technical Memoranda* (summarized in Appendix D) provide more information on PG's methods for evaluating the feasibility and costs of the individual projects that are part of each alternative.

B.2. PROJECT 5 ESTIMATED COSTS AND IMPACT

To estimate the impact of repairing targeted sewer collector sewers in the City of Tijuana, EPA compared reductions in untreated wastewater discharges to the Tijuana River from past repairs to the costs of those repairs. Specifically, EPA used the Poniente Collector Sections 1B, 2, and 3 repair projects, which had a higher cost per MGD of untreated wastewater removed than other collector repairs, thus yielding the most conservative estimate of impact versus cost.

Cost data obtained by EPA from NADB showed that the Poniente collector repairs had a construction unit cost of $1.8 million per 1 MGD of untreated wastewater removed from the Tijuana River. For consistency with the other project cost estimates, PG applied a 1.5 general contingency factor to this cost to account for unanticipated construction, unknown subsoils, and other factors associated with future collector repairs. Thus, future targeted sewer collector rehabilitations in

Tijuana are estimated to have a project cost, including contingencies, of $2.7 million per 1 MGD of untreated wastewater removed from the Tijuana River.

B.3. TIJUANA RIVER

B.3.1 Overview

Flows in the Tijuana River that are not diverted in Mexico by PB-CILA cross the U.S.-Mexico border into the Tijuana River Valley. PG defines transboundary flows in the Tijuana River main channel as flows that cross into the U.S. from Mexico and are not captured by a U.S.-side diversion. PG analyzed the frequency and magnitude of transboundary flows in the Tijuana River main channel using flow data from the IBWC flow gauge located downstream of the border from January 1, 2016, through December 31, 2019. PG's analysis focused on five parameters:

- Transboundary flow days (days on which transboundary flows occur)
- Annual transboundary flow volume
- Annual BOD_5 load
- Annual TSS load
- Annual trash load

PG developed a custom Python[1] script to apply the methods listed in Sections B.3.3 through B.3.6 to the IBWC flow gauge data. PG evaluated each parameter listed above under current conditions, as well as under the conditions produced by each alternative.

B.3.2 Initial Data Processing

PG downloaded the flow gauge data from the IBWC Water Data Portal (https://waterdata.ibwc.gov/). This website presents the average daily transboundary flow rate in MGD for each day. PG used the flow data for January 1, 2016, through December 31, 2019, to analyze the impacts of each alternative to the Tijuana sanitary system. PG did not include 2020 IBWC flow gauge data because the ongoing upgrade to PB-CILA has caused variations in transboundary flow rates that are not likely to be representative of long-term flow patterns. (Note that the Python script can be easily modified to evaluate other intervals of flow data if warranted.)

B.3.3 Adjusting Flow Data to Reflect Each Scenario

PG evaluated each alternative's impacts on river flows by considering how the alternative would affect the following two values:

1. **Diversion capacity ($\dot{Q}_{Div}$),** representing the maximum river flow rate that can be fully diverted. PG assumed that any flow rate in the river under this value would be reduced to zero.
2. **Shutoff capacity ($\dot{Q}_{Shutoff}$),** which represents the maximum river flow rate at which the river diversion operates. PG assumed that any river flow rate equal to or less than this value, but greater than the diversion capacity, would be reduced by the diversion capacity.

[1] Python is an open-source, general purpose programming language.

B.3.4 Flow Characteristics

PG first evaluated the impact of each alternative on the total number of transboundary flow days and the total flow volume. PG considered a transboundary flow day as a day when the IBWC gauge read a non-zero flow rate. PG estimated the average annual total flow volume (Q_{Total}) using Equation 1:

$$Q_{Total} = \sum \dot{Q}_{ADF} \times t \qquad [1]$$

where $\dot{Q}_{ADF}$ represents the average daily flow rate for each day and t is the time in number of days during which the average flow rate occurs. In this case, t = 1 day.

PG calculated the transboundary flow days and total transboundary flow volume for the current baseline condition and for each alternative. Based on the current condition, percent reduction in transboundary flows and total flows in the Tijuana River were calculated for each alternative.

B.3.5 Water Quality Calculations

B.3.5.1 Estimating Pollutant Loadings Using the Flow Data

In addition to transboundary flows, PG examined how each alternative would affect the annual loading of pollutants in the Tijuana River. PG evaluated the BOD_5 and TSS load under current conditions in the Tijuana River. The load of any pollutant in a water body over an interval of time is a function of both concentration of the pollutant and the flow rate. In this case, the BOD_5 and TSS concentrations in the river are both functions of flow rate. Therefore, the total load over a period of time can be calculated using Equation 2:

$$\dot{m} = k \int_{t_1}^{t_2} \dot{Q}(t) \times C\left(\dot{Q}(t)\right) dt \qquad [2]$$

where $\dot{m}$ represents the total annual load, $\dot{Q}(t)$ equals the flow rate, $C(\dot{Q}(t))$ represents the concentration of a pollutant as a function of flow rate, t_1 and t_2 represent the time interval that is being evaluated, and k is a constant unit conversion factor to convert the total load into an annual average. In this case, k is equal to 0.25 $years^{-1}$. $\dot{Q}(t)$ is the river's flow rate measured at the IBWC flow gauge and $C(\dot{Q}(t))$ is the function relating BOD_5 and TSS concentrations in the river to $\dot{Q}(t)$. Since $\dot{Q}(t)$ is a discrete set of points, the loading function is estimated numerically using the sum of the daily pollutant loadings, shown in Equation 3:

$$\dot{m} = k \sum_{k=t_1}^{t_2} \dot{Q}(t)_k \times C\left(\dot{Q}(t)\right)_k \times \Delta t \qquad [3]$$

where Δt is the time interval between each data point. In this case Δt = 1 day.

PG estimated the impact of each alternative on BOD_5 and TSS loads in the river by estimating the load of each pollutant that would continue to flow across the border and comparing the loads to the estimates on current conditions. PG estimated the pollutant loadings by assuming the following:

- The transboundary flow rates on days that are currently less than $\dot{Q}_{Div}$ would be eliminated, so those pollutant loadings are zero.

- The transboundary flow rates on days that are currently greater than $\dot{Q}_{Shutoff}$ would remain unchanged. Therefore, the pollutant loadings would be the same as they are under current conditions.
- The transboundary flow rates on days that are currently greater than $\dot{Q}_{Div}$ but equal to or less than $\dot{Q}_{Shutoff}$ would be reduced by the $\dot{Q}_{Div}$ flow rate. Therefore, a portion of the pollutant loadings would continue to flow across the border.

For the scenario described by the third assumption, PG estimated the portion of pollutant loadings that would continue to flow across the border by multiplying the estimated pollutant load during that day by the proportion of river flows that would not be diverted, shown in Equation 4:

$$\dot{m}_{t,Alt} = \frac{\dot{Q}(t) - \dot{Q}_{Div}}{\dot{Q}(t)} \times \dot{m}_t \qquad [4]$$

where $\dot{m}_{t,Alt}$ is the estimated pollutant load in transboundary flows for a single day once the alternative is implemented and $\dot{m}_t$ is the estimated pollutant load for a single day in transboundary flows under current conditions.

B.3.5.2 Untreated Wastewater (BOD_5) in the Tijuana River

PG evaluated the effects of each alternative on untreated wastewater contamination in the Tijuana River by estimating how much each alternative would reduce the BOD_5 load. PG used BOD_5 as a surrogate parameter for untreated wastewater because it is readily measurable and BOD_5 data are already available for untreated wastewater in Tijuana. PG estimated that untreated wastewater in Tijuana has a BOD_5 concentration of 400 mg/L based on the IBWC *Binational Water Quality Study of the Tijuana River and Adjacent Canyons and Drains*, and on ITP influent data from 2016 through 2019 (IBWC 2020). PG assumed that all other sources of flow in the river are negligible sources of BOD_5.

The BOD_5 concentration in transboundary flows is dependent on the flow rate of untreated wastewater entering the river relative to the total flow in the river. PG estimated the flow rate of untreated wastewater into the river using available flow source from August 2020 to January 2021 collected by CESPT and provided by NADB (see Appendix E). CESPT collected these data by visually monitoring the points where untreated wastewater is discharged to the Tijuana River channel. CESPT used these data to estimate that the average flow rate of untreated wastewater was 13 MGD over this period. However, EPA and NADB stated, based on their observations, that untreated wastewater discharges into the river throughout 2020 were abnormally high compared to 2016 through 2019. Actual flow source data in the Tijuana River were not available for 2016 through 2019. Therefore, PG adjusted the 2020 average daily flow rate of untreated wastewater into the river (13 MGD) using flow balances between the river and the International Collector from 2016 through 2019. Based on the flow balances, PG estimated that the average daily flow rate of untreated wastewater into the river for 2016 through 2019 was 10 MGD.

During dry weather, the estimated average daily flow rate of 10 MGD of untreated wastewater that enters the river is diluted by effluent from the Arturo Herrera WWTP, effluent from the La Morita WWTP, and flows from the Alamar River. PG used the average daily effluent flow rate data presented in a 2020 CESPT report to estimate the average daily effluent flow rates from the Arturo Herrera and La Morita WWTPs (CESPT 2020). PG estimated the average daily flow rate from the

Alamar River using 2020 flow data collected by CESPT and provided by NADB. The sources of flow in the Tijuana River are summarized in Table B-2.

Table B-2. Summary of Dry Weather Flow Sources in the Tijuana River, 2016–2019

Source	Average Daily Flow (MGD)
Effluent from the Arturo Herrera WWTP (CESPT 2020)	5.0
Effluent from the La Morita WWTP (CESPT 2020)	5.3
River flows from Rio Alamar	4.1
Untreated wastewater from Tijuana	10
Average daily dry weather flows, 2016–2019	**24.4**

PG used a piecewise function[2] to estimate the BOD_5 concentration as a function of river flow rate at the IBWC river gauge to account for PB-CILA diverting river water at lower flow rates. At flow rates under 25 MGD, PG used a BOD_5 concentration of 165 mg/L during dry weather flows, based on the flow sources shown in Table B-2. At flow rates over 25 MGD, PG estimated the concentration of BOD_5 using the ratio of untreated wastewater to the total river flow rate. Combined, the relationship between BOD_5 and the river flow rate measured at the IBWC gauge is expressed by Equation 5:

$$C_{BOD5}\left(\dot{Q}(t)\right) = \begin{cases} 165\ \dfrac{\text{mg}}{\text{L}}, & \dot{Q}(t) \le 25\ \text{MGD} \\ \dfrac{10\ \text{MGD}}{\dot{Q}(t)} \times 400\ \dfrac{\text{mg}}{\text{L}}, & \dot{Q}(t) > 25\ \text{MGD} \end{cases} \qquad [5]$$

PG applied Equation 5 to the IBWC gauge data, then used Equation 3 to estimate that the average annual BOD_5 load in the river from 2016 to 2019 is 1,670 tons.

PG evaluated alternatives that included rehabilitating targeted sewer collectors in Tijuana (Project 5) using EPA's assumption that the rehabilitation would reduce the untreated wastewater in the Tijuana River from 10 MGD to 5 MGD. PG accounted for this flow reduction by evaluating these scenarios with a 50% reduction in BOD_5 concentration relative to current conditions. Therefore, PG evaluated the annual BOD_5 load of these alternatives assuming that transboundary flows below 25 MGD have a BOD_5 concentration of 82.5 mg/L in dry weather; for flows over 25 MGD in wet weather flows, PG used a BOD_5 concentration derived as shown in Equation 6:

$$C_{BOD5}(\dot{Q}_{River}) = \begin{cases} 82.5\ \dfrac{\text{mg}}{\text{L}}, & \dot{Q}_{River} \le 25\ \text{MGD} \\ \dfrac{5\ \text{MGD}}{\dot{Q}(t)} \times 400\ \dfrac{\text{mg}}{\text{L}}, & \dot{Q}_{River} > 25\ \text{MGD} \end{cases} \qquad [6]$$

B.3.5.3 Sediment Loads (TSS) in the Tijuana River

The sediment load in the river is also a function of the flow rate in the river. However, sediment behaves differently than BOD_5 in that its concentration in the river increases as flow rate increases due to the progressively higher sediment concentration in stormwater runoff. PG used TSS as a surrogate parameter for sediment loading in the river. PG estimated the river's TSS concentration

[2] A piecewise function is a function defined by multiple sub-functions, each applying to a different interval in the domain.

as a function of flow rate in the river using a piecewise function to represent different conditions during dry and wet weather.

During dry weather and smaller wet weather flows, sediment-laden untreated wastewater that is not captured in the sanitary sewer system is the primary source of TSS in the river. PG used the 2020 Water Quality Study from IBWC and ITP influent monitoring data to estimate that untreated wastewater in Tijuana has a TSS concentration of 400 mg/L. Factoring in the flow sources shown in Table B-2, PG estimated that the average TSS concentration in the river during dry weather is 200 mg/L.

During wet weather events, the main source of TSS is stormwater runoff flowing to the river. The TSS concentration in wet weather river flows increases as the flow rate increases. PG used a preliminary correlation from May 2020 (developed by Dr. Trent Biggs of San Diego State University) on sediment samples over 5 m^3/s (114 MGD) to estimate how sediment concentrations increase as wet weather flow rates increase. PG assumed that the TSS concentration in the river had a floor of 200 mg/L and that the piecewise function is smooth; therefore, the San Diego State University correlation was only used for river flow rates over 80 MGD (the river flow rate at which the correlation exceeds 200 mg/L). PG used Equation 7 to estimate the TSS concentration of varying river flows.

$$C_{TSS}(\dot{Q}(t)) = \begin{cases} 200\ \dfrac{\text{mg}}{\text{L}} & , \quad \dot{Q}(t) \leq 80\ \text{MGD} \\ 66.24 \times \left(\dfrac{\dot{Q}(t)}{0.0438\, \dfrac{\text{MGD} \times s}{m^3}} \right)^{0.8837} & , \quad \dot{Q}(t) > 80\ \text{MGD} \end{cases} \qquad [7]$$

where C_{TSS} is the sediment concentration, and $\dot{Q}(t)$ is the flow rate in MGD. PG applied Equation 7 to the 2016–2019 IBWC flow gauge data, then used Equation 3 to estimate that the average annual sediment load over the four-year period was 125,000 tons of sediment. PG used the same method to estimate the reductions in annual sediment load that each alternative would provide.

The estimated average annual sediment load from 2016 to 2019 does not account for very large storm events. Such events occur infrequently but are significant sources of sediment loading in the Tijuana River. The maximum 24-hour precipitation accumulation measured at the NOAA gauge, collected at Brown Field Municipal Airport in southern San Diego County (the closest NOAA gauge to the City of Tijuana) between 2016 and 2019, was 2.21 inches. According to the NOAA Atlas 14 Precipitation Frequency Estimates, this event falls between a five-year, 24-hour storm (2.04 inches) and a 10-year, 24-hour storm (2.40 inches). PG used the *Phase 2 Hydrology, Floodplain, and Sediment Transport Report* developed by the U.S. Army Corps of Engineers (USACE) to account for the sediment load from storm events larger than the storms that occurred between 2016 through 2019. The USACE Phase 2 study described modeling used to estimate the sediment loads that are transported to the estuary during storm events with recurrence intervals ranging from two years to 500 years. USACE calculated the average sediment load that each storm contributes annually by multiplying the total sediment yield by the probability for a storm of that size to occur in an average year. The estimated sediment yields for the Tijuana River main channel are shown in Table B-3 (USACE 2020).

Table B-3. Estimated Sediment Loads from Storm Events in the Main Channel

Storm Recurrence Interval	Main Channel Estimated Sediment Load per Event (at U.S.-Mexico Border) (Tons)	Main Channel Annualized Sediment Load (Tons/Year)
500 years	2,211,000	4,422
200 years	1,075,000	5,375
100 years	696,000	6,960
50 years	644,000	12,880
25 years	399,000	15,960
10 years	169,000	16,900
5 years	89,000	17,800
2 years	19,000	9,500
Annual average	**N/A**	**90,000**

Source: USACE 2020

PG used the annualized sediment load averages at the U.S.-Mexico border shown in Table B-3 to estimate that storm events with a recurrence interval of 10 years or greater have an annualized sediment load of 62,000 tons. PG combined the annualized sediment load estimate of large storm events (62,000 tons) with the average annual sediment load from 2016 through 2019 (125,000 tons) to estimate that the average annual sediment load in transboundary flows in the river is 187,000 tons.

This estimate is based on limited monitoring data, and the data that has been collected is highly variable. More data should be collected to better quantify the annual sediment loading in the river.

B.3.5.4 Trash Impacts

PG estimated the average annual trash load consistent with the methodology used in the *SB-507 Tijuana River Valley Needs and Opportunities Assessment* developed by HDR, which assumes that the annual trash load is 10% of the annual sediment load by volume (HDR 2020). PG assumed that the sediment in the river has a dry density of 1.2 cubic yards per ton, based on the density estimates in the Stantec report and the USACE Phase 2 study (Stantec 2020; USACE 2020). PG applied the estimated density to the annual sediment load of 187,000 tons/year to estimate the trash load, as shown in Equation 8:

$$187{,}000\,\frac{\text{tons of TSS}}{\text{year}} \times 1.2\,\frac{\text{yd}^3\text{ of TSS}}{\text{tons of TSS}} \times 0.1\,\frac{\text{yd}^3\text{ of trash}}{\text{yd}^3\text{ of TSS}} = 15{,}000\,\frac{\text{yd}^3\text{ of trash}}{\text{year}} \qquad [8]$$

This approach yielded an average annual trash load in main channel transboundary flows of 15,000 cubic yards. More monitoring should be conducted to better characterize the loadings and types of trash the Tijuana River carries.

B.3.6 Example Transboundary Flow and Load Calculations

The example transboundary flow event below shows how PG estimated the impacts of each alternative during wet weather. This event occurred due to a storm on January 31, 2016, that produced 0.38 inches of rain at the NOAA gauge at Brown Field Municipal Airport in southern San Diego County. In this example, PG estimated the effects of an example alternative with a diversion capacity ($\dot{Q}_{Div}$) of 35 MGD and a shutoff capacity ($\dot{Q}_{Shutoff}$) of 60 MGD.

The impacts of this scenario on the flows in the river from January 29 through February 13, 2016, are shown in Table B-4, below. All flow rates that were under 35 MGD were reduced to 0 MGD. On January 31 and February 1, the flow rate in the river exceeded $\dot{Q}_{Shutoff}$, so the adjusted average daily flow rate remained the same as the actual average daily flow rate. The average daily flow rate on February 2 was above $\dot{Q}_{Div}$ (35 MGD), but below the $\dot{Q}_{Shutoff}$ (60 MGD). Therefore, PG calculated the adjusted average daily flow rate for February 2 by subtracting $\dot{Q}_{Div}$ from the actual average daily flow rate, as shown in Equation 9:

$$43.97 \text{ MGD} - 35 \text{ MGD} = 8.97 \text{ MGD} \qquad [9]$$

Table B-4. Flow Characteristics During a Sample Transboundary Flow Event

Date	Actual Average daily Flow Rate (MGD)	Adjusted Average Daily Flow Rate After Example Alternative (MGD)
1/29/2016	0	0
1/30/2016	0	0
1/31/2016	293.187098	293.187098
2/1/2016	68.49784585	68.49784585
2/2/2016	43.97135673	8.97135673
2/3/2016	32.84128997	0
2/4/2016	27.93101677	0
2/5/2016	26.82845857	0
2/6/2016	25.83556984	0
2/7/2016	26.47164083	0
2/8/2016	25.74009436	0
2/9/2016	24.97623883	0
2/10/2016	24.33368775	0
2/11/2016	16.69501659	0
2/12/2016	0	0
2/13/2016	0	0

To demonstrate how the reduction in BOD_5 and TSS loadings for each alternative was calculated, PG used Equations 2–7 to calculate the reduction in BOD_5 and TSS for the example transboundary flow event. The results are shown in Table B-5.

Table B-5. Pollutant Loadings in the Tijuana River During a Sample Transboundary Flow Event

Date	Actual Daily Flow Rate (MGD)	Actual BOD_5 Load* (Tons/Day)	Adjusted BOD_5 Load After Example Alternative (Tons/Day)	Actual TSS Load (Tons/Day)	Adjusted TSS Load After Example Alternative (Tons/Day)
1/29/2016	0	0	0	0	0
1/30/2016	0	0	0	0	0
1/31/2016	293.187098	16.7	16.7	774	774
2/1/2016	68.49784585	16.7	16.7	57	57
2/2/2016	43.97135673	16.7	3.40	36.7	7.49
2/3/2016	32.84128997	16.7	0	27.4	0
2/4/2016	27.93101677	16.7	0	23.3	0
2/5/2016	26.82845857	16.7	0	22.4	0
2/6/2016	25.83556984	16.7	0	21.6	0
2/7/2016	26.47164083	16.7	0	22.1	0
2/8/2016	25.74009436	16.7	0	21.5	0
2/9/2016	24.97623883	16.7	0	20.8	0
2/10/2016	24.33368775	16.2	0	20.3	0
2/11/2016	16.69501659	11.1	0	13.9	0
2/12/2016	0	0.0	0	0	0
2/13/2016	0	0.0	0	0	0
Total	**637 million gallons**	**194 tons**	**36.8 tons**	**1,060 tons**	**838 tons**

* The BOD load in the river remains the same from January 31 through February 9 because the untreated wastewater discharges are assumed to be a constant 10 MGD, with a BOD_5 concentration of 400 mg/L, in river flows above 25 MGD. The actual annual BOD load was calculated with Equation 3.

As shown in Table B-5, days with flows that are under $\dot{Q}_{Div}$ (35 MGD) would have zero pollutant loads because transboundary flows would be eliminated through the implementation of the example project's river diversion. On January 31 and February 1, 2016, flows exceeded $\dot{Q}_{Shutoff}$ (60 MGD), so the pollutant loadings remained the same. On February 2, the flow rate was above the diversion capacity but below the shutoff capacity. Therefore, PG calculated the BOD_5 and TSS loads on this date adjusted for the example alternative using Equations 10 and 11:

$$\frac{43.97\text{ MGD} - 35\text{ MGD}}{43.97\text{ MGD}} \times 16.7\ \frac{\text{tons of BOD}_5}{\text{day}} = 3.40\ \frac{\text{tons of BOD}_5}{\text{day}} \qquad [10]$$

$$\frac{43.97\text{ MGD} - 35\text{ MGD}}{43.97\text{ MGD}} \times 36.7\ \frac{\text{tons of TSS}}{\text{day}} = 7.49\ \frac{\text{tons of TSS}}{\text{day}} \qquad [11]$$

In this scenario, the example alternative with a diversion capacity of 35 MGD would have provided the reductions in BOD_5 and TSS in the river between January 29 and February 13, 2016, as shown in Equations 12 and 13:

$$\left(1 - \frac{36.8\text{ tons of BOD}_5}{194\text{ tons of BOD}_5}\right) \times 100 = 81\%\text{ reduction in BOD}_5\text{ load} \qquad [12]$$

$$\left(1 - \frac{838\text{ tons of TSS}}{1{,}060\text{ tons of TSS}}\right) \times 100 = 21\%\text{ reduction in TSS load} \qquad [13]$$

PG used the calculations listed above to ensure that the Python script was accurately applying the methodology outlined in Sections B.3.3 through Section B3.6. The transboundary flow days, total flows, BOD_5 load, and TSS loads generated by the script for both the current conditions and the 35 MGD diversion matched the values calculated above.

B.3.7 Diversion and Shutoff Values for the Final Three Alternatives

For each final alternative, PG developed values for $\dot{Q}_{Div}$ and $\dot{Q}_{Shutoff}$ that reflect how each project is expected to affect river flows using the following factors.

- A U.S.-side diversion and APTP (Project 1) can divert all river flows up to the capacity of the treatment plant. Additionally, a U.S.-side diversion would divert a portion of flows up to a shutoff threshold. PG assumed that the four U.S.-side diversion sizes would have the shutoff values shown in Table B-6.

Table B-6. Diversion and Shutoff Values for Each Project 1 Size

U.S.-Side Diversion/APTP Size (MGD)	$\dot{Q}_{Shutoff}$ (MGD)
35	60
60	120
100	100
163	163

- Diverting flows from PB-CILA to a U.S.-side APTP (Project 2) would be able to divert river flows up to the diversion and plant capacity. PG assumed that PB-CILA will not operate at flow rates over the current diversion capacity of 23 MGD after the ongoing upgrade is completed, so $\dot{Q}_{Shutoff}$ is equal to $\dot{Q}_{Div}$. Although it is likely technically feasible to partially divert flows above the diversion's capacity, doing so would depend on a revised operational agreement between the U.S. and Mexico.
- Rehabilitating targeted sanitary sewer collectors in Tijuana (Project 5) is estimated to reduce the average daily flow in the river by 5 MGD. PG assumed that this would increase both $\dot{Q}_{Div}$ and $\dot{Q}_{Shutoff}$ by 5 MGD.
- Constructing a new force main to convey effluent from the Arturo Herrera WWTP and La Morita WWTP to the Rodriguez Dam impoundment (Project 7) is estimated to reduce the average daily flow in the river by 10.3 MGD. PG assumed that this would increase both $\dot{Q}_{Div}$ and $\dot{Q}_{Shutoff}$ by 10.3 MGD.

PG applied these factors to each alternative to estimate a $\dot{Q}_{Div}$ and $\dot{Q}_{Shutoff}$ that represents the effects of all included projects. The $\dot{Q}_{Div}$ and $\dot{Q}_{Shutoff}$ values for the final three alternatives are detailed in Table B-7.

Table B-7. Summary of the Diversion and Shutoff Values for the Three Final Alternatives

Alternative	$\dot{Q}_{Div}$	$\dot{Q}_{Shutoff}$	Summary
E-2	50.3 MGD	75.3 MGD	The 35 MGD U.S.-side diversion (Project 1) and the Mexico-side diversion would divert all flows under 35 MGD and divert 35 MGD of flow at river flow rates up to 60 MGD to a new APTP. Alternative E-2 also includes Project 5 and Project 7, which are expected to reduce the flow rate in the river by 15.3 MGD daily. PG evaluated the BOD_5 in the river using Equation 6, which accounts for the effects of the targeted sanitary sewer collectors.
H	38.3 MGD	38.3 MGD	Project 5 and Project 7 are expected to reduce the flow rate in the river by 15.3 MGD daily. On days when the average daily flow rate in the river is less than 38.3 MGD, this would reduce the average daily flow rate in the river to under PB-CILA's current shutoff capacity of 23 MGD. For the purposes of this analysis, PG assumed that the upgrades to PB-CILA would allow the pump station to operate more reliably but would not increase the shutoff threshold.
I-2	75.3 MGD	135.3 MGD	The 60 MGD U.S.-side diversion (Project 1) and the Mexico-side diversion would divert all flows under 60 MGD and divert 60 MGD of flow at river flow rates up to 135.3 MGD to a new APTP. Project 5 and Project 7 are expected to reduce the flow rate in the river by 15.3 MGD daily. PG evaluated the BOD_5 in the river using Equation 6, which accounts for the effects of the targeted sanitary sewer collectors.

B.4. TIJUANA WASTEWATER COLLECTION SYSTEM

B.4.1 Overview

The City of Tijuana operates an existing network of pump stations, collectors, and sewer mains to convey collected wastewater from the city and diverted river water to either the ITP for treatment or to the Pacific Ocean via SAB Creek. Figure B-1 shows a process flow diagram for the existing system.

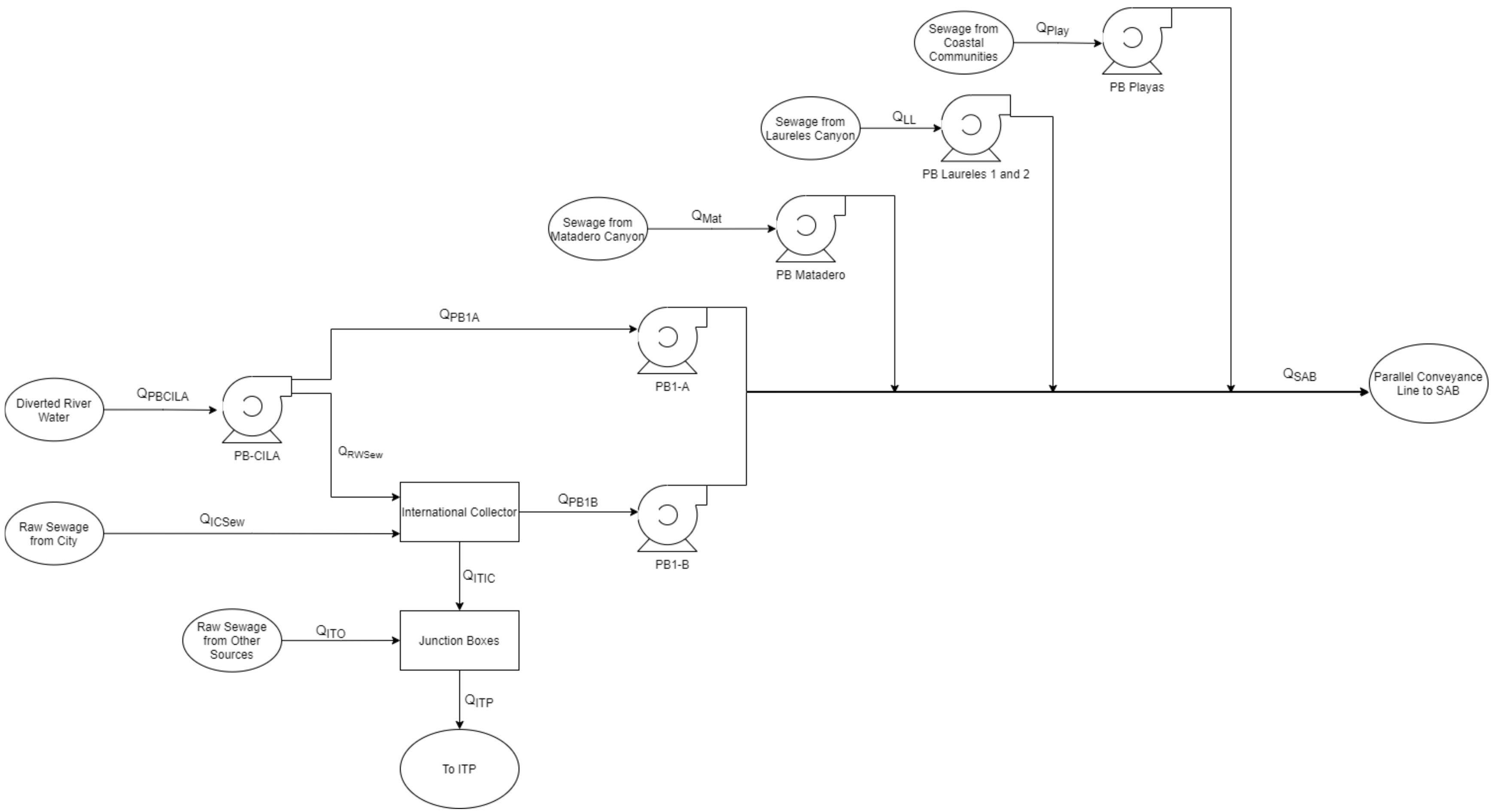

Figure B-1. Process Flow Diagram of the Existing System Showing Relevant Infrastructure and Flow Streams

PG evaluated the impacts of each alternative on flows conveyed to SAB Creek using flow data from PB-CILA, PB1-A, PB1-B, Matadero Pump Station, and Playas Pump Station from January 1, 2016, through December 31, 2019, and available monthly influent data from the ITP from August 2018 to December 2019. PG used the impacts on flow, water quality data from the IBWC Water Quality Study, influent data from the ITP, river flow source data from CESPT provided by NADB, and flow and mass balances to evaluate the impact on BOD_5 and TSS loads discharged to SAB Creek (IBWC 2020).

PG calculated the flow balances and pollutant loadings for dry weather discharges at SAB Creek using the following assumptions and factors:

- The 2016–2019 IBWC flow gauge data are representative of the current condition of flows in the Tijuana River.
- PB1-A exclusively diverts river water from PB-CILA to SAB Creek.
- PG used ITP monthly influent flow data when available. For months where flow data wasn't available, PG assumed that the average monthly flow rate to the ITP was 25 MGD.
  - PG verified this assumption by calculating the average daily flow rate from the months of data that were available, which was equal to 25 MGD.
- PG estimated that the average monthly flow rate of all flows collected in the U.S.-side canyon collectors was 0.6 MGD. This value is based on monitoring data from January through July 2021 provided by IBWC. Flows from these sources were assumed to be untreated wastewater.
- The diverted river water and untreated wastewater flows in the International Collector are well mixed. Therefore, the BOD_5 and TSS concentrations of the flows sent to the ITP are identical to the BOD_5 and TSS concentrations of flows sent to PB1-B.
- Flow data on the Los Laureles 1 Pump Station and the Los Laureles 2 Pump Station from January 1, 2016, through December 31, 2016, were not available. PG estimated that the average monthly flow rate of the combined flows from the Los Laureles 1 and Los Laureles 2 Pump Stations was 1.83 MGD, based on limited flow data from September 2020 through November 2020 provided from CESPT.
  - These flows are assumed to be 100% untreated wastewater.
- The total flow conveyed to SAB Creek is the sum of the discharges from PB1-A, PB1-B, the canyon pump stations, and the Playas Pump Station. Other minor sources were assumed to be negligible.
- SABTP in its current condition does not provide an improvement in the water quality of the effluent.
- Rehabilitating and upgrading the collectors in Tijuana (Project 5) would remove 5 MGD of untreated wastewater flows from the river. The 5 MGD of flows would be conveyed to the International Collector instead.
- Constructing the effluent conveyance line from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment (Project 7) would increase the number of days, volume of flow, and pollutant loadings in the diverted river water. PG estimated the impacts of the new conveyance line to the wastewater collection system using the changes in total flow,

BOD_5 load, and TSS load in the river (which were calculated using the methods discussed in Section B.3).

  - If the rehabilitated and extended force main from PB-CILA to the APTP, and the APTP (Project 2), are implemented with Project 7, Project 7 would not affect flows in the wastewater collection system because Project 2 conveys all of the diverted river water to the APTP.

- A new SABTP would have a BOD_5 removal of 96% and a TSS removal of 96.5% (for all sizes considered).

B.4.2 Flow Balances

B.4.2.1 PB-CILA and PB1-A

The PB-CILA Pump Station pumps the diverted river water to either PB1-A or the International Collector. The flow streams that are relevant to PB-CILA and PB1-A are listed in Table B-8.

Table B-8. List of Flow Streams Attributed to PB-CILA and PB1-A

Stream Description	Stream Identifier	Flow Destination	Type of Flow	Source
River water diverted to PB-CILA	PBCILA	PB-CILA	River water	CESPT monthly data
River water conveyed to PB1-A	PB1A	PB1-A	River water	CESPT monthly data
River water conveyed to the International Collector	RWInt	International Collector	River water	Flow balances

PG evaluated current conditions using total flow data from PB-CILA and PB1-A measured by CESPT and provided by NADB. PG used the flow balance shown in Equation 14 to calculate the average flow rate of the river water conveyed to the International Collector.

$$\dot{Q}_{RWInt} = \dot{Q}_{PBCILA} - \dot{Q}_{PB1A} \quad [14]$$

B.4.3 International Collector and ITP

PG performed flow and mass balance calculations on the flows into and out of the International Collector to calculate the following parameters:

1. Average monthly flow rate of untreated wastewater entering the International Collector.
2. Proportion of flows in the International Collector that are river water.
3. Average monthly flow rate of river water that is currently being treated at the ITP.

Table B-9 shows the streams that are relevant to the International Collector and the ITP.

Table B-9. List of Flow Streams Attributed to the International Collector and the ITP

Stream Description	Stream Identifier	Flow Destination	Type of Flow	Source
River water from PB-CILA	ICRW	International Collector	River water	Flow balance
Untreated wastewater collected in Tijuana	ICWW	International Collector	Untreated wastewater	Flow balance
Flows to PB1-B	PB1B	PB1-B	River water and untreated wastewater mix	CESPT monthly data
International Collector flows to the ITP	ITIC	ITP	River water and untreated wastewater mix	Flow balance
Other flows treated at the ITP	ITO	ITP	Untreated wastewater	Estimated as 0.6 MGD
ITP influent flow	ITP	ITP	River water and untreated wastewater	ITP design and influent data

The ITP is designed to treat an average flow rate of 25 MGD from the International Collector and dry weather flows from the other drains that cross the border at Stewarts Drain, Silva Drain, Canyon del Sol, Smugglers Gulch, and Goat Canyon. PG calculated the flow from the International Collector to the ITP using a flow balance on the ITP and the estimated other flows treated at the ITP, as shown in Equation 15:

$$\dot{Q}_{ITIC} = \dot{Q}_{ITP} - \dot{Q}_{ITO} \quad [15]$$

PG used the calculated flow rates of the river water conveyed to the International Collector and flows from the International Collector conveyed to the ITP, as well as the monthly flow data from PB1-B, to calculate the flow rate of untreated wastewater conveyed to the International Collector using the flow balance shown in Equation 16:

$$\dot{Q}_{ICWW} = \dot{Q}_{ITIC} + \dot{Q}_{PB1B} - \dot{Q}_{ICRW} \quad [16]$$

PG used the flow rate of the river water conveyed to the International Collector and the flow rate of untreated wastewater conveyed to the International Collector to estimate the proportion of river water in the International Collector ($P_{River,IC}$) each month using Equation 17:

$$P_{River,IC} = \frac{\dot{Q}_{ICRW}}{\dot{Q}_{ICRW} + \dot{Q}_{ICWW}} \quad [17]$$

PG used the proportion of river water in the International Collector, multiplied by the flows from the International Collector to the ITP, to estimate the average volume of river water that the ITP is treating each month using Equation 18:

$$\dot{Q}_{ITP,River\ Water\ Only} = P_{River,IC} \times \dot{Q}_{ITIC} \quad [18]$$

B.4.4 Flows Conveyed to SAB Creek

Table B-10 shows the major sources of flow conveyed to SAB Creek.

Table B-10. List of Major Flow Streams tributary to SAB Creek Discharges

Stream Description	Stream Identifier	Flow Destination	Type of Flow	Data Source
Flows from PB1-A	PB1A	SAB Creek	River water	CESPT monthly data
Flows from PB1-B	PB1B	SAB Creek	River water and untreated wastewater mix	CESPT monthly data
Flows from Matadero Pump Station	Mat	SAB Creek	Untreated wastewater	CESPT monthly data
Flows from Los Laureles Pump Stations 1 and 2	LL	SAB Creek	Untreated wastewater	Assumed 1.83 MGD
Flows from the Playas Pump Station	Play	SAB Creek	Untreated wastewater	CESPT monthly data
Total flows to SAB Creek	SAB	SAB Creek	River water and untreated wastewater mix	Flow balance

PG calculated the total flow rate of flows sent to SAB Creek using the flow balance shown in Equation 19:

$$\dot{Q}_{SAB} = \dot{Q}_{PB1A} + \dot{Q}_{PB1B} + \dot{Q}_{Mat} + \dot{Q}_{LL} + \dot{Q}_{Play} \qquad [19]$$

B.4.5 Water Quality Calculations

PG used BOD_5 and TSS to assess water quality in discharges at SAB Creek. PG assumed that the diverted river water had BOD_5 and TSS concentrations consistent with the dry weather river water discussed in Section 2 due to the nature of PB-CILA's operations. PG assumed that all other wastewater collected had BOD_5 and TSS concentrations consistent with the ITP influent monitoring and the IBWC Water Quality Study. The concentrations are summarized in Table B-11.

Table B-11. BOD_5 and TSS Concentrations for Dry Weather River Flow and Untreated Wastewater

Parameter	River Water (Dry Weather)	Untreated Wastewater
BOD5 concentration	165 mg/L	400 mg/L
TSS concentration	200 mg/L	400 mg/L

PG calculated the pollutant loads (BOD_5 and TSS) in each flow stream using Equation 20:

$$\dot{m}\left(\frac{\text{tons}}{\text{day}}\right) = \dot{Q}\ (\text{MGD}) \times C\left(\frac{\text{mg}}{\text{L}}\right) \times 3.79 \times 10^{6}\left(\frac{\text{L}}{\text{million gallons}}\right) \times 10^{-6}\left(\frac{\text{kg}}{\text{mg}}\right) \times 0.0011\left(\frac{\text{tons}}{\text{kg}}\right) \qquad [20]$$

where $\dot{m}$ is the pollutant load in tons/day, $\dot{Q}$ is the flow rate of the stream in MGD, and C is the pollutant concentration in mg/L (the other terms in the equation are conversion factors). Flows in the International Collector consist of both untreated wastewater ($\dot{Q}_{ICSew}$) and diverted river water ($\dot{Q}_{RWInt}$). Therefore, the concentration of pollutant flows in the International Collector, $C_{IC\ Total}$, can be calculated using Equation 21:

$$C_{IC\ Total} = \frac{\dot{Q}_{RWInt} \times C_{Riv} + \dot{Q}_{ICSew} \times C_{WW}}{\dot{Q}_{RWInt} + \dot{Q}_{ICSew}} \qquad [21]$$

where C_{Riv} is the pollutant concentrations in diverted river water and C_{WW} is the concentration of untreated wastewater. PG calculated the average daily concentrations of BOD_5 and TSS in the

International Collector each month by applying the concentrations of river water and untreated wastewater from Table B-11 to determine the monthly average concentrations of the flows in the International Collector ($C_{IC\ Total}$) with Equation 21. The concentration was used to calculate the monthly average BOD_5 and TSS load from PB1-B ($\dot{m}_{PB1B}$) with Equation 20.

PG applied the river water BOD_5 and TSS concentrations and the monthly average PB1-A flow data to calculate the monthly average BOD_5 and TSS load from PB1-A ($\dot{m}_{PB1A}$) with Equation 20.

PG applied the untreated wastewater BOD_5 and TSS concentrations to the monthly flow data from Matadero Pump Station, monthly flow data from the Playas Pump Station, and the estimated average flow rate from the Los Laureles 1 and Los Laureles 2 Pump Stations (1.8 MGD) to calculate the monthly average BOD_5 and TSS load from the three canyon pump stations ($\dot{m}_{Mat}$ and $\dot{m}_{LL}$) and the Playas Pump Station ($\dot{m}_{Play}$) with Equation 20.

PG calculated the monthly BOD_5 and TSS loads discharged to SAB Creek using a mass balance on the BOD_5 and TSS loads from PB1-A, PB1-B, the canyon pump stations, and the Playas Pump Station, as shown by Equation 22:

$$\dot{m}_{SAB} = \dot{m}_{PB1A} + \dot{m}_{PB1B} + \dot{m}_{Mat} + \dot{m}_{LL} + \dot{m}_{Play} \qquad [22]$$

B.4.6 Evaluating Alternative Impacts

PG estimated both the total and percentage reduction in flow and pollutant loading for each of the proposed alternatives by modifying the existing flow streams to reflect how the system would operate once the alternative is fully implemented. PG determined that the three final alternatives would have the effects shown in Table B-12.

Table B-12. Impacts to the Flow and Mass Balances for the Tijuana Wastewater Collection System from Each Alternative

Alternative	Component	Description	Impact on Flow Balances
E-2	Project 2 (convey Mexico-side diversion flow to APTP)	Would divert river water to the APTP, allowing PB1-A to be decommissioned. River water would be removed from the International Collector, freeing up capacity for ITP.	$\dot{Q}_{PB1A} = 0$ $\dot{Q}_{RWInt} = 0$ Flow of river water through PB1-A and the International Collector would be eliminated.
	Project 3 (ITP expansion to 40 MGD)	The ITP capacity would be expanded to allow the plant to receive up to 40 MGD of flows from the International Collector.	$\dot{Q}_{ITP} \leq 40$ MGD Flows to the International Collector and ITP would consist only of untreated wastewater. Flows over 40 MGD would continue to be conveyed to SAB Creek via PB1-B.
	Project 5 ($13.5 million for rehabilitating targeted collectors in Tijuana)	Would prevent an average of 5 MGD of untreated wastewater from entering the river. The 5 MGD of untreated wastewater would flow into the International Collector. Would also decrease the overall flow rate of the river.	$\dot{Q}_{ICSew,\ Alt\ E-2} = \dot{Q}_{ICSew} + 5$ MGD $C_{BOD,\ PB\text{-}CILA} = 82.5$ mg/L (for flow less than 25 MGD) $C_{TSS,\ PB\text{-}CILA} = 100$ mg/L (for flow less than 80 MGD) BOD_5 concentration would be reduced by 50% relative to current conditions due to the elimination of half the untreated wastewater from the river. TSS concentration would also be reduced by 50%, because untreated wastewater is the primary source of TSS at lower flow rates.
	Project 7 (Rodriguez Dam reuse)	The Project 7 conveyance line would remove an average of 10.3 MGD of treated wastewater effluent from the river, which is expected to increase PB-CILA's operating days and thereby increase the volume of untreated wastewater that is diverted from the river. However, Project 7 would not affect the discharges to SAB Creek for E-2 because all of the diverted river water is conveyed to the APTP.	$\dot{Q}_{PB-CILA,\ Alt\ E-2} = \dot{Q}_{PB-CILA} - 10.3$ MGD The Project 7 conveyance line would reduce the flow rate at PB-CILA by 10.3 MGD when PB-CILA is operating. Alternative E-2 routes all flows from PB-CILA to the APTP, so Project 7 would affect none of the other identified flow streams in the collection system.
H	Project 3 (ITP expansion to 50 MGD)	The ITP capacity would be expanded to allow the plant to receive up to 50 MGD of flows from the International Collector and Mexico-side canyon collectors.	$\dot{Q}_{ITP} \leq 50$ MGD $\dot{Q}_{RWInt} = 0$ Flows over 50 MGD would continue to be conveyed to SAB Creek. This alternative assumes that PB1-A would be able to handle the river water effectively, and therefore no river water would enter the International Collector and the ITP.

Alternative	Component	Description	Impact on Flow Balances
	Project 4 (U.S. canyon collector upgrades and conveyance to ITP)	All flows from Matadero and Los Laureles Canyons would be conveyed to the ITP for treatment. Flows from the Tijuana River via PB1-A and the Playas Pump Station would go to SAB Creek untreated.	$\dot{Q}_{SAB,Alt\ H} = \dot{Q}_{PB1,Alt\ H} + \dot{Q}_{Play}$ Only flows from the Playas Pump Station, diverted river water, and untreated wastewater from International Collector that the ITP would not have the capacity to treat would go to SAB Creek untreated.
	Project 5 ($13.5 million for rehabilitating targeted collectors in Tijuana)	Would prevent an average of 5 MGD of untreated wastewater from entering the river. The 5 MGD of untreated wastewater would flow into the International Collector. Would also decrease the overall flow rate of the river.	$\dot{Q}_{ICSew,Alt\ H} = \dot{Q}_{ICSew} + 5\ \text{MGD}$ $C_{BOD,\ PB\text{-}CILA} = 82.5\ \text{mg/L}$ $C_{TSS,\ PB\text{-}CILA} = 100\ \text{mg/L}$ BOD_5 concentration would be reduced by 50% relative to current conditions due to the elimination of half the untreated wastewater from the river. TSS concentration would also be reduced by 50%, because untreated wastewater is the primary source of TSS at lower flow rates.
	Project 7 (Rodriguez Dam reuse)	The Project 7 conveyance line would remove an average of 10.3 MGD of treated wastewater effluent from the river, which is expected to increase PB-CILA's operating days and thereby increase the volume of untreated wastewater that is diverted from the river. The removal of the WWTP effluents from the river water would decrease the total flow rate from the river under all flow conditions.	PG estimated the impact of Project 7 by first calculating the impacts that Alternative H would have on transboundary flows. PG used the methods discussed in B.3 to estimate the increase in BOD_5 and TSS loads in the river water diverted at PB-CILA. The annual BOD_5 and TSS reductions in transboundary flows were added to the annual BOD_5 and TSS loads discharged at SAB Creek. Then PG calculated the total flow at SAB Creek by adding the quantity of untreated wastewater to the average Alamar River flow rate multiplied by the average number of days that PB-CILA operates annually: $\dot{Q}_{SAB,\ Annual} = \frac{\dot{m}_{BOD,SAB\ Annual}}{c_{BOD,Sewage}} + \dot{Q}_{Alamar} \times \text{average days that PB-CILA operates annually}$
I-2	Project 2 (convey Mexico-side diversion flow to APTP)	Would divert river water to the APTP, allowing PB1-A to be decommissioned. River water would be removed from the International Collector, freeing up capacity for ITP.	$\dot{Q}_{PB1A} = 0$ $\dot{Q}_{RWInt} = 0$ Flow of river water through PB1-A and the International Collector would be eliminated.
	Project 3 (ITP expansion to 60 MGD)	The ITP capacity would be expanded to allow the plant to receive up to 60 MGD of flows from the International Collector and Mexico-side canyon collectors.	$\dot{Q}_{ITP} \leq 60\ MGD$ Flows to the International Collector and ITP would consist only of untreated wastewater. The flows in the International Collector would not have exceeded the ITP's capacity during any month over the time period evaluated.

Alternative	Component	Description	Impact on Flow Balances
	Project 4 (U.S. canyon collector upgrades and conveyance to ITP)	All wastewater flows from both Matadero and Laureles Canyons would be conveyed to the ITP for treatment.	$\dot{Q}_{PB1B,\ Alt\ I-2} = 0$ Flows from the International Collector and Matadero and Laureles Canyons would no longer be pumped to SAB Creek.
	Project 5 ($13.5 million for rehabilitating targeted collectors in Tijuana)	Would prevent an average of 5 MGD of untreated wastewater from entering the river. The 5 MGD of untreated wastewater would flow into the International Collector. Would also decrease the overall flow rate of the river.	$\dot{Q}_{ICSew,\ Alt\ E-2} = \dot{Q}_{ICSew} + 5\ \text{MGD}$ $C_{BOD,\ PB\text{-}CILA} = 82.5\ \text{mg/L}$ $C_{TSS,\ PB\text{-}CILA} = 100\ \text{mg/L}$ BOD_5 concentration would be reduced by 50% relative to current conditions due to the elimination of half the untreated wastewater from the river. TSS concentration would also be reduced by 50%, because untreated wastewater is the primary source of TSS at lower flow rates.
	Project 8 (new 5 MGD SABTP)	Up to 5 MGD of flows from the Playas Pump Station would be conveyed to and treated at SABTP.	$\dot{Q}_{SAB,Alt\ I-2} = \dot{Q}_{Play}$ The new SABTP would treat the flows from the Playas Pump Station. All other untreated wastewater flows in the International Collector and the decommissioned canyon Pump stations would be sent to the ITP for treatment.
	Project 7 (Rodriguez Dam reuse)	The Project 7 conveyance line would remove an average of 10.3 MGD of treated wastewater effluent from the river, which is expected to increase PB-CILA's operating days and thereby increase the volume of untreated wastewater that is diverted from the river. However, Project 7 would not affect the discharges to SAB for I-2 because all of the diverted river water is conveyed to the APTP.	$\dot{Q}_{PBCILA,\ Alt\ E-2} = \dot{Q}_{PB-CILA} - 10.3\ \text{MGD}$ The Project 7 conveyance line would reduce the flow rate at PB-CILA by 10.3 MGD when PB-CILA is operating. Alternative I-2 routes all flows from PB-CILA to the APTP, so Project 7 would affect none of the other identified flow streams in the collection system.

B.5. BEACH IMPACTS

Beaches in the County of San Diego are regularly required to close due to untreated wastewater discharges to the Pacific Ocean via SAB Creek and the Tijuana River. The County of San Diego monitors the ocean water for FIB, and beaches are closed if the concentration of FIB exceeds EPA's limit for the estimated illness rate of 32 primary contact recreators per 1,000 primary contact recreators, known as the beach action value (USEPA 2012).

To estimate the amount of time during the tourist season (May 22–September 8) when FIB concentrations above EPA's beach action value (referred to hereafter as "FIB exceedances") occurred at beaches along the U.S. and Mexican coasts, EPA referenced a 2020 model developed by Scripps Institution of Oceanography that used 2017 data to examine the shoreline water quality impacts of untreated wastewater discharge through the Tijuana River and SAB Creek (Feddersen et al. 2020). The Scripps report included four inflow scenarios, denoted as NADB 00, 35, 100, and 163. NADB 00 represented the baseline condition, in which Tijuana River total flows matched IBWC gauged river flows and contain up to 10 MGD of untreated wastewater and 35 MGD of untreated wastewater is discharged to SAB Creek. NADB 35 eliminated Tijuana River flows below 35 MGD and reduced the discharge out of SAB Creek to 10 MGD of treated wastewater. NADB 100 and 163 eliminated Tijuana River flows below 100 and 163 MGD, respectively, and kept the same baseline untreated wastewater discharges of 35 MGD out of SAB Creek. Scripps conducted an unpublished version of the NADB 35 scenario for EPA that also included a reduced discharge out of SAB Creek to 10 MGD of untreated wastewater (F. Feddersen, personal communication, December 2020).

The model found that while the Tijuana River and SAB Creek discharges are both contributors to FIB exceedances, discharges at SAB Creek are the primary contributor during the tourist season. The baseline scenario resulted in FIB exceedances at Imperial Beach 24% of the time during the tourist season. This impairment was caused by untreated wastewater flows from SAB Creek reaching the U.S. during this period. The NADB 35 scenario with 10 MGD of treated untreated wastewater discharged to SAB Creek resulted in days of FIB exceedances decreasing to 0%, and the modified unpublished version of NADB 35 with 10 MGD of untreated wastewater out of SAB Creek resulted a decrease to 9%. Scenarios NADB 100 and 163 did not reduce days of FIB exceedances during the tourist season, indicating that the Tijuana River is not a contributor during the tourist season.[3] Therefore, river flows were assumed not to have any significant impact on FIB exceedances during the tourist season, and untreated wastewater discharge out of SAB Creek was considered the sole contributor of FIB exceedances in the following analysis. The three scenarios NADB 00, NADB 35 (published), and NADB 35 (unpublished), which demonstrate different levels of untreated wastewater out of SAB Creek, are summarized in Table B-13 and plotted in Figure B-2.

Table B-13. Summary of Scripps SAB Creek Modeling Scenarios

Scripps Model Scenario	Untreated Wastewater Discharged into SAB Creek (MGD)	Frequency of FIB Exceedances During the Tourist Season
NADB 00 (baseline)	35	24%
NADB 35 (published)	0	0%
NADB 35 (unpublished)	10	9%

[3] The scenarios used data from 2017 showing no significant transboundary flows in the Tijuana River during the tourist season. 2020 data showed a significant increase in transboundary flows during the tourist season (2021 tourist season flows have returned to nearly zero). However, nearly all of these 2020 flows were under 35 MGD.

EPA consulted with Scripps to verify that it was reasonable to use untreated wastewater discharges at SAB Creek to interpolate beach impacts from the results of their model (F. Feddersen, personal communication, March 2021). Percent time of FIB exceedances at Imperial Beach during the tourist season versus untreated wastewater effluent discharged to SAB Creek is plotted in Figure B-2.

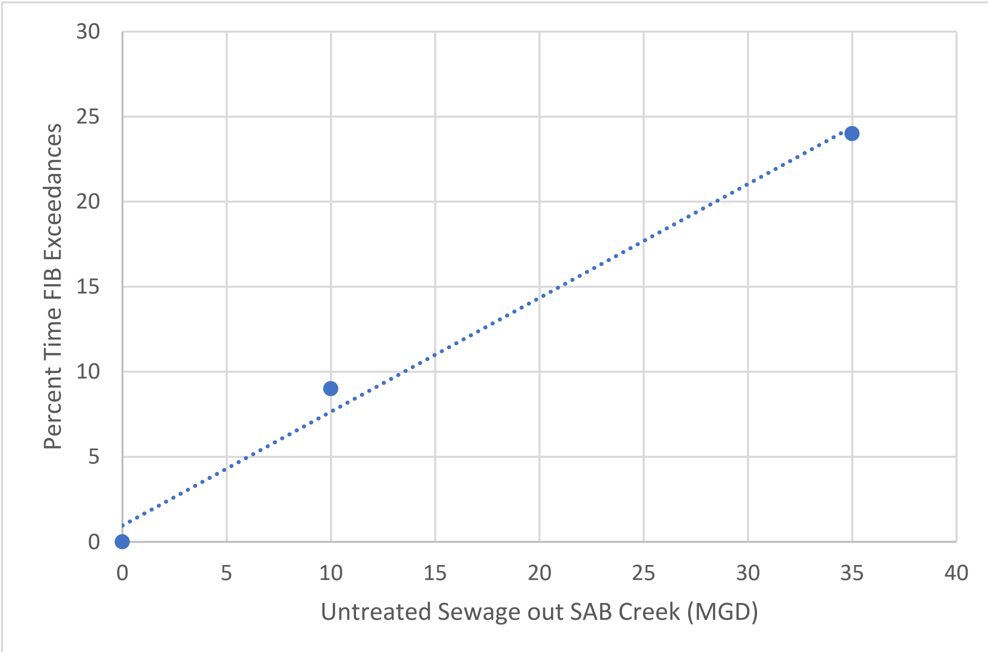

Figure B-2. SAB Creek Untreated Wastewater vs. Tourist Season FIB Exceedances

EPA applied a linear regression to the three scenarios plotted in Figure B-2 to estimate the frequency of FIB exceedances at Imperial Beach ($\%_{FIB}$) as a function of the estimated flow rate of untreated wastewater discharged to SAB Creek ($\dot{Q}_{SAB,\ Alt}$) in MGD, as shown in Equation 23.

$$\%_{FIB} = 0.6693 \frac{\%}{MGD} \times \dot{Q}_{SAB,\ Alt} + 0.9605\% \qquad [23]$$

PG calculated the flow rate of untreated wastewater discharges at SAB Creek for each alternative using the estimated BOD_5 load discharged at SAB Creek (discussed in Section 3) using Equation 24.

$$\dot{Q}_{SAB,\ Alt} = \dot{m}_{SAB,\ Alt} \times \frac{\dot{Q}_{SAB}}{\dot{m}_{SAB}} \qquad [24]$$

PG used the flow and mass balances discussed in Section 4 to estimate that $\dot{Q}_{SAB}$ is currently 28.2 MGD and $\dot{m}_{SAB}$ is 17,200 tons/year. PG assessed this value to be about 28 MGD based on flow balances calculated from monthly average data for January 2016 through December 2019 provided by CESPT. The Scripps baseline condition model was initially run with 35 MGD of untreated wastewater being discharged at SAB Creek. To remain consistent with PG's assessment, EPA used 28.2 MGD as the baseline flow rate untreated wastewater discharged to SAB Creek.

PG calculated the flow rate of untreated wastewater discharges to SAB Creek for each alternative using Equation 24. EPA used the estimated flows from PG and Equation 23 to estimate the frequency of FIB exceedances at Imperial Beach during the tourist season. With 28 MGD of wastewater discharged out of SAB Creek in the baseline scenario, tourist season FIB exceedances were estimated to be 19.7%. EPA used the estimated frequency of FIB exceedances at Imperial Beach during the baseline scenario to estimate the percent that each alternative would reduce the frequency of FIB exceedances at Imperial Beach ($\Delta\%_{FIB}$) using Equation 25.

$$\Delta\%_{FIB} = \left(1 - \frac{\%_{FIB}}{19.7}\right) \times 100\% \qquad [25]$$

B.6. ENERGY REQUIREMENTS

B.6.1 Overview

PG estimated the energy requirements for each alternative by considering the following three major sources of energy for the projects being considered:

1. Energy requirements at the wastewater treatment plants.
2. Energy requirements of the major pump stations.
3. Energy requirements for trucking solids, sediment, and trash for disposal.

For each alternative, PG evaluated the change in energy requirements ΔE in kilowatt hours kWh compared to the existing energy requirements at each facility.

B.6.2 Wastewater Treatment Plants

B.6.2.1 APTP

PG determined the energy requirements for the APTP using EPA O&M cost curves (USEPA 1980) for the individual treatment units in the proposed APTP design. O&M costs in the cost curve are based on design average daily flow rates. Energy requirements for the APTP were estimated using Equation 26:

$$\Delta E_{APTP} = \frac{\alpha \times n}{r_{1980}} \qquad [26]$$

where α is the O&M annual cost in 1980 dollars from the cost curve, n is the proportion of days that the plant is expected to operate annually, and r_{1980} is \$0.02 per kWh (the electricity rate when the cost curve was developed). Because modern equipment is likely to operate more efficiently than equipment in 1980, the estimated energy requirements for the APTP should be considered conservative.

B.6.2.2 ITP Expansion

PG determined the energy requirements for the expanded ITP by analyzing the existing energy usage at the ITP per MGD and scaling it to the size of the expanded ITP. The existing ITP treats an average daily flow rate of about 25 MGD, and the energy use for this facility in 2020 was about 1.7 million kWh per month or 20.4 million kWh per year. PG divided the energy requirements from 2020 by the ITP's average daily flow rate to estimate that the ITP requires 68,000 kWh per MGD of flow monthly or 820,000 kWh annually. PG assumed that the 40 MGD plant would have the same energy requirement as the current ITP. PG expects that the larger ITP expansions (50 MGD and 60

MGD) would operate more efficiently. Therefore, PG applied best engineering judgement to estimate the energy requirements per MGD annually would be reduced by 28,000 kWh per MGD for the 50 MGD plant and 51,000 kWh per MGD for the 60 MGD plant. The energy requirements for each ITP expansion size are shown in Table B-14.

Table B-14. Energy Requirements of Each ITP Expansion Size Evaluated in the Alternatives Analysis

Plant Capacity (MGD)	Energy Requirement per MGD Annually (kWh)	Total Energy Requirements Annually (kWh)
25 MGD	820,000	20.4 million
40 MGD	820,000	32.8 million
50 MGD	790,000	39.5 million
60 MGD	770,000	46.2 million

PG calculated the change in energy by subtracting the current energy requirements from the estimated energy requirements of the expanded plant, as shown in Equation 27:

$$\Delta E_{ITP} = E_{Exp\ Plant} - E_{25\ MGD} \qquad [27]$$

where $E_{Exp\ Plant}$ is the estimated annual energy requirements of the expanded plant in kWh and $E_{25\ MGD}$ is the current energy requirements for the ITP in kWh.

B.6.2.3 New SABTP

PG applied best engineering judgement to estimate that the new SABTP would require 2,000 kWh per million gallons of wastewater treated. PG then calculated the annual energy requirements for the plant by multiplying the estimated energy requirements using Equation 28.

$$\Delta E_{SABTP} = E_{SABTP} * \dot{Q}_{SABTP} * k \qquad [28]$$

where E_{SABTP} is 2,000 kWh per million gallons of wastewater, $\dot{Q}_{SABTP}$ is the design flow rate of the new SABTP, and k is the unit conversion factor of 365 days per year. The change in energy requirements for the new SABTP is based on the current energy consumption at the SABTP, which is negligible because the plant is not currently functioning.

B.6.3 Pump Stations

PG estimated the change in energy requirements for both existing and proposed pump stations. For each alternative, PG evaluated the change in energy for each of the following pump stations:

- PB-CILA
- PB1-A
- PB1-B
- Matadero Pump Station
- Los Laureles Pump Station 1
- Los Laureles Pump Station 2

Additionally, PG evaluated the energy requirements for new pump stations that would be constructed as part of each alternative. These new pump stations include the following:

- A new pump station from the U.S.-side river diversion to the APTP
- A new pump station from the La Morita WWTP to the Rodriguez Dam impoundment
- A new pump station from the Arturo Herrera WWTP to the Rodriguez Dam impoundment

PG estimated the change in energy requirements at each pump station using the change in annual flow volume, the estimated pump efficiency, and the dynamic head. PG estimated these parameters for each of these pump stations using the following information and methods:

- PG estimated the change in the annual flow volume for each of the existing pump stations using the flow balances discussed in Section B.4.
- PG treated the annual flow volume for the U.S-side river diversion pump station as equal to the estimated change in total transboundary flow volume. This was calculated using the methods discussed in Section B.3.
- PG estimated the annual flow volume for the pump stations from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment using the average daily effluent flow rate from each plant, multiplied by 365 days per year.
  - For the pump station to convey flows from the Arturo Herrera WWTP, the average daily effluent flow rate is 5.3 MGD. Therefore, the annual flow volume is 1,930 million gallons.
  - For the pump station to convey flows from the La Morita WWTP, the average daily effluent flow rate is 5.0 MGD. Therefore, the annual flow volume is 1,830 million gallons.
- PG estimated the annual flow volume for the new pump station to the rehabilitated SABTP by multiplying the average daily flow rate in MGD by 365 days per year.
- PG used the pump station information from the Arcadis report to determine the dynamic head of PB1-A and PB1-B (Arcadis 2019).
- Information on the dynamic head was not available for PB-CILA, Matadero Pump Station, Los Laureles Pump Station 1, and Los Laureles Pump Station 2. For these pump stations, PG estimated the dynamic head using LiDAR elevation data. Refer to the *Baseline Conditions Summary: Technical Document* for more information on the canyon pump stations.
- The dynamic head of the new pump stations is based on the design parameters discussed in the *Feasibility Analysis Technical Memoranda*.
- The PB-CILA Pump Station is currently being upgraded with chopper pumps. The PB-CILA upgrade summary stated that these pumps operate at a 67% efficiency.
- The pumps that convey water from the U.S.-side diversion are expected to be screw pumps. Correspondence with a vendor indicated that screw pumps have an efficiency of 85%.
- Excluding PB-CILA and the proposed U.S.-side diversion, the existing and proposed pump stations use or are expected to use centrifugal pumps. Properly designed centrifugal pumps typically operate with an efficiency between 70% and 90%. PG applied a 70% efficiency to all pumps that are pumping untreated wastewater or river water. The effluent has minimal solids/debris content, allowing for higher-efficiency pumping. Therefore, PG applied an 85% efficiency to the pump stations that convey treated effluent from the Arturo Herrera and La Morita WWTPs to the Rodriguez Dam impoundment and the pump station that returns treated effluent from the ITP to PB1-B for reuse in Mexico.

PG applied these assumptions to each pump station; the characteristics of each pump station are summarized in Table B-15.

Table B-15. Characteristics of the Existing and Proposed Pump Stations

Pump Station	Type of Flows	Pump Types	Pump Efficiency (%)	Total Dynamic Head (ft)
Existing Pump Stations				
PB-CILA	Diverted river water	Chopper	67	40
PB1-A	Diverted river water	Centrifugal	70	462
PB1-B	Wastewater and river water	Centrifugal	70	462
Matadero Pump Station	Wastewater	Centrifugal	70	250
Los Laureles Pump Station 1	Wastewater	Centrifugal	70	150
Los Laureles Pump Station 2	Wastewater	Centrifugal	70	100
Proposed Pump Stations				
New U.S.-side river diversion	Diverted river water	Archimedean screw	85	25
La Morita WWTP to Rodriguez Dam impoundment pump station	Treated effluent	Centrifugal	85	170
Arturo Herrera WWTP to Rodriguez Dam impoundment pump station	Treated effluent	Centrifugal	85	5
Effluent pump station from the ITP to PB1-B	Treated effluent	Centrifugal	85	21

For the existing pump stations, PG estimated the change in energy requirements using the expected annual change in volume of flows, the hydraulic energy requirement of the pump station per unit mass, and the pumping efficiency, as shown in Equation 29:

$$\Delta E_{pump} = \frac{k \times \rho \times \Delta V \times w}{\varepsilon} \qquad [29]$$

where ΔE_{pump} is the annual energy requirement for the pump station in kWh, k is the unit conversion factor of 2.78 × 10^{-7} kWh/joule, ε is the pump station efficiency, ρ is the density of water in kilograms per cubic meter, V is the annual volume of water pumped in cubic meters, and w is the hydraulic energy requirement of the pump station per unit mass in joules per kilogram. PG used the Bernoulli equation (simplified) to relate the energy requirements of a pump station per unit of mass to its dynamic head, as shown in Equation 30:

$$w = g \times H \qquad [30]$$

where H represents the dynamic head of the pump station in meters and g is the gravitational coefficient in meters per second squared. PG combined Equation 29 and Equation 30 to relate the energy of the pump station to the to the change the annual volume of flows through the pump station, as shown in Equation 31:

$$\Delta E_{pump} = \frac{k \times \rho \times \Delta V \times g \times H}{\varepsilon} \qquad [31]$$

PG used this equation to estimate the change in energy requirements for both new and existing pump stations.

B.6.4 Truck Trips

PG estimated the energy requirements for the increased trucking by estimating the volume of diesel fuel that the trucks would need annually and multiplying it by the heat of combustion of diesel. PG first estimated the annual volume of diesel needed using the estimated length of each truck trip, the number of truck trips annually, and the fuel efficiency of the trucks, as shown in Equation 32:

$$V_{Diesel} = n_{trips} \times \varepsilon_{truck} \times D \qquad [32]$$

where V_{Diesel} is the annual volume of diesel required, n_{trips} is the estimated annual increase in number of truck trips, ε_{truck} is the fuel efficiency of the trucks in miles per gallon, and D is the average distance of each trip in miles. PG assumed a fuel efficiency of 6 miles per gallon for all the trucks. PG assumed an expanded ITP would continue to dispose of solids at the SABTP, which is 10 miles from the ITP by road. Therefore, PG used satellite data to estimate that D = 20 miles (round trip) for the truck trips from the ITP. PG assumed that the solids from the new APTP and the trash boom would be disposed of at the Miramar Landfill, which is 25 miles by road from the ITP treatment complex. Therefore, PG estimated that the average distance for the truck trips from the APTP and the trash booms is 50 miles (round trip).

PG then used the volume of diesel needed for annual trucking to estimate the energy requirements for each alternative, multiplying the fuel by the heat of combustion of diesel, as shown in Equation 33:

$$\Delta E_{truck} = k \times V_{Diesel} \times H_{C,Diesel} \times \rho_{Diesel} \qquad [33]$$

where ΔE_{truck} is the energy requirement for each truck trip, k is a constant unit conversion value of 0.278 kWh/megajoule, $H_{C,\ Diesel}$ is the heat of combustion of diesel fuel in megajoules/liter, and ρ_{Diesel} is the density of diesel in kilograms/liter. PG used 44.7 megajoules/liter as the heat of combustion and 0.85 kilograms/liter as the density of diesel (Speight 2011).

B.7. OPINION OF PROBABLE COSTS

PG developed opinions of probable cost to a Class V level of accuracy in accordance with AACE International Recommended Practice No. 17R-97 (AACE International 2020). Class V estimate accuracy can range from +40%/-20% to +200%/-100%. Based on the information that PG reviewed, PG's estimated accuracy for construction in the U.S. is +50%/-25%, meaning actual construction costs may range from 50% higher than PG estimates to 25% lower. Because there are fewer sources of cost data for construction in Mexico, PG's estimate accuracy for construction in the Mexico is +100%/-50%, meaning actual construction costs may range from 100% higher than PG estimates to 50% lower.

For project construction cost data, PG used manufacturers' cost information, bid tabulations from similar projects in the U.S. and Mexico in recent years, R.S. Means Heavy Construction Cost Data 2020, EPA cost databases (cost curves for various treatment technologies), and adjustments for a 2020 *Engineering News-Record* value of 11,455. The sum of project construction cost plus equipment/material cost was multiplied by 1.4 to account for project engineering and owner administration costs. That total was multiplied by a general contingency factor of 1.5 to account for unanticipated construction, unknown subsoils, and other factors. Therefore, project capital cost equals project construction cost × 1.4 × 1.5, which is equivalent to project construction cost × 2.1.

The O&M costs in the alternatives analysis are presented as the average O&M costs over the expected 40-year life cycle of the project in present dollars. This was done to account for interest and inflation over time. Life cycle costs were determined using an interest rate of 3% and an inflation rate of 2%.

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APPENDIX C: ALTERNATIVE GROUPINGS AND AAA SCORES

Augmented Alternatives Analysis (AAA)

The Augmented Alternatives Analysis (AAA) is EPA's capital project decision-making method, which provides a simple, sound, easily explainable, and transparent way to incorporate community values and best meet the needs of the project. This method scales economic, environmental, and social benefits to quantify and effectively compare on an "apples to apples" basis to determine the alternative with the highest benefit to cost ratio. The AAA prioritizes (and weighs) different decision-making criteria to ensure the best use of often limited financial resources.[1]

The four investment goals for the USMCA Tijuana River Watershed project were identified as the following: Public Health & Community Livability, Stewardship of Public Resources, Ecological Protection, and System Resiliency. The four goals were built out into objectives which are specific, measurable outcomes that contribute to achieving the goals. From the objective, criteria were identified to evaluate the performance relative to the goals and objectives. For each criteria, a metric was established to measure the qualitative or quantitative performance of each alternative. This goals matrix on the following page demonstrates the criteria that were scored.

Round 1: Nine alternatives, identified as Alternative A through Alternative I, were scored against the goals matrix after being narrowed down from the 39 initial alternatives.

Round 2: Three alternatives B, E, and F were renamed and rescored with the following changes:

- Alternative B-2: Removing Project 8 (10 MGD SABTP) from Alternative B
- Alternative E-2: Adding Project 7 (Rodriguez Dam reuse) to Alternative E
- Alternative F-2: Adding Project 5 (Tijuana collection improvements) to Alternative F

Round 3: Alternative E-2 and H were rescored, and costs were re-evaluated, and Alternative I was modified in Round 3 with the following changes:

- Alternative I-2: Add Project 3 sub-project (ITP effluent reuse to Mexico)
  Reduce amount of funding for Project 5 to match other alternatives
  Reduce Project 8 (SABTP expansion) to 5 MGD

[1]EPA (September 2021) *Making the Right Choices for Your Utility: Uniting Community Priorities and Triple Bottom Line Criteria in the Decision-Making Process through Augmented Alternative Analysis.*

USMCA Tijuana River Watershed Goals Matrix

Goals	Objectives	Criteria	Metrics
Public Health & Community Livability, 47%	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations
Stewardship of Public Resources, 20%	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season
Ecological Protection, 19%	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction
System Resiliency, 14%	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a additional MGD of raw sewage treatment and/or water reuse
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required

Cost Breakdown (Round 1)

Alternative	Estimated Capital Cost (Current Dollars)				Estimated O&M (Current Dollars)			40- year Lifecycle Cost
	Total	US (% US Funded)	Mexico (% Mexico Funded)	Infrastructure built in US	Total	US	Mexico	Total
A	$ 280,435,000	$ 264,285,000 (94%)	$ 16,150,000 (6%)	$ 248,135,000	$ 15,639,000	$ 13,232,000	$ 2,408,000	$ 906,000,000
B	$ 313,935,000	$ 258,085,000 (82%)	$ 55,850,000 (18%)	$ 202,235,000	$ 16,812,000	$ 11,159,000	$ 5,653,000	$ 993,500,000
C	$ 332,235,000	$ 332,235,000 (100%)	$ - (0%)	$ 332,235,000	$ 12,759,000	$ 11,149,000	$ 1,610,000	$ 966,600,000
D	$ 350,135,000	$ 350,135,000 (100%)	$ - (0%)	$ 350,135,000	$ 18,687,000	$ 16,010,000	$ 2,677,000	$ 1,097,600,000
E	$ 346,235,000	$ 333,685,000 (96%)	$ 12,550,000 (4%)	$ 321,135,000	$ 16,357,000	$ 14,093,000	$ 2,264,000	$ 1,000,500,000
F	$ 372,235,000	$ 356,085,000 (96%)	$ 16,150,000 (4%)	$ 339,935,000	$ 17,794,000	$ 14,999,000	$ 2,795,000	$ 1,084,000,000
G	$ 381,435,000	$ 342,685,000 (90%)	$ 38,750,000 (10%)	$ 303,935,000	$ 19,687,000	$ 13,789,000	$ 5,897,000	$ 1,176,000,000
H	$ 368,035,000	$ 335,535,000 (91%)	$ 32,500,000 (9%)	$ 303,035,000	$ 14,299,000	$ 12,098,000	$ 2,201,000	$ 940,000,000
I	$ 674,135,000	$ 584,635,000 (87%)	$ 89,500,000 (13%)	$ 495,135,000	$ 29,9920,000	$ 21,926,000	$ 8,066,000	$ 1,880,900,000

Alternative A Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	88%	50
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	84%	50
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	36%	20
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net negative impact to border security operations.	-10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.014	0
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	88%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	34%	7
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	3%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-4,962 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	8.7 MGD deficit of sewage treatment	-5
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	0 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	12 operators	15
				Total Score	190
				40 Year Lifecycle Cost	$906,000,000.00
				Score/40 Year Lifecycle Cost (in millions)	21

Alternative B Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	83%	50
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	90%	50
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	53%	30
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net negative impact to border security operations.	-10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.226	7
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	64%	14
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	50%	14
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	2%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-5,560 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	3.7 MGD deficit of sewage treatment	0
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	7,000 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	13 operators	10
				Total Score	200
				40 Year Lifecycle Cost	$993,500,000
				Score/40 Year Lifecycle Cost (in millions)	20

Alternative C Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	82%	50
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low-moderate net positive impact to nuisance conditions along Tijuana River	20
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	72%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	26%	10
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net negative impact to border security operations	-20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.274	7
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	100%	35
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	25%	7
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	2%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-4,566 tons/year	15
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	3.7 MGD deficit of sewage treatment	0
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	29,000 MWh	-5
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	11 operators	15
				Total Score	179
				40 Year Lifecycle Cost	$966,600,000
				Score/40 Year Lifecycle Cost (in millions)	19

Alternative D Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	70%	40
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low-moderate net positive impact to nuisance conditions along Tijuana River	20
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	72%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	42%	20
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net negative impact to border security operations	-20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.446	14
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	100%	35
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	40%	14
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	2%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-4,638 tons/year	15
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	6.3 MGD surplus of sewage treatment	5
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	32,000 MWh	-10
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	13 operators	10
				Total Score	188
				40 Year Lifecycle Cost	$1,097,600,000
				Score/40 Year Lifecycle Cost (in millions)	17

Alternative E Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	56%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low-moderate net positive impact to nuisance conditions along Tijuana River	20
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	78%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	66%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net negative impact to border security operations	-20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.477	14
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	93%	35
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	63%	21
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-5,818 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	1.3 MGD surplus of sewage treatment	0
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	15,000 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	11 operators	15
				Total Score	220
				40 Year Lifecycle Cost	$1,000,500,000
				Score/40 Year Lifecycle Cost (in millions)	22

Alternative F Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	60%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	No/neutral impact to nuisance conditions along Tijuana River	0
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	36%	20
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	69%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net positive impact to border security operations	10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.674	28
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	91%	35
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	66%	21
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-4,069 tons/year	15
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	11.3 MGD surplus of sewage treatment	10
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	20,000 MWh	-5
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	13 operators	10
				Total Score	219
				40 Year Lifecycle Cost	$1,084,000,000
				Score/40 Year Lifecycle Cost (in millions)	20

Alternative G Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	53%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	No/neutral impact to nuisance conditions along Tijuana River	0
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	30%	10
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	99%	50
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	No/neutral impact to border security operations	0
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.673	28
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	80%	21
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	94%	35
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-2,841 tons/year	10
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	16.3 MGD surplus of sewage treatment	15
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	25,000 MWh	-5
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	16 operators	5
				Total Score	204
				40 Year Lifecycle Cost	$1,176,000,000
				Score/40 Year Lifecycle Cost (in millions)	17

Alternative H Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	54%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	No/neutral impact to nuisance conditions along Tijuana River	0
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	66%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	78%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net positive impact to border security operations	20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.674	28
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	82%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	74%	28
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-4,826 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	11.3 MGD surplus of sewage treatment	10
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	24,000 MWh	-5
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	8 operators	20
				Total Score	264
				40 Year Lifecycle Cost	$ 940,000,000
				Score/40 Year Lifecycle Cost (in millions)	28

Alternative I Score Breakdown (Round 1)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	76%	40
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	90%	50
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	100%	50
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net positive impact to border security operations	20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.542	21
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	73%	21
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	95%	35
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	2%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-6,794 tons/year	25
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	26.3 MGD surplus of sewage treatment	25
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	43,000 MWh	-15
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	22 operators	0
				Total Score	287
				40 Year Lifecycle Cost	$1,880,900,000
				Score/40 Year Lifecycle Cost (in millions)	15

Cost Breakdown (Round 2)

Alternative	Estimated Capital Cost (Current Dollars)				Estimated O&M (Current Dollars)			40- year Lifecycle Cost
	Total	US (% US Funded)	Mexico (% Mexico Funded)	Infrastructure built in US	Total	US	Mexico	Total
B-2	$ 248,035,000	$ 225,135,000 (91%)	$ 22,900,000 (9%)	$ 202,235,000	$ 13,112,000	$ 11,159,000	$ 1,953,000	$ 772,500,000
E-2	$ 366,935,000	$ 344,035,000 (94%)	$ 22,900,000 (6%)	$ 321,135,000	$ 16,689,000	$ 14,093,000	$ 2,597,000	$ 1,034,500,000
F-2	$ 385,735,000	$ 362,835,000 (94%)	$ 22,900,000 (6%)	$ 339,935,000	$ 17,794,000	$ 14,999,000	$ 2,795,000	$ 1,097,500,000

Alternative B-2 Score Breakdown (Round 2)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	83%	50
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	90%	50
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	18%	0
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net negative impact to to border security operations.	-10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.016	0
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	82%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	17%	0
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	2%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-4,966 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	13.7 MGD deficit of sewage treatment	-10
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	-3,000 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	9 operators	20
				Total Score	163
				40 Year Lifecycle Cost	$772,500,000
				Score/40 Year Lifecycle Cost (in millions)	21

Alternative E-2 Score Breakdown (Round 2)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	64%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	78%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	66%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net negative impact to border security operations	-10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.488	21
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	88%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	63%	21
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-5,946 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	1.3 MGD surplus of sewage treatment	0
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	17,000 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	11 operators	15
				Total Score	220
				40 Year Lifecycle Cost	$ 1,034,500,000
				Score/40 Year Lifecycle Cost (in millions)	21

Alternative F-2 Score Breakdown (Round 2)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	64%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	72%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	69%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net positive impact to border security operations	10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.673	28
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	88%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	66%	21
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-5,399 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	6.3 MGD surplus of sewage treatment	5
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	20,000 MWh	-5
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	13 operators	10
				Total Score	242
				40 Year Lifecycle Cost	$1,097,500,000
				Score/40 Year Lifecycle Cost (in millions)	22

Cost Breakdown (Round 3)

Alternative	Estimated Capital Cost* (Current Dollars)				Estimated O&M* (Current Dollars)			40- year Lifecycle Cost*
	Total	US (% US Funded)	Mexico (% Mexico Funded)	Infrastructure built in US	Total	US	Mexico	Total
E-2	$ 366,900,000	$ 344,000,000 (94%)	$ 22,900,000 (6%)	$ 321,100,000 (88%)	$ 14,600,000	$ 13,000,000 (81%)	$ 1,600,000 (19%)	$ 950,500,000
H	$ 368,000,000	$ 335,500,000 (91%)	$ 32,500,000 (9%)	$ 303,000,000 (82%)	$ 11,300,000	$ 9,000,000 (80%)	$ 2,300,000 (20%)	$ 817,100,000
I-2	$ 627,300,000	$ 561,200,000 (89%)	$ 66,100,000 (11%)	$ 495,100,000 (79%)	$ 25,600,000	$ 20,300,000 (79%)	$ 5,300,000 (21%)	$ 1,652,000,000

* Cost estimates were updated from prior rounds by considering the holistic alternative cost that considered savings when the projects with an alternative were combined. In previous rounds, the costs were calculated by summing the project components.

Alternative E-2 Re-Score Breakdown (Round 3)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	64%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	80%	50
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	66%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low net negative impact to border security operations	-10
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.488	21
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	88%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	63%	21
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-6,439 tons/year	25
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	1.3 MGD surplus of sewage treatment	0
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	-2,560 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	13 operators	10
				Total Score	230*
				40 Year Lifecycle Cost	$950,500,000
				Score/40 Year Lifecycle Cost (in millions)	24

* Total score was updated from Round 2 of scoring of Alternative E-2 to reflect more recent data

Alternative H Re-Score Breakdown (Round 3)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	54%	30
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	No/neutral impact to nuisance conditions along Tijuana River	0
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	65%	40
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	78%	40
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net positive impact to border security operations	20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.674	28
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	82%	28
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	74%	28
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	1%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-5,319 tons/year	20
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	11.3 MGD surplus of sewage treatment	10
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	3,480 MWh	0
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	8 operators	20
				Total Score	269*
				40 Year Lifecycle Cost	$817,100,000
				Score/40 Year Lifecycle Cost (in millions)	33

* Total score was updated from Round 1 of scoring of Alternative H to reflect more recent data

Alternative I-2 Score Breakdown (Round 3)

Goals Matrix					
Goals	**Objectives**	**Criteria**	**Metrics**	**Raw Data**	**Score**
Public Health & Community Livability	1.1 Improve conditions along the Tijuana River	1.1.1 Reduce days of transboundary river flows	1.1.1a % change in days of transboundary river flows	76%	40
		1.1.2 Reduce nuisance conditions within and adjacent to Tijuana River Valley in U.S.	1.1.2a Net impact to visual, odor, disease vector, noise, traffic, and flooding/access issues	Low net positive impact to nuisance conditions along Tijuana River	10
	1.2 Improve water quality at U.S. beaches	1.2.1 Reduce sewage discharged to ocean via Tijuana River	1.2.1a % change in total TR untreated sewage (annual)	87%	50
		1.2.2 Reduce sewage discharged to ocean from SAB Creek	1.2.2a % change in total SAB untreated sewage (annual)	99%	50
	1.3 Protect and improve conditions for impacted constituencies	1.3.1 Reduce siting and O&M requirements for border security personnel	1.3.1a Net impact to border security operations	Low-moderate net positive impact to border security operations	20
Stewardship of Public Resources	2.1 Achieve a timely Intervention	2.1.1 Pursue accelerated time to implement project	2.1.1a NEPA efficiency scored based on capital cost of alternatives not expected to require a NEPA EIS/ROD	0.533	21
	2.2 Increase funding to U.S. side solutions	2.2.1 Bolster U.S. oversight of construction	2.2.1a % of funding on U.S. side projects	79%	21
	2.3 Reduce tourism impacts in local communities	2.3.1 Reduce tourist season beach impacts	2.3.1a % change in days of contaminated beaches during tourist season	95%	35
Ecological Protection	3.1 Reduce impacts to habitat and wildlife	3.1.1 Reduce sediment deposition in Tijuana River and Estuary	3.1.1a % change in amount of sediment reaching Tijuana River Estuary	2%	0
		3.1.2 Reduce trash in estuary and marine debris	3.1.2a Change in amount of trash in Tijuana River	Moderate reduction in amount of the trash.	15
		3.1.3 Reduce ecological pollutants in aquatic habitats (e.g., Tijuana River, Tijuana Estuary, and Pacific Ocean)	3.1.3a Net change in pollutant loadings in the Tijuana River or in discharges to Pacific Ocean	-7,288 tons/year	25
		3.1.4 Avoid reduction of special-status species habitat	3.1.4a Number of special-status species in proximity to construction	18 species	-10
System Resiliency	4.1 Plan for long-term treatment needs	4.1.1 Account for future population growth and urbanization	4.1.1a Sewage treatment capacity surplus/deficit	26.3 MGD surplus of sewage treatment	25
	4.2 Mitigate impacts of climate change	4.2.1 Reduce energy use	4.2.1a Net change in energy use	14,420 MWh	-5
	4.3 Improve system reliability	4.3.1 Retain an adequate and prepared workforce	4.3.1a Number of new licensed operators required	21 operators	0
				Total Score	297
				40 Year Lifecycle Cost	$1,652,000,000
				Score/40 Year Lifecycle Cost (in millions)	18

Appendix C: Initial 39 Alternatives

	Alternative	Size	Project Grouping	BOD Impact (tons/year)	BOD Score	Sediment Score	Transboundary Flow Impacts (days/year)	Transboundary Flow Score	Total Environmental Significance Score (higher score = greater environmental benefit)	Alternative Capital Cost	Alternative 40-year Life Cycle Cost	Capital Budget Remaining for Add-ons
					= BOD Impact / Max BOD	= Sediment Impact / Max Sediment		= Transboundary Impact / Max Transboundary	= BOD Score x BOD ESF + Sediment Score x Sediment ESF + Transboundary Score x Transboundary ESF			=$290M - Alternative Capital Cost
Project 1 Groupings	Alternative A	35	1, 8	-7,130	5	1	-80	6	43	$ 310,700,000	$ 1,116,000,000	$ (20,700,000)
	Alternative B	35	1, 3 (50 MGD)	-8,761	6	1	-80	6	50	$ 409,700,000	$ 1,203,000,000	$ (119,700,000)
	Alternative C	35	1 (100 MGD diversion, 35 MGD APTP), 9 (15 MGD)	-8,761	6	1	-80	6	50	$ 238,400,000	$ 1,418,000,000	$ 51,600,000
	Alternative D	35	1, 7, 8	-7,133	5	1	-153	10	47	$ 347,600,000	$ 1,166,200,000	$ (57,600,000)
	Alternative E	35	1, 3 (60 MGD), 4	-16,531	10	1	-80	6	78	$ 513,500,000	$ 1,478,900,000	$ (223,500,000)
	Alternative F	35	1, 9 (30 MGD), 4	-16,531	10	1	-80	6	78	$ 415,500,000	$ 1,738,900,000	$ (125,500,000)
	Alternative G	35	1, 3 (60 MGD), 7	-12,634	8	1	-153	10	68	$ 519,600,000	$ 1,493,200,000	$ (229,600,000)
	Alternative H	35	1, 9 (30 MGD), 7	-12,634	8	1	-153	10	68	$ 421,600,000	$ 1,753,200,000	$ (131,600,000)
	Alternative I	35	1, 3 (60 MGD), 4, 7	-16,534	10	1	-153	10	82	$ 550,400,000	$ 1,529,100,000	$ (260,400,000)
	Alternative J	35	1, 9 (30 MGD), 4, 7	-16,534	10	1	-153	10	82	$ 452,400,000	$ 1,789,100,000	$ (162,400,000)
	Alternative K	100	1, 8	-7,516	5	3	-126	9	50	$ 420,700,000	$ 2,224,000,000	$ (130,700,000)
	Alternative L	100	1, 9 (15 MGD)	-9,147	6	2	-126	9	55	$ 325,700,000	$ 2,370,000,000	$ (35,700,000)
	Alternative M	100	1, 7, 8	-7,519	5	3	-153	10	51	$ 457,600,000	$ 2,274,200,000	$ (167,600,000)
	Alternative N	100	1, 9 (30 MGD), 4	-16,917	10	3	-126	9	85	$ 525,500,000	$ 2,846,900,000	$ (235,500,000)
	Alternative O	100	1, 9 (15 MGD), 7	-9,150	6	2	-153	10	56	$ 362,600,000	$ 2,420,200,000	$ (72,600,000)
	Alternative P	100	1, 9 (30 MGD), 4, 7	-16,920	10	3	-153	10	86	$ 562,400,000	$ 2,897,100,000	$ (272,400,000)
	Alternative Q	163	1, 8	-7,610	5	4	-133	9	52	$ 495,500,000	$ 3,054,000,000	$ (205,500,000)
	Alternative R	163	1, 9 (15 MGD)	-9,241	6	4	-133	9	59	$ 400,500,000	$ 3,200,000,000	$ (110,500,000)
	Alternative S	163	1, 7, 8	-7,613	5	4	-153	10	53	$ 532,400,000	$ 3,104,200,000	$ (242,400,000)
	Alternative T	163	1, 9 (30 MGD), 4	-17,011	10	4	-133	9	87	$ 600,300,000	$ 3,676,900,000	$ (310,300,000)
	Alternative U	163	1, 9 (15 MGD), 7	-9,244	6	4	-153	10	60	$ 437,400,000	$ 3,250,200,000	$ (147,400,000)
	Alternative V	163	1, 9 (30 MGD), 4, 7	-17,014	10	4	-153	10	88	$ 637,200,000	$ 3,727,100,000	$ (347,200,000)
Project 2 Groupings	Alternative W		2, 8	-11,430	7	1	-80	6	57	$ 288,000,000	$ 995,400,000	$ 2,000,000
	Alternative X		2, 3 (50 MGD)	-13,061	8	1	-80	6	64	$ 387,000,000	$ 1,082,400,000	$ (97,000,000)
	Alternative Y		2, 9 (15 MGD)	-13,061	8	1	-80	6	64	$ 193,000,000	$ 1,141,400,000	$ 97,000,000
	Alternative Z		2, 7, 8	-11,433	7	1	-153	10	61	$ 324,900,000	$ 1,045,600,000	$ (34,900,000)
	Alternative AA		2, 3 (50 MGD), 4	-16,961	10	1	-80	6	78	$ 417,800,000	$ 1,118,300,000	$ (127,800,000)
	Alternative AB		2, 9 (15 MGD), 4	-16,961	10	1	-80	6	78	$ 223,800,000	$ 1,177,300,000	$ 66,200,000
	Alternative AC		2, 3 (50 MGD), 4, 7	-16,964	10	1	-153	10	82	$ 454,700,000	$ 1,168,500,000	$ (164,700,000)
	Alternative AD		2, 9 (15 MGD), 4, 7	-16,964	10	1	-153	10	82	$ 260,700,000	$ 1,227,500,000	$ 29,300,000
Stand Alone	Alternative AE		8	-6,259	4	1	0	0	30	$ 200,000,000	$ 613,000,000	$ 90,000,000
	Alternative AF		7, 8	-6,262	4	1	-79	6	36	$ 236,900,000	$ 663,200,000	$ 53,100,000
	Alternative AG		3 (50 MGD)	-7,890	5	1	0	0	37	$ 299,000,000	$ 700,000,000	$ (9,000,000)
	Alternative AH		9 (15 MGD)	-7,890	5	1	0	0	37	$ 105,000,000	$ 759,000,000	$ 185,000,000
	Alternative AI		3 (60 MGD), 4	-15,660	9	1	0	0	65	$ 402,800,000	$ 975,900,000	$ (112,800,000)
	Alternative AJ		9 (30MGD), 4	-15,660	9	1	0	0	65	$ 304,800,000	$ 1,235,900,000	$ (14,800,000)
	Alternative AK		3 (60 MGD), 4, 7	-15,663	9	1	-79	6	71	$ 439,700,000	$ 1,026,100,000	$ (149,700,000)
	Alternative AL		9 (15 MGD), 4, 7	-11,793	7	1	-79	6	57	$ 172,700,000	$ 845,100,000	$ 117,300,000
	Alternative AM		9 (30 MGD), 4, 7	-15,663	9	1	-79	6	71	$ 341,700,000	$ 1,286,100,000	$ (51,700,000)
Add-ons	Project 3		Convey ITP Effluent to Mexico	NA	NA	NA	NA	NA	NA	NA	$ 18,700,000	$ 149,000,000
	Project 3		New pipeline in the U.S. to replace IC	NA	NA	NA	NA	NA	NA	NA	$ 14,100,000	$ 28,900,000
	Project 4		Upgrade canyon collection structures	NA	NA	NA	NA	NA	NA	NA	$ 435,000	$ 600,000
	Project 5		Rehabilitate targeted collectors	NA	NA	NA	NA	NA	NA	NA	$ 149,000,000	NA
	Project 5		Extend wastewater collection facilities	NA	NA	NA	NA	NA	NA	NA	$ 756,000,000	NA
	Project 5		Rehabilitate or replace existing pump stations	NA	NA	NA	NA	NA	NA	NA	$ 84,000,000	NA
	Project 6		Yogurt Canyon modification to Monument Road	NA	NA	NA	NA	NA	NA	NA	$ 2,900,000	$ 3,200,000
	Project 6		Tijuana River Main Channel trash boom	NA	NA	NA	NA	NA	NA	NA	$ 3,600,000	$ 156,000,000
	Project 10		Source control BMPs	NA	NA	NA	NA	NA	NA	NA	$ -	$ -

Max BOD Reduction	-17,490
Max Sediment Reduction	-800,000
Max Transboundary Reduction	-153
SAB Factor	40%
Environmental Significance Factor (ESF) for BOD	7
Environmental Significance Factor for Sediment	2
Environmental Significance Factor for Transboundary Flow	1

Appendix C: Initial 39 Alternatives

	Alternative	Size	Project Grouping	Cost Benefit (Capital) (lower score = greater cost benefit) = Environmental Significance Score / Capital Cost	Cost Benefit (Life Cycle) (lower score = greater cost benefit) = Environmental Significance Score / Life Cycle Cost	Combined Cost Benefit (lower score = greater cost benefit) = Capital Cost Benefit / Life Cycle Cost Benefit
Project 1 Groupings	Alternative A	35	1, 8	72	260	332
	Alternative B	35	1, 3 (50 MGD)	82	241	323
	Alternative C	35	1 (100 MGD diversion, 35 MGD APTP), 9 (15 MGD)	48	284	331
	Alternative D	35	1, 7, 8	74	248	322
	Alternative E	35	1, 3 (60 MGD), 4	66	190	255
	Alternative F	35	1, 9 (30 MGD), 4	53	223	276
	Alternative G	35	1, 3 (60 MGD), 7	76	220	296
	Alternative H	35	1, 9 (30 MGD), 7	62	258	320
	Alternative I	35	1, 3 (60 MGD), 4, 7	67	186	254
	Alternative J	35	1, 9 (30 MGD), 4, 7	55	218	273
	Alternative K	100	1, 8	84	445	529
	Alternative L	100	1, 9 (15 MGD)	59	431	490
	Alternative M	100	1, 7, 8	90	446	536
	Alternative N	100	1, 9 (30 MGD), 4	62	335	397
	Alternative O	100	1, 9 (15 MGD), 7	65	432	497
	Alternative P	100	1, 9 (30 MGD), 4, 7	65	337	402
	Alternative Q	163	1, 8	95	587	683
	Alternative R	163	1, 9 (15 MGD)	68	542	610
	Alternative S	163	1, 7, 8	100	586	686
	Alternative T	163	1, 9 (30 MGD), 4	69	423	492
	Alternative U	163	1, 9 (15 MGD), 7	73	542	615
	Alternative V	163	1, 9 (30 MGD), 4, 7	72	424	496
Project 2 Groupings	Alternative W		2, 8	51	175	225
	Alternative X		2, 3 (50 MGD)	60	169	230
	Alternative Y		2, 9 (15 MGD)	30	178	209
	Alternative Z		2, 7, 8	53	171	225
	Alternative AA		2, 3 (50 MGD), 4	54	143	197
	Alternative AB		2, 9 (15 MGD), 4	29	151	180
	Alternative AC		2, 3 (50 MGD), 4, 7	55	143	198
	Alternative AD		2, 9 (15 MGD), 4, 7	32	150	181
Stand Alone	Alternative AE		8	67	204	271
	Alternative AF		7, 8	66	184	250
	Alternative AG		3 (50 MGD)	81	189	270
	Alternative AH		9 (15 MGD)	28	205	234
	Alternative AI		3 (60 MGD), 4	62	150	212
	Alternative AJ		9 (30MGD), 4	47	190	237
	Alternative AK		3 (60 MGD), 4, 7	62	145	206
	Alternative AL		9 (15 MGD), 4, 7	30	148	179
	Alternative AM		9 (30 MGD), 4, 7	48	181	229
Add-ons	Project 3		Convey ITP Effluent to Mexico	NA	NA	NA
	Project 3		New pipeline in the U.S. to replace IC	NA	NA	NA
	Project 4		Upgrade canyon collection structures	NA	NA	NA
	Project 5		Rehabilitate targeted collectors	NA	NA	NA
	Project 5		Extend wastewater collection facilities	NA	NA	NA
	Project 5		Rehabilitate or replace existing pump stations	NA	NA	NA
	Project 6		Yogurt Canyon modification to Monument Road	NA	NA	NA
	Project 6		Tijuana River Main Channel trash boom	NA	NA	NA
	Project 10		Source control BMPs	NA	NA	NA

Max BOD Reduction	-17,490
Max Sediment Reduction	-800,000
Max Transboundary Reduction	-153
SAB Factor	40%
Environmental Significance Factor (ESF) for BOD	7
Environmental Significance Factor for Sediment	2
Environmental Significance Factor for Transboundary Flow	1

APPENDIX D: USMCA PROJECTS AND SUB-PROJECTS

Project	Project Title	Sub-Project Title	Project Purpose
1	New Tijuana Diversion System in the U.S. and Treatment in the U.S.	U.S.-side river diversion system to pump a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	Divert and treat river water during wet-weather flow conditions in order to protect the estuary and coastal communities; divert and treat dry-weather transboundary flows if the PB-CILA diversion fails.
		82-million-gallon storage basin designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	
		APTP designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD	
2	Expand and Upgrade Tijuana River Diversion System in Mexico and Provide Treatment in the U.S.	Rehabilitation and extension of the conveyance line from PB-CILA to the headworks of a new APTP in the U.S.	Eliminate the need for PB1-A, improve water quality in the Tijuana River, and reduce flows directed to SAB, and make PB-CILA more reliable.
		Upgrading the existing Mexico-side river diversion, PB-CILA, and the conveyance to divert river flows up to 60 MGD to a new APTP in the U.S.	
		APTP designed to treat 35 MGD or 60 MGD of diverted river water from PB-CILA	
3	Expansion of ITP to Handle All Wastewater Flows from International Collector	Increase ITP Average Daily Design Flow Rate to 40 MGD, 50 MGD, 55 MGD, or 60 MGD	Reduce impacts to the U.S. coast by capturing and treating sewage from the International Collector (and potentially flows from the canyon pump stations) that otherwise would be discharged to the Pacific Ocean via SAB Creek without adequate treatment.
		Construct a pipeline to return treated effluent from the expanded ITP to PB1-B for beneficial reuse and/or discharge in Mexico	Provide a source of water to be beneficially re-used in Mexico while also lessening the volume of effluent discharged from the SBOO.
		Construct a new pipeline in the U.S. to replace the International Collector	Reduce spillage from the International Collector while also enabling easier pipeline maintenance.
4	Shift Wastewater Treatment of Canyon Flows to U.S. (via Expanded ITP or SBWRP) to Reduce Flows to SAB	Decommissioning the El Matadero, Los Laureles 1, and Los Laureles 2 Pump Stations in Mexico and constructing a new conveyance system	Protect coastal communities and reduce beach impacts in the U.S. due to untreated or undertreated sewage discharged from the SAB wastewater treatment plant that originate in Matadero and Los Laureles Canyons.
		Upgrading the U.S.-side wastewater collection structures at Smuggler’s Gulch and Goat Canyon	Reduce CBP agents’ exposure to untreated wastewater at the canyon collectors.

Project	Project Title	Sub-Project Title	Project Purpose
5	Enhance Mexico Wastewater Collection System to Reduce Flows into Tijuana River	Rehabilitating targeted collector pipelines as identified by CESPT	Provide the facilities necessary to collect sanitary wastewater from the Tijuana metropolitan area and treat it in Mexico, thereby minimizing the flow of untreated wastewater into the Tijuana River and the Pacific Ocean.
		Extending wastewater collection facilities into developed but unsewered areas	
		Rehabilitating or replacing existing local pump stations.	
		Rehabilitating or replacing the existing local sanitary sewer system	
		Expanding the Tijuana sanitary sewer system to account for future growth	
		Expanding the treatment capacity in Tijuana to treat the additional wastewater captured by the sanitary system	
6	Construct New Infrastructure to Address Trash and Sediment During Wet Weather Flows	Restoration of the Tijuana River Main Channel sediment basin between the US/Mexico Border and Dairy Mart Road to its original configuration by removing accumulated sediment	Reduce sediment loads in transboundary flows.
		Sediment basin located on the US-side of the border at Smuggler's Gulch (in channel)	
		Sediment basin located on the US-side of the border at Smuggler's Gulch (in and off channel combined)	
		In-channel sediment basin on the Mexico-side of the border at Smuggler's Gulch	
		US-side pilot channel in Yogurt Canyon	Reduce wet-weather flooding over Monument Road - ineffective.
		US-side modification to Monument Road just east of International Friendship Park	Reduce wet-weather flooding over Monument Road.
		Installation of trash booms in the Tijuana River Main Channel (U.S. side)	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows.
		Installation of trash booms in Smuggler's Gulch (Mexico side)	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows.

Project	Project Title	Sub-Project Title	Project Purpose
7	Divert or Reuse Treated Wastewater from Existing Wastewater Treatment Plants in Mexico to Reduce Flows into the Tijuana River	Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, all new infrastructure	Reduce the need to divert and treat as much river water at the border, and ultimately reducing the quantity and frequency of transboundary flows.
		Discharge to Rodriguez Dam impoundment for potential indirect potable reuse, reuse some existing infrastructure	
		Piping of treated wastewater from La Morita and Arturo Herrera WWTPs directly to the SBOO	
8	New San Antonio de Los Buenos Wastewater Treatment Plant to Reduce Untreated Wastewater to Coast	New SAB treatment plant to properly treat reduced flows coming from Playas and direct vicinity of the SAB plant (10 MGD)	Reduce untreated wastewater discharged to SAB Creek to reduce impacts of wastewater along the coastline.
		New SAB treatment plant to properly treat reduced flows coming from Playas and direct vicinity of the SAB plant (5 MGD)	
9	Shift More Wastewater Treatment to U.S. (via SBWRP) to Reduce Flows in Tijuana River and San Antonio de los Buenos	Use the SBWRP at its current design capacity (15 MGD) and layout with solids pumped to Point Loma for processing	Reduce impacts to southern San Diego County beaches from untreated or undertreated sewage discharged to the Pacific Ocean via SAB Creek.
		Use the SBWRP at its current design capacity (15 MGD) but construct a new onsite solids processing chain	
		Expand the SBRWP to a design capacity of 30 MGD (average daily flow), including a new onsite solids processing train	
10	Reduce Trash and Sediment in Tijuana River and Goat Canyon via Source Control Projects in Mexico	Road paving	Reduce sediment loads in transboundary flows.
		Trash and tire collection, processing, and disposal	Potential to reduce trash, waste tires, and associated pollutants in transboundary flows.
		Public education, outreach, and participation programs	Potential to facilitate public acceptance of investment in higher-cost trash and sediment source control projects.
		Land stabilization	Reduce sediment loads in transboundary flows.
		Green infrastructure	Potential sediment load reductions in transboundary flows.

APPENDIX E: RIVER AND COLLECTION SYSTEM DATA

IBWC Flow Gauge Data - 2016				IBWC Flow Gauge Data - 2017			
Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)
1/1/2016	0	7/1/2016	0	1/1/2017	322.2033819	7/1/2017	0
1/2/2016	0	7/2/2016	1.399913194	1/2/2017	83.95187847	7/2/2017	0
1/3/2016	0	7/3/2016	0	1/3/2017	50.72032639	7/3/2017	0
1/4/2016	158.7283576	7/4/2016	0.0461875	1/4/2017	48.14656944	7/4/2017	0
1/5/2016	568.564184	7/5/2016	0	1/5/2017	82.69522569	7/5/2017	0
1/6/2016	283.0753819	7/6/2016	0	1/6/2017	71.19610417	7/6/2017	0
1/7/2016	420.6577986	7/7/2016	0	1/7/2017	57.61661111	7/7/2017	0
1/8/2016	550.9296875	7/8/2016	0	1/8/2017	53.74858333	7/8/2017	0
1/9/2016	84.29115625	7/9/2016	0	1/9/2017	52.59101736	7/9/2017	0
1/10/2016	61.12614583	7/10/2016	0	1/10/2017	56.14371875	7/10/2017	0
1/11/2016	52.98400347	7/11/2016	0	1/11/2017	44.36597222	7/11/2017	0
1/12/2016	38.80579167	7/12/2016	0	1/12/2017	38.0314375	7/12/2017	0
1/13/2016	34.53376042	7/13/2016	0	1/13/2017	524.2896458	7/13/2017	0
1/14/2016	31.89729861	7/14/2016	0	1/14/2017	82.05124306	7/14/2017	0
1/15/2016	30.303625	7/15/2016	0	1/15/2017	56.46457986	7/15/2017	0
1/16/2016	11.36721181	7/16/2016	0	1/16/2017	49.28597569	7/16/2017	0
1/17/2016	1.052430556	7/17/2016	0	1/17/2017	51.91628472	7/17/2017	0
1/18/2016	0.117659722	7/18/2016	0	1/18/2017	51.26461111	7/18/2017	0
1/19/2016	0	7/19/2016	0	1/19/2017	599.0444479	7/19/2017	0
1/20/2016	0.189145833	7/20/2016	0	1/20/2017	1859.62834	7/20/2017	0
1/21/2016	0	7/21/2016	0	1/21/2017	787.2184028	7/21/2017	0
1/22/2016	0	7/22/2016	0	1/22/2017	411.5624167	7/22/2017	0
1/23/2016	0.155052083	7/23/2016	0	1/23/2017	1084.248948	7/23/2017	0
1/24/2016	0.024194444	7/24/2016	0	1/24/2017	807.37275	7/24/2017	0
1/25/2016	0	7/25/2016	0.084680556	1/25/2017	437.2096944	7/25/2017	0
1/26/2016	0	7/26/2016	0	1/26/2017	312.9399132	7/26/2017	0
1/27/2016	0	7/27/2016	0	1/27/2017	200.520184	7/27/2017	0
1/28/2016	0	7/28/2016	0	1/28/2017	155.4032986	7/28/2017	0
1/29/2016	0	7/29/2016	0	1/29/2017	125.37125	7/29/2017	0
1/30/2016	0	7/30/2016	0	1/30/2017	96.91283681	7/30/2017	0
1/31/2016	293.0091979	7/31/2016	0	1/31/2017	74.14816667	7/31/2017	1.240461806
2/1/2016	68.56697917	8/1/2016	0	2/1/2017	67.8645625	8/1/2017	0
2/2/2016	44.00667014	8/2/2016	0	2/2/2017	70.88910069	8/2/2017	0
2/3/2016	32.84757639	8/3/2016	0	2/3/2017	65.94684375	8/3/2017	0.004402778
2/4/2016	27.94685764	8/4/2016	0	2/4/2017	54.19127431	8/4/2017	0.101173611
2/5/2016	26.82931597	8/5/2016	0	2/5/2017	51.55486806	8/5/2017	0
2/6/2016	25.83079167	8/6/2016	0	2/6/2017	44.08265625	8/6/2017	0
2/7/2016	26.46564583	8/7/2016	0	2/7/2017	52.27503125	8/7/2017	0.567440972
2/8/2016	25.74510417	8/8/2016	0	2/8/2017	56.07479861	8/8/2017	1.240444444
2/9/2016	24.98292708	8/9/2016	0	2/9/2017	50.07821528	8/9/2017	0.616885417
2/10/2016	24.33675	8/10/2016	0	2/10/2017	49.454	8/10/2017	0.478354167
2/11/2016	16.74120486	8/11/2016	0	2/11/2017	49.79726389	8/11/2017	0.251836806
2/12/2016	0	8/12/2016	0	2/12/2017	45.45963889	8/12/2017	0
2/13/2016	0	8/13/2016	0	2/13/2017	48.88207639	8/13/2017	0.006604167
2/14/2016	0	8/14/2016	0	2/14/2017	53.87078819	8/14/2017	0.394798611
2/15/2016	0	8/15/2016	0	2/15/2017	54.54979861	8/15/2017	0.247409722
2/16/2016	0	8/16/2016	0	2/16/2017	52.10260764	8/16/2017	0.767597222
2/17/2016	0	8/17/2016	0	2/17/2017	1106.345069	8/17/2017	1.117274306
2/18/2016	0	8/18/2016	0	2/18/2017	738.8077813	8/18/2017	0.987538194
2/19/2016	0	8/19/2016	0	2/19/2017	234.4846875	8/19/2017	0.559736111
2/20/2016	0	8/20/2016	0	2/20/2017	129.8103507	8/20/2017	0.052802083
2/21/2016	0	8/21/2016	0	2/21/2017	93.91254514	8/21/2017	0.024194444
2/22/2016	0	8/22/2016	0	2/22/2017	64.32744444	8/22/2017	0
2/23/2016	0	8/23/2016	0	2/23/2017	52.29252431	8/23/2017	0.203440972
2/24/2016	0	8/24/2016	0	2/24/2017	46.46964236	8/24/2017	0
2/25/2016	0	8/25/2016	0	2/25/2017	45.06514583	8/25/2017	0
2/26/2016	0	8/26/2016	0	2/26/2017	35.20944444	8/26/2017	0
2/27/2016	0	8/27/2016	0	2/27/2017	2733.18801	8/27/2017	0
2/28/2016	0	8/28/2016	0	2/28/2017	3494.637108	8/28/2017	0
2/29/2016	0	8/29/2016	0	3/1/2017	479.1020556	8/29/2017	0
3/1/2016	0	8/30/2016	0	3/2/2017	253.5277361	8/30/2017	0
3/2/2016	0	8/31/2016	0	3/3/2017	188.2710243	8/31/2017	0
3/3/2016	0	9/1/2016	0	3/4/2017	146.9276806	9/1/2017	0
3/4/2016	0	9/2/2016	0	3/5/2017	128.9652917	9/2/2017	0
3/5/2016	0	9/3/2016	0	3/6/2017	135.2024722	9/3/2017	0
3/6/2016	40.80228472	9/4/2016	0	3/7/2017	120.0049861	9/4/2017	0
3/7/2016	181.8645451	9/5/2016	0	3/8/2017	94.29072222	9/5/2017	0
3/8/2016	90.6600625	9/6/2016	0	3/9/2017	73.79856597	9/6/2017	0
3/9/2016	33.1578125	9/7/2016	0	3/10/2017	67.65562153	9/7/2017	0.206770833
3/10/2016	24.09561458	9/8/2016	0	3/11/2017	59.40551736	9/8/2017	0
3/11/2016	65.16811111	9/9/2016	2.528215278	3/12/2017	50.45917014	9/9/2017	1.879371528
3/12/2016	32.37165972	9/10/2016	0	3/13/2017	50.429625	9/10/2017	4.61540625
3/13/2016	21.40779861	9/11/2016	0	3/14/2017	59.69099653	9/11/2017	0.350795139
3/14/2016	20.20686458	9/12/2016	0	3/15/2017	76.75569444	9/12/2017	0.092395833
3/15/2016	18.63318056	9/13/2016	0	3/16/2017	61.55038889	9/13/2017	0.46846875
3/16/2016	14.16075347	9/14/2016	0	3/17/2017	49.04056597	9/14/2017	0.050631944
3/17/2016	0	9/15/2016	0	3/18/2017	48.72799653	9/15/2017	0.414552083
3/18/2016	0	9/16/2016	0	3/19/2017	48.15701736	9/16/2017	0.38159375
3/19/2016	0	9/17/2016	0	3/20/2017	47.45686111	9/17/2017	0.322170139
3/20/2016	0	9/18/2016	0	3/21/2017	51.93792361	9/18/2017	0.272743056
3/21/2016	0	9/19/2016	0.296920139	3/22/2017	58.056	9/19/2017	0.575104167
3/22/2016	0	9/20/2016	381.6846771	3/23/2017	62.67498958	9/20/2017	1.016100694
3/23/2016	0	9/21/2016	124.5180764	3/24/2017	42.75743403	9/21/2017	0.361704861
3/24/2016	0	9/22/2016	22.48642361	3/25/2017	36.30039236	9/22/2017	0.397010417
3/25/2016	0	9/23/2016	2.718465278	3/26/2017	34.27552778	9/23/2017	0.12425
3/26/2016	0	9/24/2016	0	3/27/2017	22.79136458	9/24/2017	0.031920139
3/27/2016	0	9/25/2016	0	3/28/2017	22.00567014	9/25/2017	0
3/28/2016	0	9/26/2016	0	3/29/2017	26.49465972	9/26/2017	0
3/29/2016	0	9/27/2016	0	3/30/2017	25.08201042	9/27/2017	0
3/30/2016	18.97461806	9/28/2016	0	3/31/2017	15.70253125	9/28/2017	0
3/31/2016	0	9/29/2016	0.092375	4/1/2017	16.76705903	9/29/2017	0
4/1/2016	0	9/30/2016	0	4/2/2017	11.625875	9/30/2017	0
4/2/2016	0	10/1/2016	0	4/3/2017	11.23452083	10/1/2017	0
4/3/2016	0	10/2/2016	0	4/4/2017	14.83123611	10/2/2017	0
4/4/2016	0	10/3/2016	0	4/5/2017	28.31394444	10/3/2017	0
4/5/2016	3.621673611	10/4/2016	0	4/6/2017	0	10/4/2017	0
4/6/2016	0	10/5/2016	0	4/7/2017	0.776395833	10/5/2017	0
4/7/2016	53.91101389	10/6/2016	0	4/8/2017	5.670020833	10/6/2017	0

IBWC Flow Gauge Data - 2016			
Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)
4/8/2016	30.58084375	10/7/2016	0
4/9/2016	18.34498958	10/8/2016	0
4/10/2016	308.7010729	10/9/2016	0
4/11/2016	34.32792361	10/10/2016	0
4/12/2016	30.03252431	10/11/2016	0
4/13/2016	26.45652083	10/12/2016	0
4/14/2016	23.29704861	10/13/2016	0
4/15/2016	9.145041667	10/14/2016	0
4/16/2016	0	10/15/2016	0
4/17/2016	0	10/16/2016	0
4/18/2016	0	10/17/2016	0
4/19/2016	0	10/18/2016	0
4/20/2016	0	10/19/2016	0
4/21/2016	0	10/20/2016	0
4/22/2016	0	10/21/2016	0
4/23/2016	0	10/22/2016	0
4/24/2016	0	10/23/2016	0
4/25/2016	0	10/24/2016	0.211145833
4/26/2016	0	10/25/2016	0.001100694
4/27/2016	0	10/26/2016	0
4/28/2016	0	10/27/2016	0
4/29/2016	0	10/28/2016	0
4/30/2016	0	10/29/2016	0
5/1/2016	0	10/30/2016	0
5/2/2016	0	10/31/2016	0
5/3/2016	0	11/1/2016	0
5/4/2016	0	11/2/2016	0
5/5/2016	0	11/3/2016	0
5/6/2016	595.1283056	11/4/2016	0
5/7/2016	43.92794792	11/5/2016	0
5/8/2016	26.31019792	11/6/2016	0
5/9/2016	26.67252778	11/7/2016	0
5/10/2016	24.85229861	11/8/2016	0
5/11/2016	13.78246181	11/9/2016	0
5/12/2016	0.59271875	11/10/2016	0
5/13/2016	0	11/11/2016	0
5/14/2016	0	11/12/2016	0
5/15/2016	0	11/13/2016	0
5/16/2016	0	11/14/2016	0
5/17/2016	0	11/15/2016	0
5/18/2016	0	11/16/2016	0
5/19/2016	0	11/17/2016	0
5/20/2016	0	11/18/2016	0
5/21/2016	0	11/19/2016	0
5/22/2016	0	11/20/2016	0
5/23/2016	0	11/21/2016	149.6118125
5/24/2016	0	11/22/2016	20.22344792
5/25/2016	0	11/23/2016	19.22486111
5/26/2016	0	11/24/2016	17.00463889
5/27/2016	0	11/25/2016	15.63983681
5/28/2016	0	11/26/2016	28.99802083
5/29/2016	0	11/27/2016	46.35995833
5/30/2016	0	11/28/2016	27.15812847
5/31/2016	0	11/29/2016	22.87482639
6/1/2016	0	11/30/2016	18.67281944
6/2/2016	0	12/1/2016	19.418375
6/3/2016	0	12/2/2016	20.87002083
6/4/2016	0	12/3/2016	20.60605556
6/5/2016	0	12/4/2016	20.78096181
6/6/2016	0	12/5/2016	21.34288194
6/7/2016	0	12/6/2016	20.97997222
6/8/2016	0	12/7/2016	6.281465278
6/9/2016	0	12/8/2016	2.516083333
6/10/2016	0	12/9/2016	0
6/11/2016	0	12/10/2016	0
6/12/2016	0	12/11/2016	0
6/13/2016	0	12/12/2016	0
6/14/2016	0	12/13/2016	0
6/15/2016	0	12/14/2016	0
6/16/2016	0	12/15/2016	0
6/17/2016	0	12/16/2016	391.8398403
6/18/2016	0	12/17/2016	53.63955903
6/19/2016	0	12/18/2016	40.72991667
6/20/2016	0	12/19/2016	30.00273611
6/21/2016	0	12/20/2016	27.97025
6/22/2016	0	12/21/2016	97.81635069
6/23/2016	0	12/22/2016	1319.083017
6/24/2016	0	12/23/2016	184.9939792
6/25/2016	0	12/24/2016	1009.181889
6/26/2016	0	12/25/2016	183.4454479
6/27/2016	0	12/26/2016	105.3883646
6/28/2016	0	12/27/2016	57.44062847
6/29/2016	0	12/28/2016	42.81300347
6/30/2016	0	12/29/2016	29.31945486
		12/30/2016	81.66471528
		12/31/2016	279.0593993

IBWC Flow Gauge Data - 2017			
Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)
4/9/2017	22.01842361	10/7/2017	0
4/10/2017	10.26678125	10/8/2017	0
4/11/2017	4.228392361	10/9/2017	0
4/12/2017	0.999631944	10/10/2017	0
4/13/2017	0.757704861	10/11/2017	0.028590278
4/14/2017	1.585736111	10/12/2017	0.514659722
4/15/2017	0.146243056	10/13/2017	0
4/16/2017	0.019795139	10/14/2017	0
4/17/2017	1.049121528	10/15/2017	0
4/18/2017	0.081385417	10/16/2017	0
4/19/2017	0.655423611	10/17/2017	0
4/20/2017	0.751083333	10/18/2017	0
4/21/2017	0	10/19/2017	0
4/22/2017	0	10/20/2017	0
4/23/2017	0	10/21/2017	0
4/24/2017	0.593833333	10/22/2017	0
4/25/2017	0.62353125	10/23/2017	0
4/26/2017	0	10/24/2017	0
4/27/2017	0.312322917	10/25/2017	0
4/28/2017	0	10/26/2017	0
4/29/2017	0.604826389	10/27/2017	0
4/30/2017	2.094934028	10/28/2017	0
5/1/2017	1.536277778	10/29/2017	0
5/2/2017	1.372409722	10/30/2017	0
5/3/2017	0.109972222	10/31/2017	0
5/4/2017	0	11/1/2017	0
5/5/2017	0.003302083	11/2/2017	0
5/6/2017	0	11/3/2017	0
5/7/2017	860.4546806	11/4/2017	0
5/8/2017	168.8094722	11/5/2017	0
5/9/2017	51.56757986	11/6/2017	0.320017361
5/10/2017	35.55490625	11/7/2017	172.0372361
5/11/2017	27.42689236	11/8/2017	69.25716319
5/12/2017	23.55045486	11/9/2017	35.69345833
5/13/2017	3.470649306	11/10/2017	8.433559028
5/14/2017	2.383024306	11/11/2017	4.211791667
5/15/2017	2.703059028	11/12/2017	2.593090278
5/16/2017	0	11/13/2017	0
5/17/2017	0	11/14/2017	0.291427083
5/18/2017	0	11/15/2017	0
5/19/2017	0	11/16/2017	0
5/20/2017	0	11/17/2017	0
5/21/2017	0.90725	11/18/2017	0
5/22/2017	0	11/19/2017	0
5/23/2017	0	11/20/2017	0
5/24/2017	0.25403125	11/21/2017	0
5/25/2017	1.024920139	11/22/2017	0
5/26/2017	0.182569444	11/23/2017	0
5/27/2017	0	11/24/2017	0
5/28/2017	0	11/25/2017	0
5/29/2017	0	11/26/2017	0
5/30/2017	0	11/27/2017	0
5/31/2017	0	11/28/2017	0
6/1/2017	0	11/29/2017	0
6/2/2017	0	11/30/2017	0
6/3/2017	0	12/1/2017	0
6/4/2017	0.087961806	12/2/2017	0
6/5/2017	0.001100694	12/3/2017	0
6/6/2017	0	12/4/2017	0
6/7/2017	0	12/5/2017	0.162756944
6/8/2017	0	12/6/2017	0
6/9/2017	0.49371875	12/7/2017	0
6/10/2017	0.561892361	12/8/2017	0
6/11/2017	0.969878472	12/9/2017	0.037416667
6/12/2017	0.879736111	12/10/2017	0.120989583
6/13/2017	0.417881944	12/11/2017	0.953451389
6/14/2017	0	12/12/2017	0
6/15/2017	0	12/13/2017	0
6/16/2017	0	12/14/2017	0
6/17/2017	0	12/15/2017	0
6/18/2017	0	12/16/2017	0
6/19/2017	0	12/17/2017	0
6/20/2017	0	12/18/2017	0
6/21/2017	0	12/19/2017	0
6/22/2017	0	12/20/2017	0.30021875
6/23/2017	0	12/21/2017	9.454496528
6/24/2017	0	12/22/2017	0
6/25/2017	0	12/23/2017	0
6/26/2017	0	12/24/2017	0
6/27/2017	0	12/25/2017	0
6/28/2017	0	12/26/2017	0.666409722
6/29/2017	0	12/27/2017	0.487149306
6/30/2017	0	12/28/2017	0
		12/29/2017	0
		12/30/2017	0
		12/31/2017	0

IBWC Flow Gauge Data - 2018			
Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)
1/1/2018	0	7/1/2018	0
1/2/2018	0	7/2/2018	0
1/3/2018	0	7/3/2018	0
1/4/2018	0	7/4/2018	0
1/5/2018	0	7/5/2018	0
1/6/2018	0	7/6/2018	0
1/7/2018	0	7/7/2018	0
1/8/2018	2.328055556	7/8/2018	0
1/9/2018	1144.190483	7/9/2018	0
1/10/2018	359.3503646	7/10/2018	0
1/11/2018	124.3447917	7/11/2018	0
1/12/2018	58.2591875	7/12/2018	0
1/13/2018	45.40442708	7/13/2018	0
1/14/2018	39.04496181	7/14/2018	0
1/15/2018	35.19054861	7/15/2018	0
1/16/2018	33.13576389	7/16/2018	0
1/17/2018	29.98690278	7/17/2018	0
1/18/2018	27.34438889	7/18/2018	0
1/19/2018	25.83674306	7/19/2018	0
1/20/2018	20.03356944	7/20/2018	0
1/21/2018	1.426166667	7/21/2018	0
1/22/2018	8.145993056	7/22/2018	0
1/23/2018	0	7/23/2018	0
1/24/2018	0	7/24/2018	0
1/25/2018	0	7/25/2018	0
1/26/2018	0	7/26/2018	0
1/27/2018	0	7/27/2018	0
1/28/2018	0	7/28/2018	0
1/29/2018	0.449770833	7/29/2018	0
1/30/2018	0	7/30/2018	0
1/31/2018	0.754395833	7/31/2018	0
2/1/2018	0	8/1/2018	0
2/2/2018	0	8/2/2018	0
2/3/2018	0	8/3/2018	0
2/4/2018	2.389659722	8/4/2018	0
2/5/2018	0	8/5/2018	0
2/6/2018	0	8/6/2018	0
2/7/2018	0	8/7/2018	0
2/8/2018	0	8/8/2018	0
2/9/2018	0.898454861	8/9/2018	0
2/10/2018	1.680322917	8/10/2018	0
2/11/2018	3.391479167	8/11/2018	0
2/12/2018	2.28846875	8/12/2018	0
2/13/2018	0.258427083	8/13/2018	0
2/14/2018	6.002826389	8/14/2018	0
2/15/2018	15.25562847	8/15/2018	0
2/16/2018	0	8/16/2018	0
2/17/2018	0	8/17/2018	0
2/18/2018	0	8/18/2018	0
2/19/2018	0	8/19/2018	0
2/20/2018	0	8/20/2018	0
2/21/2018	0	8/21/2018	0
2/22/2018	0	8/22/2018	0
2/23/2018	0.183680556	8/23/2018	0
2/24/2018	0.01759375	8/24/2018	0
2/25/2018	0.142961806	8/25/2018	0
2/26/2018	1.568180556	8/26/2018	0
2/27/2018	418.4124236	8/27/2018	0
2/28/2018	46.34053819	8/28/2018	0
3/1/2018	40.34119444	8/29/2018	0
3/2/2018	32.34046181	8/30/2018	0
3/3/2018	32.52085069	8/31/2018	0
3/4/2018	28.40540625	9/1/2018	0
3/5/2018	6.326541667	9/2/2018	0
3/6/2018	2.439128472	9/3/2018	0
3/7/2018	0.476170139	9/4/2018	0
3/8/2018	0.035177083	9/5/2018	0
3/9/2018	0	9/6/2018	0
3/10/2018	20.40557639	9/7/2018	0
3/11/2018	92.94360069	9/8/2018	0
3/12/2018	38.64752431	9/9/2018	0
3/13/2018	34.78504514	9/10/2018	0
3/14/2018	37.20496528	9/11/2018	0
3/15/2018	54.48120139	9/12/2018	0
3/16/2018	32.10467014	9/13/2018	0
3/17/2018	88.63303819	9/14/2018	0
3/18/2018	39.32680903	9/15/2018	0
3/19/2018	38.50188889	9/16/2018	0
3/20/2018	35.72632986	9/17/2018	0
3/21/2018	28.19927083	9/18/2018	0
3/22/2018	21.08467708	9/19/2018	0
3/23/2018	1.053510417	9/20/2018	0
3/24/2018	0.618048611	9/21/2018	0
3/25/2018	0.192447917	9/22/2018	0
3/26/2018	0	9/23/2018	0
3/27/2018	0.002201389	9/24/2018	0
3/28/2018	0	9/25/2018	0
3/29/2018	0.465166667	9/26/2018	0
3/30/2018	0	9/27/2018	0
3/31/2018	0	9/28/2018	0
4/1/2018	0	9/29/2018	0
4/2/2018	0	9/30/2018	0
4/3/2018	0.7466875	10/1/2018	0
4/4/2018	0.288118056	10/2/2018	0
4/5/2018	0	10/3/2018	0
4/6/2018	0	10/4/2018	0
4/7/2018	0	10/5/2018	0
4/8/2018	0	10/6/2018	0

IBWC Flow Gauge Data - 2019			
Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)
1/1/2019	22.88549653	7/1/2019	3.494409722
1/2/2019	11.74140278	7/2/2019	4.045697917
1/3/2019	13.94737153	7/3/2019	0
1/4/2019	10.23856597	7/4/2019	0.029611111
1/5/2019	23.49562847	7/5/2019	0
1/6/2019	219.9845903	7/6/2019	0.041
1/7/2019	49.79032292	7/7/2019	0
1/8/2019	45.70111111	7/8/2019	5.511493056
1/9/2019	39.34429167	7/9/2019	14.70275
1/10/2019	22.38077778	7/10/2019	0.056944444
1/11/2019	11.24622222	7/11/2019	0
1/12/2019	272.0129757	7/12/2019	0.141222222
1/13/2019	48.14306944	7/13/2019	0
1/14/2019	361.1552639	7/14/2019	0
1/15/2019	199.3345972	7/15/2019	0
1/16/2019	102.5279653	7/16/2019	0
1/17/2019	98.75812847	7/17/2019	0
1/18/2019	110.6586042	7/18/2019	0
1/19/2019	67.57046875	7/19/2019	0
1/20/2019	59.37361458	7/20/2019	0.179965278
1/21/2019	52.77338194	7/21/2019	0.257413194
1/22/2019	49.13692361	7/22/2019	0
1/23/2019	45.68771875	7/23/2019	0
1/24/2019	44.20325694	7/24/2019	0
1/25/2019	44.02535764	7/25/2019	0
1/26/2019	41.93971181	7/26/2019	0
1/27/2019	42.16786111	7/27/2019	0
1/28/2019	39.58690278	7/28/2019	0
1/29/2019	39.03814583	7/29/2019	0
1/30/2019	31.84369444	7/30/2019	0
1/31/2019	149.5493507	7/31/2019	0
2/1/2019	117.2479757	8/1/2019	0
2/2/2019	1523.152024	8/2/2019	0
2/3/2019	268.4124826	8/3/2019	0
2/4/2019	237.1570069	8/4/2019	0
2/5/2019	312.2687361	8/5/2019	0
2/6/2019	183.3271493	8/6/2019	0
2/7/2019	98.012625	8/7/2019	0
2/8/2019	74.04973264	8/8/2019	0
2/9/2019	61.01626042	8/9/2019	0
2/10/2019	53.43253472	8/10/2019	0
2/11/2019	50.27878125	8/11/2019	0.064916667
2/12/2019	46.03400347	8/12/2019	0
2/13/2019	230.6103021	8/13/2019	0
2/14/2019	2003.714122	8/14/2019	0
2/15/2019	628.7765174	8/15/2019	0
2/16/2019	286.3470208	8/16/2019	0
2/17/2019	194.8229653	8/17/2019	0
2/18/2019	233.7164653	8/18/2019	0
2/19/2019	151.0464514	8/19/2019	0
2/20/2019	125.1611076	8/20/2019	0
2/21/2019	420.0021319	8/21/2019	0
2/22/2019	362.5196424	8/22/2019	0
2/23/2019	198.4802743	8/23/2019	0
2/24/2019	126.9473715	8/24/2019	0
2/25/2019	97.50499653	8/25/2019	0
2/26/2019	78.928125	8/26/2019	0
2/27/2019	70.6863125	8/27/2019	0
2/28/2019	64.09692708	8/28/2019	0
3/1/2019	62.07747569	8/29/2019	0
3/2/2019	87.68745139	8/30/2019	0
3/3/2019	79.61291319	8/31/2019	0
3/4/2019	73.23671875	9/1/2019	0
3/5/2019	88.60420486	9/2/2019	0
3/6/2019	96.51173958	9/3/2019	0
3/7/2019	132.4261493	9/4/2019	26.91623264
3/8/2019	95.57047222	9/5/2019	24.67537847
3/9/2019	89.17258333	9/6/2019	12.74426042
3/10/2019	88.56417708	9/7/2019	17.70575694
3/11/2019	146.1500903	9/8/2019	8.898923611
3/12/2019	206.3102361	9/9/2019	5.785975694
3/13/2019	73.70881597	9/10/2019	1.093479167
3/14/2019	60.54938889	9/11/2019	0.159454861
3/15/2019	64.41152431	9/12/2019	2.254100694
3/16/2019	70.24189583	9/13/2019	0.937392361
3/17/2019	62.25203472	9/14/2019	2.872114583
3/18/2019	60.04620486	9/15/2019	0.445305556
3/19/2019	54.41123611	9/16/2019	0
3/20/2019	49.15065278	9/17/2019	0
3/21/2019	51.23327778	9/18/2019	0
3/22/2019	43.77395486	9/19/2019	0
3/23/2019	42.27747917	9/20/2019	0
3/24/2019	42.08084722	9/21/2019	0
3/25/2019	41.99510069	9/22/2019	4.39546875
3/26/2019	41.96584375	9/23/2019	1.171920139
3/27/2019	29.18646181	9/24/2019	0
3/28/2019	16.55735764	9/25/2019	0
3/29/2019	11.60097222	9/26/2019	0
3/30/2019	8.427204861	9/27/2019	0
3/31/2019	10.11350694	9/28/2019	82.13321875
4/1/2019	10.33489236	9/29/2019	57.55928125
4/2/2019	7.971	9/30/2019	35.57405903
4/3/2019	18.54916667	10/1/2019	12.10308333
4/4/2019	7.971	10/2/2019	0
4/5/2019	6.338052083	10/3/2019	0
4/6/2019	0	10/4/2019	0
4/7/2019	0	10/5/2019	0
4/8/2019	4.852055556	10/6/2019	0

IBWC Flow Gauge Data - 2018				IBWC Flow Gauge Data - 2019			
Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)	Date	Flow Daily Average (MGD)
4/9/2018	0	10/7/2018	0	4/9/2019	2.585510417	10/7/2019	0
4/10/2018	0	10/8/2018	0	4/10/2019	2.438479167	10/8/2019	0
4/11/2018	0	10/9/2018	0	4/11/2019	4.793923611	10/9/2019	0
4/12/2018	0	10/10/2018	0	4/12/2019	2.255069444	10/10/2019	0
4/13/2018	0	10/11/2018	0	4/13/2019	0.991972222	10/11/2019	0
4/14/2018	0	10/12/2018	0	4/14/2019	0.238027778	10/12/2019	1.576354167
4/15/2018	0	10/13/2018	0	4/15/2019	0	10/13/2019	4.520638889
4/16/2018	0	10/14/2018	0	4/16/2019	0	10/14/2019	0
4/17/2018	0	10/15/2018	10.24396875	4/17/2019	0	10/15/2019	0
4/18/2018	0	10/16/2018	0.080267361	4/18/2019	0	10/16/2019	0
4/19/2018	0	10/17/2018	0	4/19/2019	0	10/17/2019	0
4/20/2018	0	10/18/2018	0	4/20/2019	0	10/18/2019	0
4/21/2018	0	10/19/2018	1.699996528	4/21/2019	0	10/19/2019	0
4/22/2018	0	10/20/2018	0	4/22/2019	0	10/20/2019	0
4/23/2018	0	10/21/2018	0	4/23/2019	0	10/21/2019	0.464715278
4/24/2018	0	10/22/2018	0	4/24/2019	0.232333333	10/22/2019	2.333798611
4/25/2018	0	10/23/2018	0	4/25/2019	10.64107292	10/23/2019	0
4/26/2018	0	10/24/2018	0	4/26/2019	0	10/24/2019	0
4/27/2018	0	10/25/2018	0.162756944	4/27/2019	0	10/25/2019	0
4/28/2018	0	10/26/2018	0	4/28/2019	0	10/26/2019	0
4/29/2018	0	10/27/2018	0	4/29/2019	23.87913542	10/27/2019	0
4/30/2018	0	10/28/2018	0	4/30/2019	20.53689583	10/28/2019	0
5/1/2018	0	10/29/2018	0	5/1/2019	12.75799653	10/29/2019	0
5/2/2018	0	10/30/2018	0	5/2/2019	3.788256944	10/30/2019	0
5/3/2018	0	10/31/2018	0	5/3/2019	0	10/31/2019	0
5/4/2018	0	11/1/2018	0	5/4/2019	0.617284722	11/1/2019	0
5/5/2018	0	11/2/2018	0	5/5/2019	3.249524306	11/2/2019	0
5/6/2018	0	11/3/2018	0	5/6/2019	0.121861111	11/3/2019	0
5/7/2018	0	11/4/2018	0	5/7/2019	0	11/4/2019	0
5/8/2018	0	11/5/2018	0	5/8/2019	0	11/5/2019	0
5/9/2018	0	11/6/2018	0	5/9/2019	0	11/6/2019	0
5/10/2018	0	11/7/2018	0	5/10/2019	0	11/7/2019	0
5/11/2018	0	11/8/2018	0	5/11/2019	22.44464236	11/8/2019	0
5/12/2018	0	11/9/2018	0	5/12/2019	29.72954514	11/9/2019	0
5/13/2018	0	11/10/2018	0	5/13/2019	6.095899306	11/10/2019	0
5/14/2018	0	11/11/2018	0	5/14/2019	0.99428125	11/11/2019	0
5/15/2018	0	11/12/2018	0	5/15/2019	0.405444444	11/12/2019	0
5/16/2018	0	11/13/2018	0	5/16/2019	6.784045139	11/13/2019	0
5/17/2018	0	11/14/2018	0	5/17/2019	4.535378472	11/14/2019	0
5/18/2018	0	11/15/2018	0	5/18/2019	0	11/15/2019	0
5/19/2018	0	11/16/2018	0	5/19/2019	99.97697917	11/16/2019	0
5/20/2018	0	11/17/2018	0	5/20/2019	81.39127431	11/17/2019	0
5/21/2018	0	11/18/2018	0	5/21/2019	28.82228472	11/18/2019	0
5/22/2018	0	11/19/2018	0	5/22/2019	47.26427083	11/19/2019	43.03191319
5/23/2018	0	11/20/2018	0	5/23/2019	39.72214931	11/20/2019	888.1302014
5/24/2018	0	11/21/2018	3.040350694	5/24/2019	26.22081944	11/21/2019	1199.732146
5/25/2018	0	11/22/2018	3.787364583	5/25/2019	24.84359028	11/22/2019	146.3973472
5/26/2018	0	11/23/2018	0	5/26/2019	22.07696875	11/23/2019	90.79309375
5/27/2018	0	11/24/2018	0	5/27/2019	49.70113194	11/24/2019	68.43302083
5/28/2018	0	11/25/2018	3.190232639	5/28/2019	19.58735417	11/25/2019	57.0751875
5/29/2018	0	11/26/2018	1.637451389	5/29/2019	20.19087847	11/26/2019	62.28382292
5/30/2018	0	11/27/2018	0	5/30/2019	0.862152778	11/27/2019	99.76839583
5/31/2018	0	11/28/2018	0	5/31/2019	0	11/28/2019	1527.094556
6/1/2018	0	11/29/2018	416.200691	6/1/2019	0	11/29/2019	835.0698819
6/2/2018	0	11/30/2018	251.8508681	6/2/2019	0	11/30/2019	170.4863333
6/3/2018	0	12/1/2018	70.60654514	6/3/2019	0	12/1/2019	102.4361667
6/4/2018	0	12/2/2018	56.23948611	6/4/2019	0	12/2/2019	71.3533125
6/5/2018	0	12/3/2018	45.16283681	6/5/2019	0	12/3/2019	65.47344444
6/6/2018	0	12/4/2018	38.55717014	6/6/2019	0	12/4/2019	2453.376885
6/7/2018	0	12/5/2018	258.8949931	6/7/2019	0	12/5/2019	429.4519583
6/8/2018	0	12/6/2018	964.6926111	6/8/2019	0.410041667	12/6/2019	198.6882292
6/9/2018	0	12/7/2018	580.553625	6/9/2019	0.007972222	12/7/2019	167.2166354
6/10/2018	0	12/8/2018	66.01529861	6/10/2019	0	12/8/2019	135.7049479
6/11/2018	0	12/9/2018	48.82400347	6/11/2019	0	12/9/2019	188.8502917
6/12/2018	0	12/10/2018	43.93052778	6/12/2019	0	12/10/2019	101.6833438
6/13/2018	0	12/11/2018	43.84834028	6/13/2019	0	12/11/2019	93.38477083
6/14/2018	0	12/12/2018	39.42424306	6/14/2019	0	12/12/2019	86.82577083
6/15/2018	0	12/13/2018	17.03265625	6/15/2019	0	12/13/2019	83.42998958
6/16/2018	0	12/14/2018	5.937253472	6/16/2019	0	12/14/2019	81.32780208
6/17/2018	0	12/15/2018	8.417104167	6/17/2019	0	12/15/2019	76.78005208
6/18/2018	0	12/16/2018	3.745576389	6/18/2019	0.377010417	12/16/2019	75.32542708
6/19/2018	0	12/17/2018	3.081413194	6/19/2019	0.543302083	12/17/2019	73.45442708
6/20/2018	0	12/18/2018	1.942079861	6/20/2019	2.620840278	12/18/2019	72.63604167
6/21/2018	0	12/19/2018	0.616947917	6/21/2019	0	12/19/2019	73.1963125
6/22/2018	0	12/20/2018	1.216368056	6/22/2019	0	12/20/2019	70.99569792
6/23/2018	0	12/21/2018	0.847868056	6/23/2019	0.011388889	12/21/2019	71.43214583
6/24/2018	0	12/22/2018	3.788454861	6/24/2019	0	12/22/2019	65.51902083
6/25/2018	0	12/23/2018	6.009888889	6/25/2019	0	12/23/2019	1452.056188
6/26/2018	0	12/24/2018	23.34611458	6/26/2019	3.189194444	12/24/2019	1834.299646
6/27/2018	0	12/25/2018	212.6012847	6/27/2019	3.089013889	12/25/2019	461.4055104
6/28/2018	0	12/26/2018	46.16930208	6/28/2019	5.561684028	12/26/2019	2405.076302
6/29/2018	0	12/27/2018	38.08107292	6/29/2019	4.356663194	12/27/2019	359.0375833
6/30/2018	0	12/28/2018	26.28873958	6/30/2019	1.056982639	12/28/2019	201.0815417
		12/29/2018	3.53665625			12/29/2019	148.0875938
		12/30/2018	5.197197917			12/30/2019	129.4505208
		12/31/2018	11.09289931			12/31/2019	111.5490313

Month	PB-CILA (l/s)	PB1-A (m^3/month)	PB1-A (L/s)	PB1-B (m^3/month)	PB1-B (L/s)
Jan-16	542	565884	211.2768817	2268612	847.0026882
Feb-16	514	202554	80.84051724	2365524	944.0948276
Mar-16	487	374022	139.6438172	2507116	936.0498805
Apr-16	551	566874	218.7013889	2275596	877.9305556
May-16	721	483318	180.4502688	2517624	939.9731183
Jun-16	773	849222	327.6319444	2579670	995.2430556
Jul-16	774	919512	343.3064516	2761146	1030.893817
Aug-16	725	1023786	382.2379032	2821986	1053.608871
Sep-16	702	1133586	437.3402778	2362950	911.6319444
Oct-16	782	1302804	486.4112903	2270718	847.7889785
Nov-16	515	858528	331.2222222	1938086	747.7183642
Dec-16	233	156690	58.50134409	2349828	877.3252688
Jan-17	542	360	0.134408602	1023498	382.1303763
Feb-17	0	0	0	1282176	530
Mar-17	297	0	0	1718100	641.4650538
Apr-17	1272	146016	56.33333333	3396492	1310.375
May-17	926	783720	292.6075269	2668086	996.1491935
Jun-17	1093	1696727	654.601466	1937250	747.3958333
Jul-17	987	1718802	641.7271505	2187864	816.8548387
Aug-17	1026	1927325	719.5807198	2015946	752.6680108
Sep-17	1114	1791572	691.1929012	2067174	797.5208333
Oct-17	1077	1968750	735.047043	1984266	740.8400538
Nov-17	1051	2020500	779.5138889	1741914	672.0347222
Dec-17	1017	1769580	660.6854839	2185182	815.8534946
Jan-18	663	1339380	500.0672043	1753920	654.8387097
Feb-18	738	1600920	661.7559524	1786140	738.3184524
Mar-18	517	1535760	573.3870968	1284786	479.6841398
Apr-18	1068	2076840	801.25	1671516	644.875
May-18	1025	1994580	744.6908602	1875114	700.0873656
Jun-18	1063	1252620	483.2638889	2441667	942.0011574
Jul-18	1064	1124460	419.8252688	2782188	1038.75
Aug-18	1027	1096380	409.3413978	2750850	1027.049731
Sep-18	1145	766260	295.625	2966742	1144.576389
Oct-18	888	1103940	412.1639785	2379240	888.3064516
Nov-18	1003	1240920	478.75	2599920	1003.055556
Dec-18	601	966780	360.9543011	1610172	601.1693548
Jan-19	305	835740	312.0295699	916542	342.1975806
Feb-19	0	547560	226.3392857	781956	323.2291667
Mar-19	191	435240	162.5	862002	321.8346774
Apr-19	1308	1033380	398.6805556	2487672	959.75
May-19	775	919440	343.2795699	2138886	798.5685484
Jun-19	1259	671760	259.1666667	3023082	1166.3125
Jul-19	1181	955260	356.6532258	2997270	1119.052419
Aug-19	1138	1223820	456.922043	2781234	1038.393817
Sep-19	1049	1256184	484.6388889	2429802	937.4236111
Oct-19	1079	1194120	445.8333333	2746314	1025.356183
Nov-19	650	887652	342.4583333	1897002	731.8680556
Dec-19	0	8100	3.024193548	0	0

Month	Matadero Pump Station (m^3/month)	Matadero Pump Station (l/s)	Playas Pump Station (m3)	Playas Pump Station (l/s)
Jan-16	485525	181.2742682	275537	102.8737306
Feb-16	463468	184.9728608	242584	96.81673052
Mar-16	484808	181.0065711	258133	96.37582139
Apr-16	497315	191.8653549	246226	94.99459877
May-16	508493	189.849537	244094	91.13425926
Jun-16	529650	204.3402778	235739	90.94868827
Jul-16	542585	202.5780317	253771	94.74723716
Aug-16	523442	195.4308542	260676	97.32526882
Sep-16	490952	189.4104938	229954	88.71682099
Oct-16	552121	206.1383662	250349	93.46960872
Nov-16	524156	202.220679	247212	95.375
Dec-16	569498	212.6261947	273110	101.9675926
Jan-17	507138	189.343638	263182	98.26090203
Feb-17	444171	183.6024306	224734	92.89599868
Mar-17	551383	205.8628286	243389	90.87104241
Apr-17	532735	205.5304784	225216	86.88888889
May-17	572861	213.8817951	248544	92.79569892
Jun-17	595710	229.8263889	240235	92.68325617
Jul-17	575802	214.9798387	253411	94.61282855
Aug-17	565661	211.1936231	250409	93.49201016
Sep-17	596131	229.9888117	246881	95.24729938
Oct-17	630068	235.2404421	256390	95.72505974
Nov-17	594162	229.2291667	239643	92.45486111
Dec-17	575204	214.7565711	248926	92.93832139
Jan-18	560138	209.1315711	245054	91.4926822
Feb-18	461628	190.8184524	228755	94.55811839
Mar-18	510736	190.6869773	252731	94.35894564
Apr-18	495565	191.1902006	240505	92.78742284
May-18	533372	199.1382915	243166	90.78778375
Jun-18	550447	212.3638117	241952	93.34567901
Jul-18	533610	199.2271505	252634	94.32272999
Aug-18	521370	194.6572581	262091	97.8535693
Sep-18	521636	201.2484568	256093	98.80131173
Oct-18	538940	201.2171446	239929	89.5792264
Nov-18	516726	199.3541667	255492	98.56944444
Dec-18	420998	157.1826464	264359	98.70034349
Jan-19	520186	194.2152031	262224	97.90322581
Feb-19	397768	164.4212963	226274	93.53257275
Mar-19	497628	185.7930108	249926	93.31167861
Apr-19	507964	195.9737654	507964	195.9737654
May-19	493117	184.1087963	252709	94.35073178
Jun-19	545731	210.5443673	249095	96.10146605
Jul-19	552614	206.3224313	262220	97.90173238
Aug-19	529229	197.5914725	253526	94.65576464
Sep-19	550008	212.1944444	251525	97.03896605
Oct-19	533203	199.0751941	250556	93.54689367
Nov-19	490982	189.4220679	230828	89.05401235
Dec-19	357473	133.4651284	228334	85.25014934

Month	Rates Entering the Tijuana River (l/s)
August-20	661
September-20	611
October-20	664
November-20	528
December-20	519
January-21	604
Average Flow Rate in 2020 (l/s)	597.8
Average Flow Rate in 2020 (MGD)	13.6
Correction for 2016-2019 (MGD, Based on the Decrease in flows to the International Collector)	3.6
Estimated Untreated Wastewater Flow Rates Entering the Tijuana River (MGD)	10.0