Feasibility Analysis for Project 1: New Tijuana River Diversion and Treatment System in the U.S.

Technical Memorandum

USMCA Mitigation of Contaminated Transboundary Flows Project

Prepared for:

EPA

United States Environmental Protection Agency
Office of Wastewater Management
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17 September 2021
Final Report

Work Performed Under EPA Contract No. 68HERH19D0033
Task Order No. 53

Version #	Stage	Description of changes	Changes made by	Date completed
1	Initial draft	Deliberative draft; copy editing and formatting	PG	1/14/21
2	Draft	EPA edits and comments on initial draft delivered 1/14/21	EPA	1/29/21
3	Draft	Addressing EPA comments; further copy editing and formatting	PG	2/23/21
4	Final	Addressing EPA comments	PG	3/22/21
5	Final, revised	Revisions to sub-project 1 design and location; addition of 60 MGD design features for sub-projects 1 and 3	PG	9/17/21

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

AACE International	Association for the Advancement of Cost Engineering
APTP	Advanced Primary Treatment Plant
BOD	biochemical oxygen demand
BOD_5	amount of oxygen consumed by microorganisms within five days
CBP	United States Customs and Border Protection
CMDF	cloth media disk filter
EID	Environmental Impact Document
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FEMA	Federal Emergency Management Agency
fps	feet per second
$gal/ft^2/min$	gallons per square foot per minute
IBWC	International Boundary and Water Commission
ITP	South Bay International Wastewater Treatment Plant
$L/m^2/min$	liters per square meter per minute
MGD	million gallons per day
mg/L	milligrams per liter
µm	micrometer
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PB-CILA	CILA Pump Station
SAB	San Antonio de los Buenos
SABTP	San Antonio de los Buenos Wastewater Treatment Plant
SBOO	South Bay Ocean Outfall
SCCWRP	Southern California Coastal Water Research Project
TSS	total suspended solids
USMCA	United States–Mexico–Canada Agreement

EXECUTIVE SUMMARY

PG Environmental conducted a feasibility analysis of Project 1, "New Tijuana River Diversion and Treatment System in the U.S.," one of 10 proposed projects identified to mitigate contaminated transboundary flows in the Tijuana River area and neighboring coastal areas in the U.S. under the United States–Mexico–Canada Agreement. This feasibility analysis report includes an analysis of the technical, economic, and environmental feasibility of the project and builds on past studies and consultation with engaged stakeholders using available data.

The project involves constructing a new Tijuana River diversion system to intercept river water and route it to a new Advanced Primary Treatment Plant (APTP) at the South Bay International Wastewater Treatment Plant. This system and the APTP would divert and treat river water during wet-weather flow conditions, helping protect the estuary and coastal communities. PG evaluated three individual sub-projects, two of which were proposed in a report developed by HDR:

- **A U.S.-side river diversion system to pump a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD (sub-project 1)** from the Tijuana River to the new storage basin (sub-project 2) or directly to the APTP (sub-project 3). This sub-project, proposed as part of the 2020 HDR report (HDR 2020), would increase the amount of river water diverted from the Tijuana River during wet-weather flow conditions and would divert dry-weather transboundary flows if the dry-weather diversion system in Mexico (known as the PB-CILA diversion) fails. Designing the diversion system will be very challenging due to the varying flow rates in the river, as well as the loadings of sediment and trash in the river water. The estimated capital costs of the sub-project are $17.2 million, $26.7 million, $37.8 million, and $41.2 million for the 35 MGD, 60 MGD, 100 MGD, and 163 MGD diversions, respectively. The estimated 40-year life cycle costs are $28 million, $41 million, $57 million, and $63 million for the 35 MGD, 60 MGD, 100 MGD, and 163 MGD diversions, respectively.
- **An 82-million-gallon storage basin (sub-project 2)** to equalize flow into the new APTP and provide sediment removal, proposed as part of Alternative D in the 2020 HDR report (HDR 2020). This sub-project was found to be impractical, as flow equalization and preliminary sediment removal are not necessary for operation of the APTP (sub-project 3). In addition, the proposed location of the storage basin in the 100-year floodplain and Federal Emergency Management Agency regulatory floodway complicates project design, permitting, and operation; the basin will need an additional pump station and may need minimal aeration to control odors, which will reduce settling efficiency. Although the basin will be the same volume for each river diversion and APTP design peak daily flow rate, the necessary pumping capacity varies. The estimated capital costs for the basin are $71.8 million, $73.7 million, $75.0 million, and $77.3 million for the 35 MGD, 60 MGD, 100 MGD, and 163 MGD designs, respectively. The estimated 40-year life cycle costs are $97 million, $111 million, $116 million, and $130 million for the 35 MGD, 60 MGD, 100 MGD, and 163 MGD designs, respectively.
- **An APTP designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD (sub-project 3)** to treat the diverted river flow (from sub-project 1). This sub-project, proposed by PG, is expected to produce effluent that consistently satisfies the anticipated National Pollutant Discharge Elimination System effluent limits for the proposed treatment process. The estimated capital costs of the sub-project are $72.9 million, $92.4 million, $160 million, and $203 million for the 35 MGD, 60 MGD, 100 MGD, and 163 MGD flows, respectively. The estimated 40-year life cycle costs are $280 million, $390 million, $496

million, and $640 million for the 35 MGD, 60 MGD, 100 MGD, and 163 MGD flows, respectively.

Refer to Table 3-1 in Section 3.1 of this report for estimates of the water quality impacts that Project 1 could provide for the Tijuana River. Section 3.1 also discusses relevant modeling results from the recent Scripps analysis (Feddersen et al. 2020).

Note that more information on background data analyzed and referenced in this document can be found in PG's *Baseline Conditions Summary: Technical Document,* available from EPA.

1. INTRODUCTION

Under EPA Contract No. 68HERH19D0033, Task Order No. 53, PG Environmental conducted a detailed feasibility analysis of 10 proposed projects to mitigate contaminated transboundary flows that cause impacts in the Tijuana River area and neighboring coastal areas in the U.S. Each feasibility analysis considered an estimate of capital costs; an estimate of design, project, and construction management costs; an estimate of operation and maintenance (O&M) costs; an estimate of total life cycle costs; regulatory, engineering, and any possible implementation issues; and social and environmental impacts.

This feasibility analysis specifically addresses Project 1: "New Tijuana River Diversion and Treatment System in the U.S." During the analysis, PG consulted with stakeholders and reviewed previous work including water quality management strategies presented in the HDR report (HDR 2020). PG also performed independent calculations and analysis to evaluate project feasibility.

For this feasibility analysis, PG also used existing literature for the main channel flow data, sediment characteristics, and water quality characteristics, as identified below.

- **Flow data.** PG used Tijuana flow data from the U.S. International Boundary and Water Commission (IBWC) flow gauge at the international border.
- **Sediment characteristics.** In the main river channel, sediment characteristics were estimated using information on flow sources from CESPT, preliminary correlations derived from wet-weather monitoring data from San Diego State University and Southern California Coastal Water Research Project (SCCWRP), and the U.S. Army Corps of Engineers (USACE) *Phase 2 Hydrology, Floodplain, and Sediment Transport Report Final* (USACE 2020).
- **Water quality data.** In the main river channel and at the CILA Pump Station (PB-CILA), water quality data were obtained primarily from the IBWC Water Quality Study (IBWC 2020).

The PG document *Baseline Conditions Summary: Technical Document,* prepared for EPA under the United States–Mexico–Canada Agreement (USMCA) Mitigation of Contaminated Transboundary Flows Project, contains more information on background data analyzed, U.S. and Mexico entities, infrastructure and its operating conditions, water bodies, affected areas, other studies and reports, and dry- and wet-weather flow conditions referenced in this document.

This report has been revised and finalized based on comments and discussions with EPA, on new information presented to PG, and has been updated to include information on a 60 MGD river diversion and Advanced Primary Treatment Plant (APTP) in the U.S. Consistent with the task order scope, PG will work with EPA to develop and analyze several infrastructure alternatives to mitigate the transboundary wastewater and stormwater flows. Each alternative will include a grouping of one or more projects evaluated in the feasibility analyses, scaled if necessary. The alternatives include groupings of one or more projects evaluated in the feasibility analyses, scaled if necessary, and will be presented to EPA in the Water Infrastructure Alternatives Analysis report.

1.1 Project Purpose

As stormwater runoff flows through the Tijuana River watershed, it is contaminated with untreated wastewater, sediment, and other pollutants. During and after wet-weather events, transboundary flows in the Tijuana River enter the U.S. and contribute to water quality problems in the Tijuana

River estuary and coastal communities in southern San Diego County. The primary objective of Project 1 is to divert and treat river water during wet-weather flow conditions to protect the estuary and coastal communities. A secondary objective is to divert and treat dry-weather transboundary flows if the dry-weather diversion system in Mexico (known as the PB-CILA diversion) fails.

1.2 Current Conditions

This section summarizes the current conditions relevant to Project 1. Refer to the *Baseline Conditions Summary: Technical Document* for a more detailed discussion of the current conditions in the Tijuana River Watershed.

The Tijuana River flows from Mexico into the U.S. about 1.5 miles upstream from the Tijuana Estuary, then drains into the Pacific Ocean. When the PB-CILA river diversion system is functioning properly, all dry-weather flow in the Tijuana River is diverted before crossing the border. In wet weather, the river diversion system in Mexico is overwhelmed by increased flow rates in the river, resulting in transboundary flows that affect the estuary and beaches in San Diego County. Depending on the amount of precipitation in the watershed, these wet-weather transboundary flows can bring billions of gallons of water laden with untreated wastewater, sediment, and trash across the border from Mexico. Refer to the *Baseline Conditions Summary: Technical Document* for more detailed discussion and analysis about the Tijuana River under dry- and wet-weather conditions.

IBWC is substantially upgrading the PB-CILA intake structure, screens, trash removal facilities, pump station, and force main. The upgraded pump station will have chopper-type pumps that function in the presence of significant inlet debris. This is expected to make the station's performance more consistent, reducing the number of days per year on which transboundary flows occur in the Tijuana River. However, for the Project 1 feasibility analysis, PG has assumed that PB-CILA will operate and perform as it did during the 2016–2019 timeframe. (Section 2.3.6 discusses Project 1's ability to operate when the PB-CILA river diversion is nonoperational in dry weather.)

The South Bay International Wastewater Treatment Plant (ITP) is a little more than a mile west of where the Tijuana River enters the U.S., about one-half mile south of where Dairy Mart Road crosses over the Tijuana River. Existing facilities at the ITP include preliminary, primary, and secondary treatment processes designed to treat an average daily flow of 25 MGD of wastewater from the International Collector in Mexico. A graded plot in the north area of the ITP, currently vacant, is the proposed location for the new APTP (see Section 2 below for an image of the proposed location).

1.3 Major Project Elements Considered

Project 1 involves construction of a new Tijuana River diversion system to intercept river water and route it to a new APTP in the north area of the ITP. It also considers an intermediate step, involving a new storage basin. Thus, PG assessed the technical feasibility of the following individual sub-projects:

1. A U.S.-side river diversion system to pump a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD from the Tijuana River to the new storage basin and/or APTP.

2. An 82-million-gallon storage basin to equalize flow into the new APTP and provide sediment removal.

3. An APTP designed for a peak daily flow rate of 35 MGD, 60 MGD, 100 MGD, or 163 MGD constructed on the property of the ITP.

2. DESIGN INFORMATION

Sections 2.1 through 2.3 describe the design features of each of the three proposed sub-projects.

Like PB-CILA, the new river diversion and treatment facilities will not operate during all wet-weather flow conditions. Rather, the diversion will shut off when flow in the river reaches a certain threshold to avoid unnecessary O&M expenditures that do not result in significant environmental benefit. For each proposed peak flow capacity (35 MGD, 60 MGD, 100 MGD, and 163 MGD), PG determined the shutoff threshold by analyzing the total BOD_5 removed from the river under different scenarios. As can be seen in Figures 2-1, 2-2, 2-3, and 2-4, below, the estimated BOD_5 removal levels off as the shutoff threshold increases. For the 35 MGD design, continuing to operate until flow in the river reaches 60 MGD[1] provides about 10% more BOD_5 removal than if the diversion were shut down when flow in the river exceeds 35 MGD (refer to Figure 2-1). For the 60 MGD design, continuing to operate until flow in the river reaches 120 MGD provides about 10% more BOD_5 removal than if the diversion were shut down when flow in the river exceeds 120 MGD (refer to Figure 2-2). For the 100 MGD and 163 MGD peak daily design flow rates, very little additional BOD_5 removal is obtained from continuing to operate when flow in the river exceeds 100 MGD and 163 MGD, respectively (refer to Figures 2-3 and 2-4). Therefore, the 35 MGD design will stop operating when flow in the Tijuana River exceeds 60 MGD, the 60 MGD design will stop operating when flow in the river exceeds 120 MGD, the 100 MGD design will stop operating when flow in the river exceeds 100 MGD, and the 163 MGD design will stop operating when flow in the river exceeds 163 MGD. Implementing the shutoff thresholds will require real-time flow gauging.

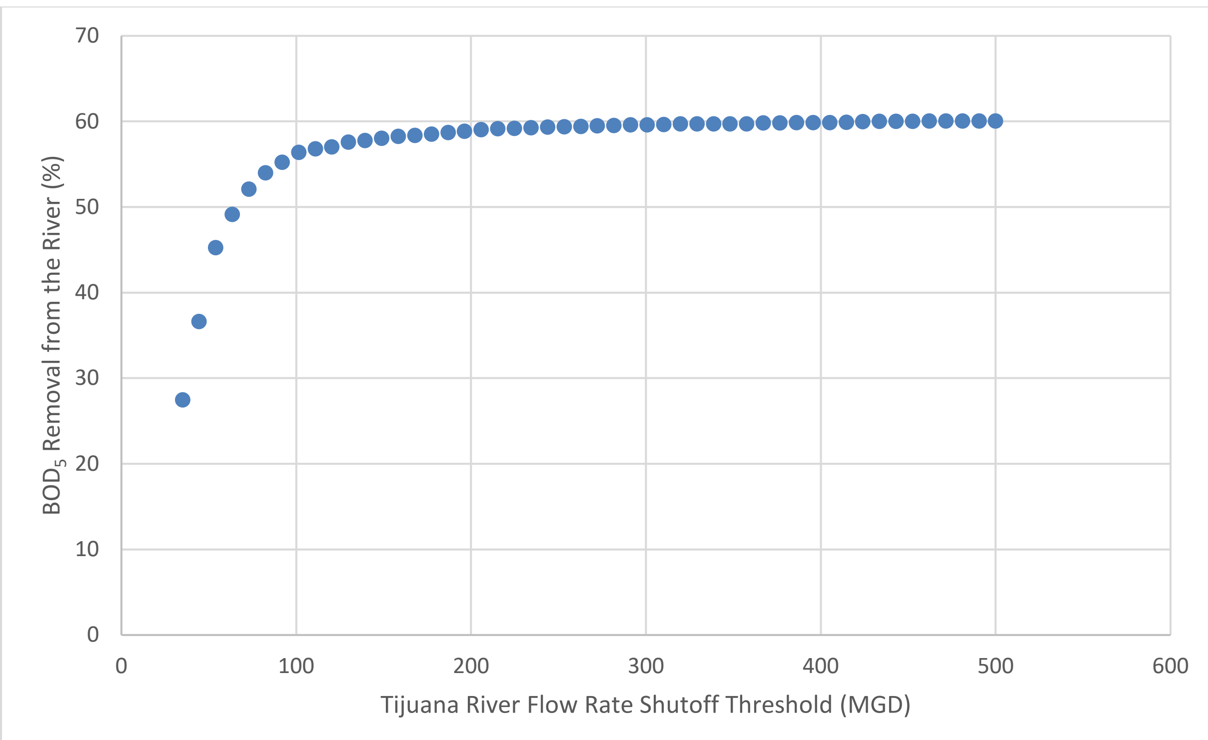


Figure 2-1. Tijuana River BOD_5 Removal at Varying Shutoff Thresholds: 35 MGD Design

[1] Shutoff threshold flow rates are instantaneous flow rates rather than average daily flow rates. Therefore, implementing the shutoff thresholds will require real-time flow gauging.

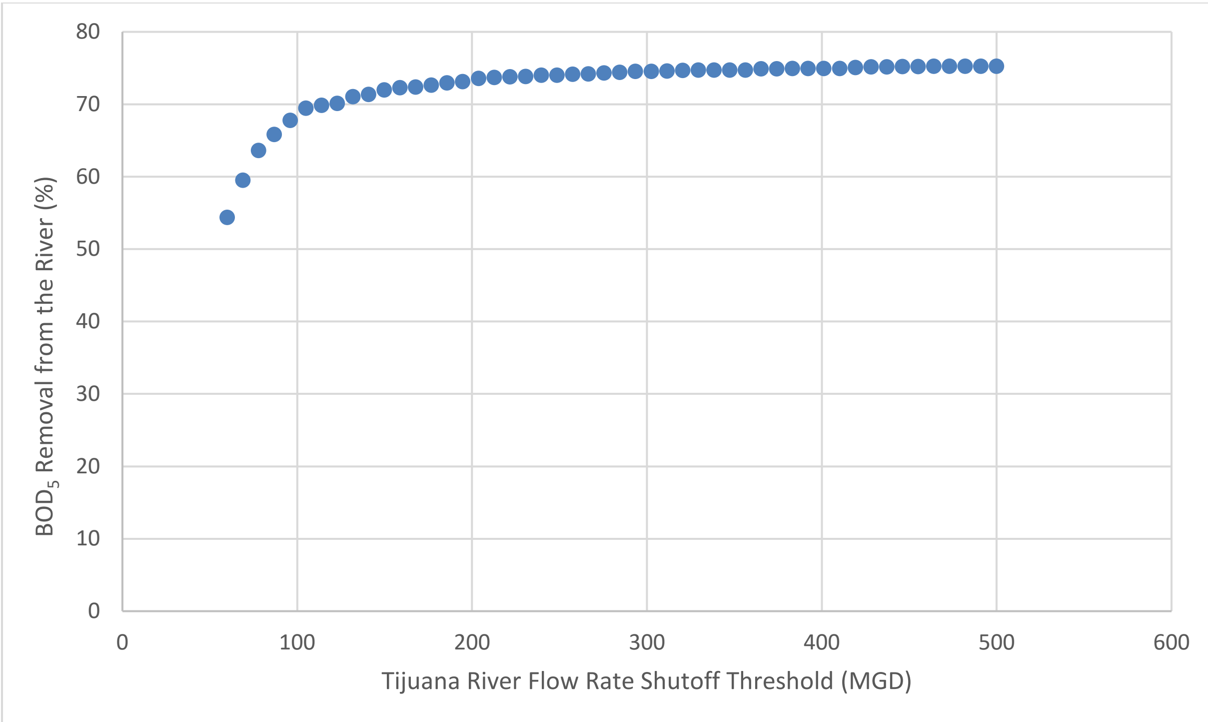


Figure 2-2. Tijuana River BOD_5 Removal at Varying Shutoff Thresholds: 60 MGD Design

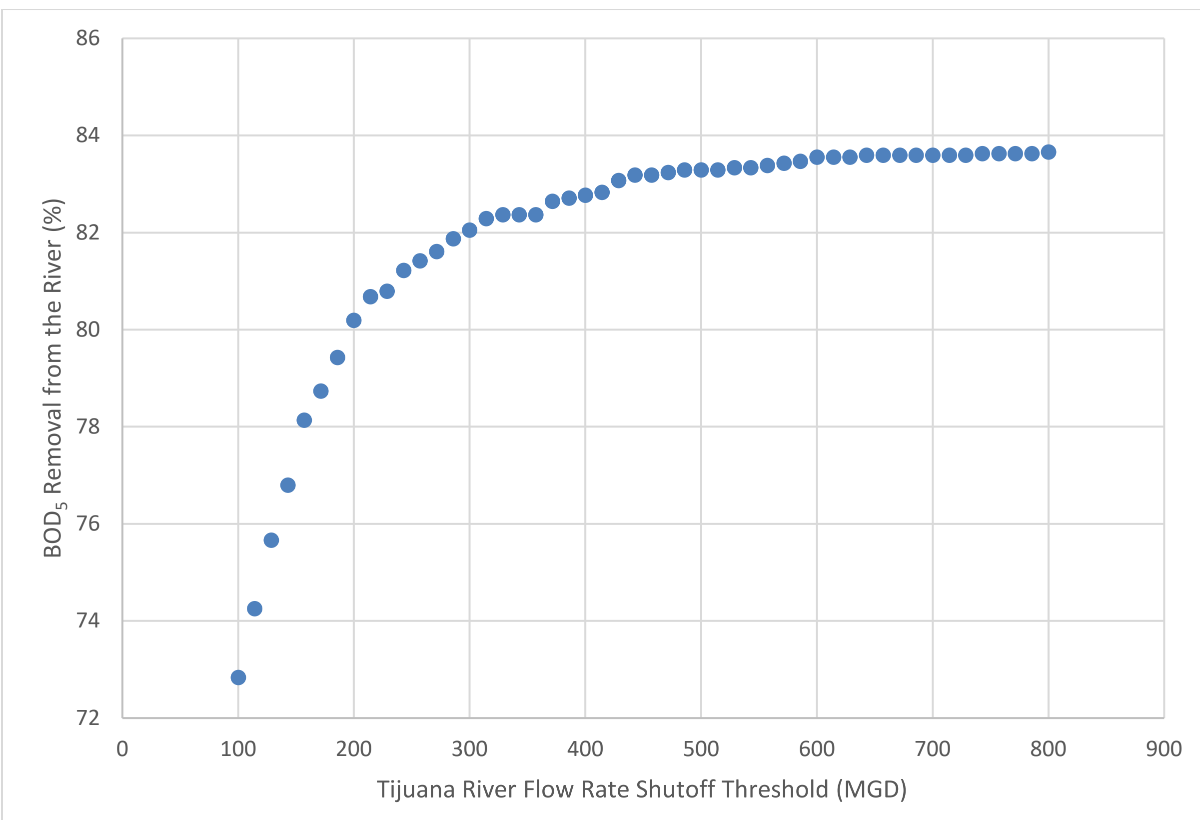


Figure 2-3. Tijuana River BOD_5 Removal at Varying Shutoff Thresholds: 100 MGD Design

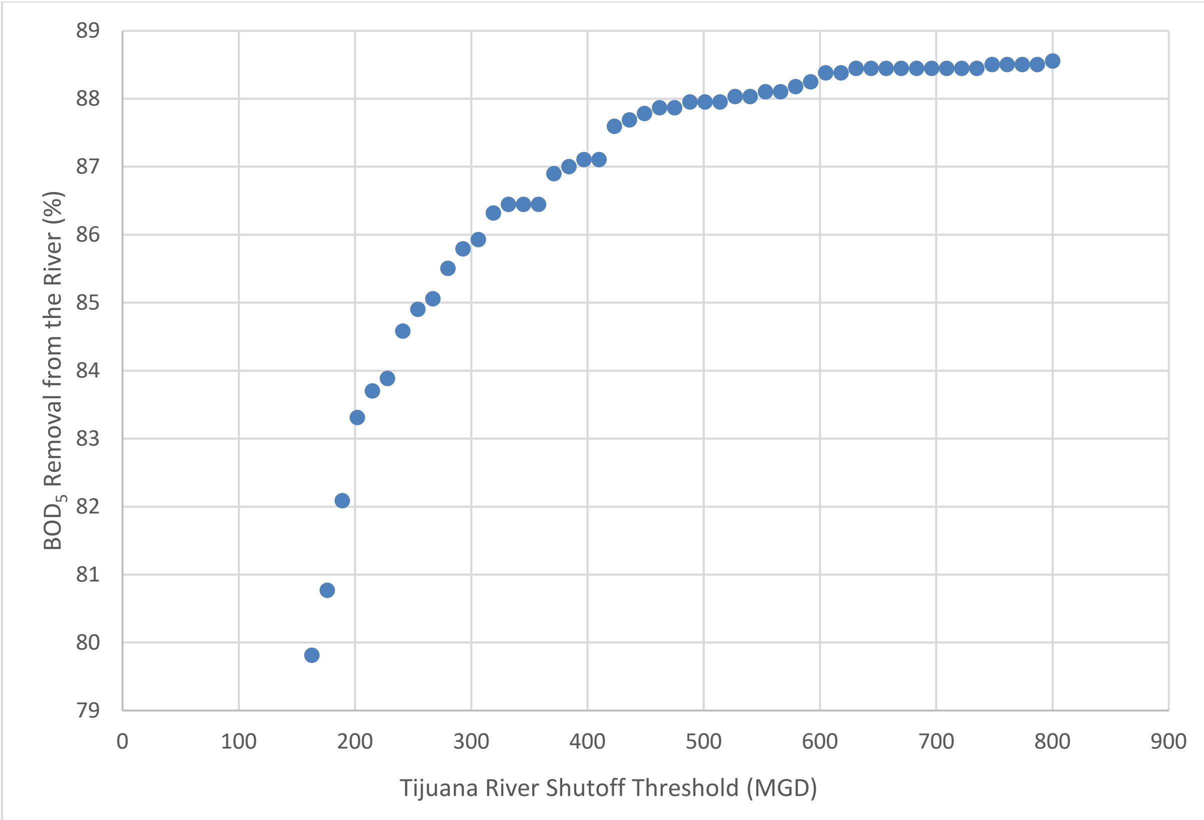


Figure 2-4. Tijuana River BOD_5 Removal at Varying Shutoff Thresholds: 163 MGD Design

Figure 2-5, on the next page, provides an overview of the proposed locations and known elevations for the three sub-projects relative to the Federal Emergency Management Agency (FEMA) 100-year and 500-year floodplains.

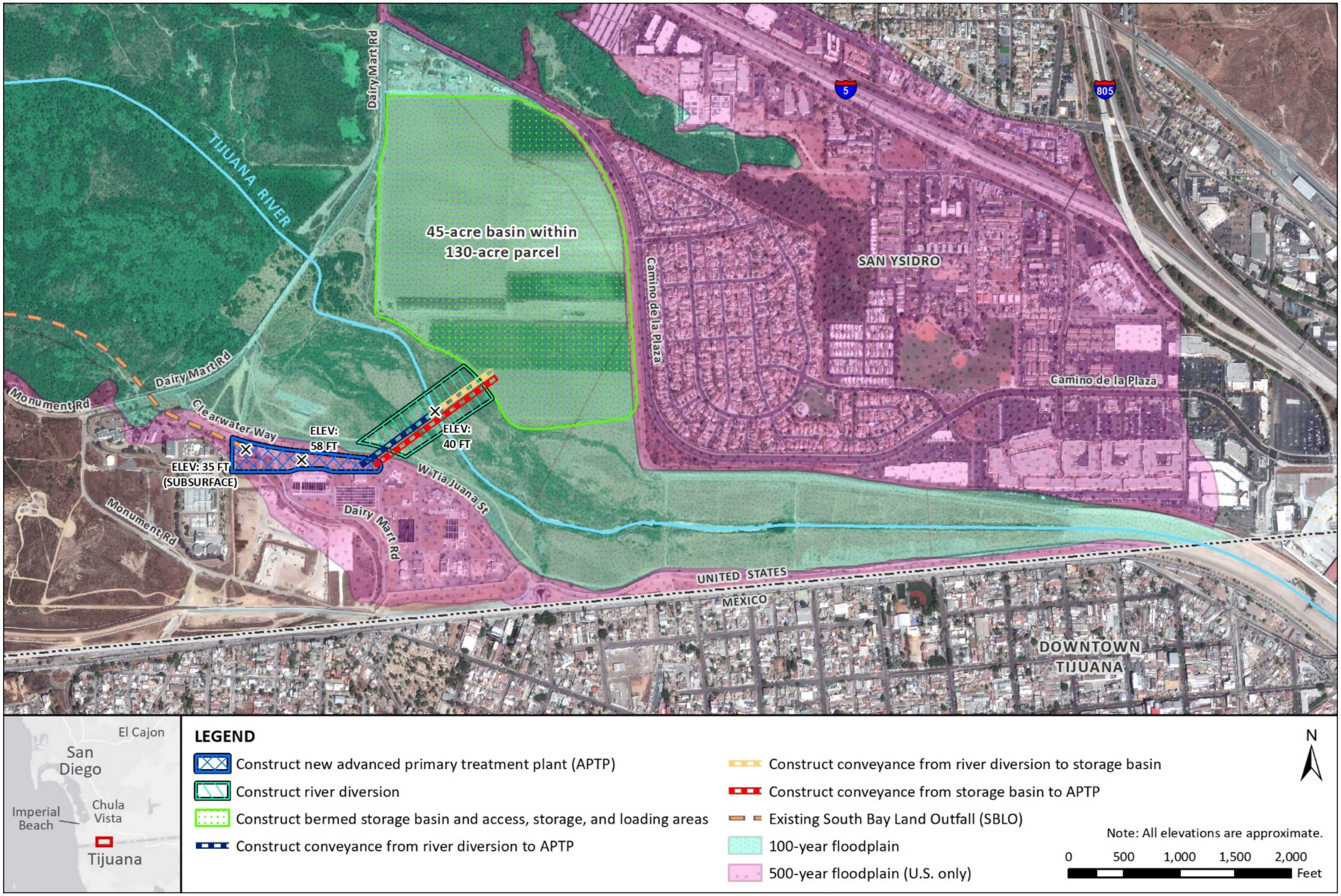


Figure 2-5. Locations of Proposed and Existing Project 1 Features Relative to FEMA Floodplains

2.1 Sub-Project 1: Tijuana River Diversion System

2.1.1 Design Features

The proposed location for the river intake structure is about 4,000 feet downstream from where the Tijuana River crosses the U.S.-Mexico border. This is a revised location that has been proposed due to concerns about scouring at the previously proposed intake location near Dairy Mart Road, where the channel narrows and flow velocities increase. The previously proposed location is also downstream from where the river's flow path sometimes bifurcates depending on flow rate. Figure 2-5 shows the new proposed location for the diversion system.

To prevent scouring of the riverbed and to ensure that no flows evade the intake structure, approximately 4 acres of the river channel will be armored with shotcrete in the vicinity of the intake structure. The armored section of the riverbed will be graded to direct flow into a concrete channel at the south bank of the river. To minimize trash and sediment in the influent, the intake channel will be oriented facing northwest such that flow must turn back upstream before entering.

The intake channel will discharge to a pump intake pool that is several feet deep. From the pool, internal lift screw pumps (installed at a 38-degree incline) will move flow up about 30 feet in elevation into an elevated trough in the north area of the ITP. The elevated trough will be roughly 5–10 feet above ground level at the ITP. The trough will feed an RCP gravity pipe, suspended via trestle, that flows into the APTP.

Table 2-1 presents the proposed pumping and conveyance configurations for the river diversion system at each of the design peak flow rate options.

Table 2-1. Proposed Diversion System Configurations for Each Peak Flow Rate

Peak Flow Rate (MGD)	Pumping Equipment	RCP Gravity Pipe to APTP Diameter(s) (Inches)
35	Two 84-inch internal lift screw pumps	48
60	Three 96-inch internal lift screw pumps	66
100	Four 108-inch internal lift screw pumps	84
163	Four 120-inch internal lift screw pumps	108

2.1.2 Engineering Issues

The feasibility analysis identified challenges involving the diversion system's ability to effectively capture all transboundary flows under low-flow conditions (when the river sometimes changes flow paths), to prevent scouring in the riverbed, and to avoid being inundated with trash and debris. The system's features, as described above, have been significantly revised since previous versions of this memorandum to address these challenges. Some of the engineering issues discussed in previous versions are mitigated if not entirely remedied by the alternate location and revised conceptual design for the diversion system. With the entire width of the main channel armored with shotcrete, riverbed scouring will not be a concern as flows change direction and enter the diversion system. Scouring or undercutting at the points where flow transitions between shotcrete and the natural river bottom will be mitigated by stone rip-rap aprons. Additionally, the new location is upstream from where the river path sometimes bifurcates, meaning that fugitive flows are no longer a predominant area of concern.

New data about potential sediment loadings in the river no longer indicate the necessity for extensive sediment removal equipment and O&M costs at the diversion structure. In addition, the internal lift screw pumps used in the revised design can readily pump water containing suspended sediments, debris, and small trash without incurring chronic damage. Therefore, PG anticipates that additional pretreatment is not necessary at the diversion; pretreatment will be provided at the APTP with influent screening and sediment removal. Large trash will be kept out of the intake channel because it will be oriented such that flows must turn about 135 degrees to the left as they enter the channel. If needed, a horizontal bar screen can be installed at the mouth of the intake channel to provide additional protection from large trash and debris.

Screw pumps must feed a gravity conveyance, rather than a pressurized force main. Therefore, to provide enough static head for the diverted river water to flow into and through the APTP, the gravity pipe between the pumps and the APTP must be elevated from ground level at the ITP using a trestle structure.

Due to the complexity of designing a river diversion system, PG advises using a physical model as part of the final design process. The model may reveal additional design challenges related to the topography of the river channel, hydrology of the river and proposed diversion system, or other factors.

2.1.3 Implementation and Regulatory Issues

Any infrastructure built in and adjacent to the river must be approved by USACE. Channel alterations, if "substantial," would require a California Lake and Streambed Alteration Agreement from the California Department of Fish and Wildlife, a process that could result in scope modifications late in the planning process. The project also must be consistent with current City of San Diego and/or San Diego County zoning requirements. All design parameters for the intake structure must satisfy State of California wastewater pumping and conveyance design criteria. Due to the immediate proximity to the border, all proposed intake and treatment infrastructure will likely need review and approval from U.S. Customs and Border Protection (CBP). Border security concerns will also need to be addressed during construction.

Reduced river flows and infiltration to groundwater in downstream areas due to the river diversion could affect riparian vegetation and habitats in the Tijuana River Estuary, potentially including habitat of protected species. Further analyses, such as an updated groundwater balance, and consultation with the U.S. Fish and Wildlife Service are necessary to assess this potential impact and determine whether compensatory mitigation (e.g., offsite habitat restoration) could be required at the government's expense. This will be addressed during preparation of the Environmental Impact Statement (EIS).

Due to the multitude of necessary reviews and approvals associated with design and construction, the project will likely take several years. Additionally, construction of the intake structure may require temporary diversion of the Tijuana River, which will further lengthen the design and construction phases.

2.2 Sub-Project 2: 82-Million-Gallon Storage Basin

2.2.1 Design Features

This sub-project consists of constructing an 82-million-gallon storage basin to equalize flow rates into the APTP and allow suspended sediment to settle. In terms of location and storage volume, this concept is based on the basin proposed as part of Alternative D in the HDR report (HDR 2020). The proposed location for the storage basin is an agricultural plot of about 130 acres on the north side of the river immediately west of Camino de la Plaza. The basin will be about 1,600 feet long, 1,200 feet wide, and about 6 feet deep. At these dimensions, about half of the proposed parcel will remain available for access and dredging area. The basin will be unlined, and riprap will be installed around the perimeter embankment to minimize bank erosion. To optimize residence time and dredging operations, the basin will be divided into three zones separated by dikes or barriers. Flow from the Tijuana River will be pumped from the river intake structure (sub-project 1) into the basin. Effluent flow from the basin will be pumped across the Tijuana River channel to the headworks of the APTP. Therefore, constructing the storage basin will necessitate additional (effluent) pumping facilities. The necessary pumping and conveyance capacity will depend on which APTP peak design flow rate is implemented.

Table 2-2 presents the estimated annual sediment accumulation for the storage basin at each of the proposed peak flow rates. The influent TSS[2] varies based on the flow rate in the river. PG estimated the sediment concentrations in transboundary river flows using information on flow sources from CESPT, preliminary correlations derived from wet-weather monitoring data from San Diego State University and Southern California Coastal Water Research Project, and the USACE (2020) Phase 2 Study (refer to the *Baseline Conditions Summary: Technical Document* for details). PG assumed 70% removal of sediment in the storage basin and estimated the specific gravity of wet sediment to be 1.37, assumptions that are consistent with industry standards. This results in dry sediment accumulation of 1,500 to 4,500 tons each year, which is equivalent to filling 0.6% to 1.9% of the detention basin annually (Table 2-2).

Table 2-2. Estimated Annual Sediment Accumulation in the Storage Basin

Peak Influent Flow Rate (MGD)	Average Influent TSS (sediment) Concentration (mg/L)	Average Annual Suspended Sediment Entering the Storage Basin (Tons)	Average Annual Sediment Accumulation (Tons)	Average Percent of 82-Million-Gallon Volume Filled with Sediment Annually
35	300	2,100	1,500	0.6%
60	350	4,700	3,300	1.4%
100	350	5,100	3,600	1.5%
163	350	6,400	4,500	1.9%

Note that including the 82-million-gallon storage basin in the Project 1 design will slightly increase the overall sediment removal achieved by Project 1. Without the basin, sediment will instead be removed during preliminary and advanced primary treatment at the APTP; refer to Sections 2.3.2 and 3.1 for more detail. Inclusion of the storage basin is not expected to affect the overall trash removal achieved by Project 1. The river diversion system will be designed to prevent large trash and debris from entering the intake channel, while smaller trash and debris will be removed by screening at the APTP headworks; refer to Sections 2.1.1, 2.1.2, and 3.2 for more detail.

2.2.2 Engineering Issues

Section 2.1.2 above discusses the anticipated TSS concentrations in the Tijuana River during wet weather; however, limited data are currently available wet-weather flow data in the Tijuana River. Therefore, before any wet-weather flow diversion or treatment systems are designed, more monitoring data are needed. Based on the information in Table 2-2, the estimated tonnage of sediment accumulation in the basin for the various peak flow rates will necessitate sediment

[2] Throughout this report TSS refers to total suspended solids, and is used to represent the concentration of sediment suspended in water.

removal every 10 to 30 years. The estimated cost of disposal for sediment removed from the basin is very high in southern California (refer to Section 4 for details).

Compared to building just the river diversion and APTP, including the 82-million-gallon storage basin in Project 1 will necessitate an additional pump station to move water from the basin, across the Tijuana River main channel and floodway, and into the APTP. The additional pump station adds to the overall O&M demands of Project 1.

Due to the relatively low BOD concentrations in the river water (compared to raw sewage), odors produced by the basin are not expected to be as significant as they would be for a wastewater lagoon. However, because the basin will be very close to a residential area, minimal aeration in it may be needed to control odors, which will reduce settling efficiency and increase O&M costs.

See Section 2.3.7 for estimates of the levels of staffing necessary to operate and maintain Project 1.

As with sub-project 1, compatibility with existing facilities/operations at the ITP does not appear to pose significant barriers to implementation, based on information PG reviewed.

2.2.3 Implementation and Regulatory Issues

Any infrastructure built in and adjacent to the river must be approved by USACE. The project also must be consistent with current City of San Diego and/or San Diego County zoning requirements. Obtaining concurrence from the California Coastal Commission on a coastal zone consistency determination for the storage basin, pursuant to the California Coastal Management Program, may be challenging due to potential adverse effects on coastal resources (potentially including land use, floodplain management, aesthetics, and air quality). All design parameters for the storage basin must satisfy State of California wastewater pumping, conveyance, and treatment design criteria. Due to the immediate proximity to the border, all proposed intake and treatment infrastructure likely will also need review and approval from CBP. Border security concerns will also need to be addressed during construction.

The proposed storage basin, because it would occupy a substantial volume within the 100-year floodplain and FEMA regulatory floodway, could have difficulty obtaining a “No Rise” certification and would trigger various additional design, notification, and permitting requirements per the County of San Diego Flood Damage Prevention Ordinance for construction in a regulatory floodway. Additionally, since the basin will be in the floodway and may require onsite operation during storm events, safety risks may pose an additional approval obstacle and may necessitate design modifications.

Due to the multitude of necessary reviews and approvals associated with design and construction, the project will likely take several years. Additionally, the storage basin is expected to be met with public opposition due to its proximity to the residential area immediately across Camino de la Plaza. Further, there may be challenges associated with land acquisition and zoning at the proposed location. These challenges could further lengthen the project implementation schedule for Project 1 if the storage basin is included in the final design.

2.3 Sub-Project 3: New APTP

2.3.1 Design Features: Overview

The new treatment plant will be designed to handle average daily flow rates from 0 to 35 MGD, 0 to 60 MGD, 0 to 100 MGD, or 0 to 163 MGD from the new river diversion system (sub-project 1) and will operate independently of the existing ITP facilities. This new facility will be located to the north of the ITP's existing secondary reactors and blower building, as shown in Figure 2-5.

PG performed a hydraulic analysis of the river, which determined that transboundary flows occur an average of about 153 days per year. Table 2-3 lists anticipated flow rates for varying wet-weather conditions. The APTP must be designed carefully so that it can handle these widely varying flow rates. If the APTP is constructed with an 82-million-gallon storage basin (sub-project 2) to equalize influent flow rates and allow suspended sediment to settle, flow rates into the APTP will be more uniform and influent sediment loads will be significantly reduced.

Table 2-3. Estimated Volume of River Water Treated for Various Design Peak Daily Flow Rates

Design Peak Flow Rate (MGD)	Range of Tijuana River Flow Rate (MGD)	Approximate Average Flow Rate into APTP (MGD)	Number of Days Flow Rate Occurs Annually	Estimated Total Volume of River Water Treated Annually (Million Gallons)	Average Daily Flow Rate When Operating (MGD)
35	0 < Q < 10	2	51	102	16
	10 < Q < 20	14	10	140	
	20 < Q < 35	26	19	494	
	35 < Q < 50	35	17	595	
	50 < Q < 60	35	10	350	
	Total	—	**107**	**1,681**	
60	0 < Q < 10	2	51	102	26
	10 < Q < 20	14	10	140	
	20 < Q < 35	26	19	494	
	35 < Q < 50	43	17	731	
	50 < Q < 60	54	10	540	
	60 < Q < 120	60	20	1,200	
	Total	—	**127**	**3207**	
100	0 < Q < 10	2	51	102	28
	10 < Q < 20	14	10	140	
	20 < Q < 35	26	19	494	
	35 < Q < 50	43	17	731	
	50 < Q < 60	54	10	540	
	60 < Q < 100	78	19	1482	
	Total	—	**126**	**3,489**	
163	0 < Q < 10	2	51	102	33
	10 < Q < 20	14	10	140	
	20 < Q < 35	26	19	494	
	35 < Q < 50	43	17	731	
	50 < Q < 60	54	10	540	
	60 < Q < 100	78	19	1482	
	100 < Q < 163	130	7	910	
	Total	—	**133**	**4,399**	

The new APTP will have the following major components: screening, aerated sediment removal, sediment dewatering and truck loading equipment, a ballasted flocculation process, sludge storage, sludge thickening, sludge dewatering, a sludge conveyor, sludge truck loading facilities, and sludge pumping facilities (see Figure 2-6). The Regional Water Quality Control Board has not finalized the new plant's effluent limits, but (based on discussions with the Board) PG has approximated the following limits:

Effluent TSS	60 mg/L (average) for influent TSS < 240 mg/L
Effluent TSS % removal	75% (average) for influent TSS ≥ 240 mg/L
Effluent pH	6.0 to 9.0

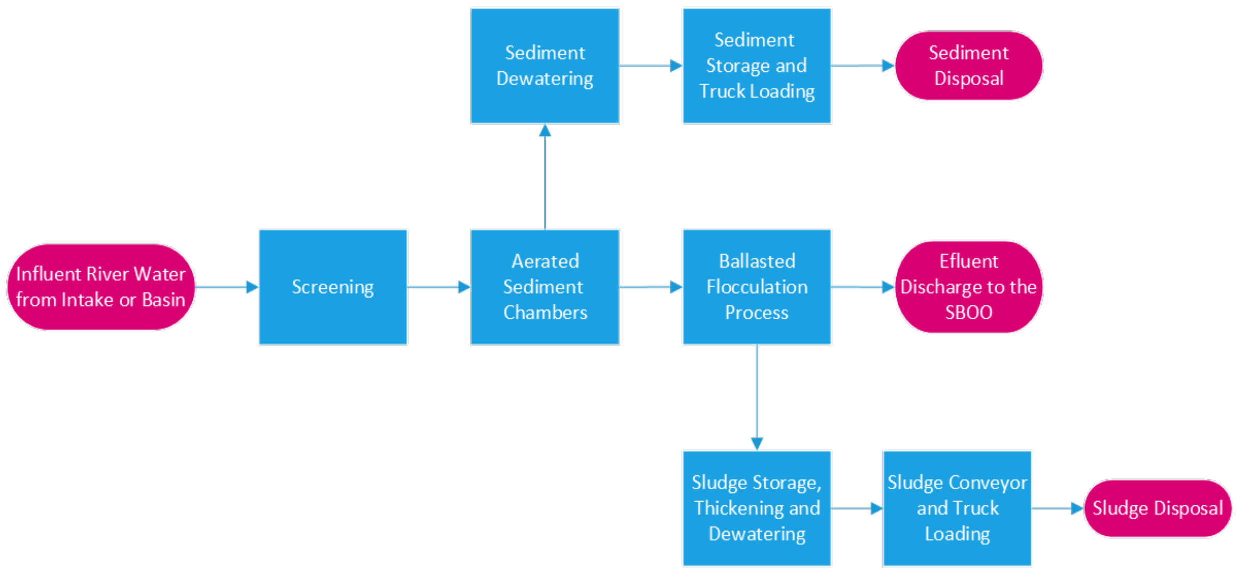


Figure 2-6. Proposed APTP Flow Diagram

2.3.2 Design Features: Preliminary Treatment

Preliminary treatment will be used to remove large debris and sediment from the influent. Preliminary wastewater treatment processes often take place inside to provide reliable odor control. However, since the river water is anticipated to have influent BOD_5 concentrations of 10 to 60 mg/L most of the time, odor control facilities are not expected to be necessary at the headworks. Automatically cleaned bar screens (with manually cleaned backup screens) will be used to remove large debris that enters the APTP. Screening removes gross pollutants from the waste stream to protect downstream operations and equipment from damage. The spacing between bars in the mechanically cleaned screens will likely need to be 0.25 to 0.5 inches. Below are the proposed configurations of bar screens for each of the peak flow rate options, developed to create adequate redundancy to maximize service lives and provide backup when individual units need maintenance.

35 MGD	Three screens, each with a peak flow capacity of 20 MGD
60 MGD	Four screens, each with a peak flow capacity of 25 MGD
100 MGD	Four screens, each with a peak flow capacity of 35 MGD

163 MGD Five screens, each with a peak flow capacity of 45 MGD

Following initial screening of the influent river water, flow will move into the sediment removal stage of treatment. Below are the proposed configurations of aerated sediment removal chambers for each of the peak flow rate options, developed to create adequate redundancy to maximize service lives and provide backup when individual units require maintenance.

35 MGD Two aerated sediment removal chambers, each with a peak flow capacity of 35 MGD

60 MGD Three aerated sediment removal chambers, each with a peak flow capacity of 35 MGD

100 MGD Four aerated sediment removal chambers, each with a peak flow capacity of 35 MGD

163 MGD Four aerated sediment removal chambers, each with a peak flow capacity of 55 MGD

PG estimates that the aerated sediment removal chambers will capture about 25% of suspended sediment. Table 2-4 lists estimated sediment quantities produced by the aerated sediment removal chambers. The wet sediment (50% dry sediment and 50% water) is assumed to have a volume of 1.73 cubic yards per ton. For the purposes of these estimates, PG assumed that the 82-million-gallon storage basin is not constructed. Therefore, PG used the same influent TSS concentrations listed in Table 2-2 for these estimates. For the estimated truckloads of dry sediment production, PG assumed that a single truck hauls 16 cubic yards of material.

Table 2-4. Estimated Sediment Production Rates for Proposed APTP Preliminary Treatment

Peak Influent Flow Rate (MGD)	Total Annual Wet Sediment Production (Cubic Yards)	Total Annual Dry Sediment Production (Tons)	Average Daily[3] Dry Sediment Production (Tons)	Average Daily[1] Dry Sediment Production (Truckloads)	Peak Daily Dry Sediment Production (Truckloads)
35	940	540	5	0.6	1.3
60	2,040	1,180	9.3	1	3
100	2,120	1,230	9.8	1	4
163	2,940	1,700	13	2	8

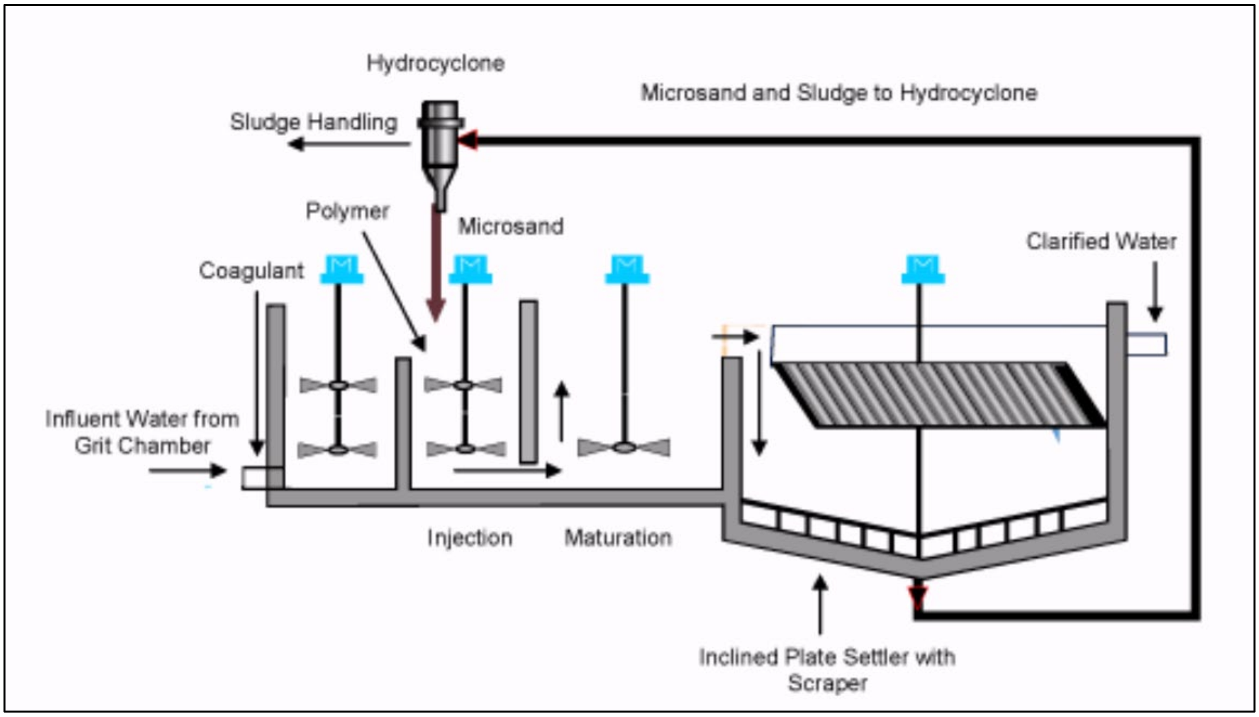
2.3.3 Design Features: Advanced Primary Treatment (Ballasted Flocculation)

After receiving preliminary treatment (screening and sediment removal), the river water will enter a ballasted flocculation process. Ballasted flocculation is a physical-chemical treatment process that uses continuously recycled media and a variety of additives to improve the settling properties of suspended solids via improved floc bridging. The ballasted flocculation process was chosen because it is less costly than conventional advanced primary sedimentation and has a smaller footprint. Moreover, the process is designed to go online and offline as necessary, which is ideal for the

[3] These values reflect estimated sediment production on days when the APTP is operating: 107 days per year for the 35 MGD design, 126 days per year for the 100 MGD design, and 133 days per year for the 163 MGD design.

varying flow rates in this design application. Ballasted flocculation is a practicable treatment technology that is used in many wet-weather treatment systems in the U.S.

The three major stages of the ballasted flocculation process are chemical coagulation, flocculation in the presence of micro-sand, and clarification with inclined tube settlers (see Figure 2-7). This technology has been used both within traditional treatment processes and as overflow treatment for peak wet-weather flows. The ballasted flocculation system functions through the addition of a coagulant (usually ferric sulfate), an anionic polymer, and a ballast material (micro-sand or chemically enhanced sludge). When used with chemical addition, this ballast material is effective in reducing coagulation-sedimentation time. For example, ballasted flocculation units have operated with overflow rates of 815 to 3,260 $L/m^2/min$ (20 to 80 $gal/ft^2/min$) while achieving TSS removal of 75% to 95%.



Source: EPA, "Wastewater Technology Fact Sheet: Ballasted Flocculation" (2003), modified from US Filter Kruger, 2002

Figure 2-7. Ballasted Flocculation Process Flow Schematic

Surface overflow rates are very high for the ballasted flocculation inclined tube clarifiers, but the clarifiers function effectively because of enhanced floc formation. Thus, ballasted flocculation achieves much faster settling than use of traditional coagulants, yielding high TSS removal efficiencies. PG estimated TSS and BOD removal through the ballasted flocculation process to be 85% and 50%, respectively; BOD removal occurs via removal of colloidal and suspended degradable organic matter. Inclined tube settlers further enhance the settling process by providing a greater surface area over which settling can occur and by reducing settling depth. Ballast from the bottom of the chamber is separated from the sludge and re-introduced into the contact chamber. A hydro-cyclone uses centrifugal force to separate the sludge from the ballast and re-introduces it into the contact chamber. The sludge is processed through the sludge treatment system before final disposal.

To determine design parameters and the treatment efficiency of the APTP, PG used information from EPA about the ballasted flocculation process and interviewed a manufacturer's representative. Design parameters that PG considered for the proposed APTP were size (μm) of micro-sand, surface overflow rate (L/m^2/min), reactor detention time (minutes), total retention time (minutes), single-train capacity (MGD), and multiple-train capacity (MGD).

PG proposes the following configurations of ballasted flocculation treatment trains for each of the peak flow rate options. Each treatment train can be turned down to about 10% of design capacity and has a peak hydraulic capacity of 140%.

35 MGD — Two treatment trains, each sized for a design capacity of 25 MGD

60 MGD — Three treatment trains, each sized for a design capacity of 25 MGD

100 MGD — Four treatment trains: two sized for a design capacity of 25 MGD and two sized for a design capacity of 50 MGD

163 MGD — Five treatment trains: two sized for a design capacity of 25 MGD and three sized for a design capacity of 50 MGD

2.3.4 Design Features: Sludge Treatment

Sludge will be removed from the ballasted flocculation process after a hydro-cyclone separates the liquid sludge from the micro-sand; the micro-sand is returned to the flocculation chamber for reuse in the liquid treatment process. Compared to sludge generated by a sewage treatment plant, the sludge generated by the APTP will have very low organic content, making it unsuitable for anaerobic digestion. For each flow rate option, sludge production rates are estimated in Table 2-5 below. For the estimated truckloads of dry solids production, PG assumed that a single truck hauls 16 cubic yards of material.

Table 2-5. Estimated Sludge Production Rates for the Proposed APTP

Peak Influent Flow Rate (MGD)	Average Daily Influent Flow Rate (MGD)	Average Sludge Flow Rate (MGD)	Average Daily Dry Solids Production (Tons)	Total Annual Dry Solids Production (Tons)	Average Daily Dry Solids Production (Truck Loads)	Peak Daily Dry Solids Production (Truck Loads)
35	16	0.15	13	1,390	4	9
60	26	0.28	23	3,000	6.5	20
100	28	0.30	25	3,130	7	25
163	33	0.39	33	4,340	9	45

Based on conversations with a ballasted flocculation treatment process manufacturer, and the expected influent sediment loadings, PG estimated the sludge removed from the ballasted flocculation process is expected to be about 2% solids. PG proposes onsite sludge storage to provide surge capacity prior to sludge processing. Sludge will then undergo gravity thickening to increase solids concentration to about 5%. After thickening, the sludge will be chemically treated to improve dewatering characteristics and will be dewatered with belt filter presses. Belt filter presses can be expected to produce sludge with about 25% solids. The dewatered sludge will discharge to a conveyor that will deposit it into trucks for offsite disposal. For each peak flow rate, PG proposes the following belt press configurations:

35 MGD — Two 2-meter belt filter presses

60 MGD	Three 2-meter belt filter presses
100 MGD	Three 2-meter belt filter presses
163 MGD	Four 2-meter belt filter presses

2.3.5 Design Features: Effluent Discharge to the SBOO

Effluent from the ballasted flocculation process will flow by gravity to the South Bay Ocean Outfall (SBOO) pipeline. To connect to the SBOO pipeline, a new pipeline must be constructed to convey effluent from the APTP to the SBWRP effluent structure (about 300 feet). The new pipeline will be installed via open trench cut and is expected to be confined to the boundaries of the ITP property. For the 35 MGD design option, the pipeline will be 60 inches in diameter. For the 60 MGD and 100 MGD designs, the pipeline will be 72 inches in diameter. For the 163 MGD design, the pipeline will be 96 inches in diameter.

2.3.6 Design Features: Dry-Weather Operation

The new treatment system also will be designed to handle dry-weather flows if PB-CILA is out of service. Based on several sampling events IBWC conducted during dry weather in 2019, the typical ranges for BOD_5 and TSS concentrations in the PB-CILA intake water are 20 to 80 mg/L and 40 to 200 mg/L, respectively. Because these pollutant levels are much lower than in the wastewater entering the ITP, these dry-weather flows could reasonably be routed through the new APTP for treatment. Dry-weather river flow rates are expected to be 15 to 25 MGD if effluents from the La Morita and Herrera wastewater treatment plants are beneficially reused or rerouted from the river channel (refer to the Project 7 feasibility analysis). If the two effluents remain in the river, dry-weather river flow rates are expected to be 25 to 35 MGD. Based on information reviewed, there is some uncertainty in the magnitude of these flow rates and whether they are constant throughout the year. However, in either scenario, the proposed APTP can readily handle these flow rates and pollutant loadings. Even if dry weather operation of the APTP becomes a regular occurrence, odor control at the headworks is not expected to be necessary because the Tijuana River dry-weather flow BOD_5 concentrations are lower than those of untreated wastewater and the APTP is sufficiently far from residential areas.

2.3.7 Engineering Issues

PG considered three types of advanced primary treatment processes: chemically enhanced clarification, ballasted flocculation, and cloth media disk filtration (CMDF). Ballasted flocculation and CMDF offer similar performance to chemically enhanced clarification including efficient TSS removal but have lower capital costs and significantly smaller footprints. PG ultimately chose ballasted flocculation because it is a more established technology. The diverted river water will likely contain high TSS loads during wet weather, which can damage the cloth media disk filters. CMDFs would need further analysis, including bench testing and/or a pilot study, if chosen instead of ballasted flocculation for Project 1.

Proper operation of a ballasted flocculation process requires greater operator expertise than conventional primary treatment. Particularly with varying flow rates, the addition of ballast must be actively metered to ensure an efficient recycling process and to maintain effluent quality. Also, because of abrasion from the micro-sand, some ballasted flocculation equipment will need to be replaced relatively often, which increases O&M effort and has been accounted for in PG's life cycle cost estimate for Project 1.

PG has estimated that Project 1 will require:

- A staff of about 20 people (including one Grade V certified operator, one Grade IV certified operator, and four Grade III certified operators) for the 35 MGD design.
- A staff of about 27 people (including one Grade V certified operator, two Grade IV certified operators, and five Grade III certified operators) for the 60 MGD design.
- A staff of about 30 people (including one Grade V certified operator, two Grade IV certified operators, and six Grade III certified operators) for the 100 MGD design.
- A staff of about 37 people (including two Grade V certified operators, two Grade IV certified operators, and eight Grade III certified operators) for the 163 MGD design.

Note that these staffing estimates are for operating and maintaining the river diversion (sub-project 1) and the APTP (sub-project 3). A significant portion of the operations staff will be needed to ensure effective solids handling and removal throughout the year.

During a site visit to the ITP, PG determined that the APTP could be constructed in the north area of the facility in a vacant space originally intended for chlorine contact chambers. As described above, the revised location for the APTP will significantly reduce that amount of piping necessary to construct Project 1. The location in the north area of the ITP is expected to accommodate the APTP at all four peak flow rate sizes (35 MGD, 60 MGD, 100 MGD, or 163 MGD).

2.3.8 Implementation and Regulatory Issues

The final project needs to be consistent with current City of San Diego and/or San Diego County zoning and building requirements. All design parameters for the APTP must also satisfy State of California wastewater treatment plant design criteria. Due to the immediate proximity to the border, all proposed intake and treatment infrastructure likely will also need review and approval from CBP. Border security concerns will also need to be addressed during construction.

Since the new treatment facility will be subject to a National Pollutant Discharge Elimination System (NPDES) permit, anticipated effluent limitations, monitoring requirements, and other conditions set by the Regional Water Quality Control Board must be achieved consistently once the treatment facility is operational. PG noted during the feasibility analysis that the most recent effluent dispersion model for the SBOO was conducted using data from 2002 to 2005 at a discharge rate of 40 MGD. Due to the additional flow rates that Project 1 proposes to discharge through the SBOO, PG conducted an updated flow dispersion model necessary to understand potential impacts to the coast. The results of the model indicate that 60 MGD of advanced primary effluent will not necessitate more stringent effluent limitations to protect the beneficial uses of the receiving water.

Based on information PG has reviewed, including information obtained during a site visit to the ITP, compatibility with existing facilities/operations at the ITP does not appear to pose significant barriers to implementation.

2.4 Sediment and Trash Management Plan

Large amounts of sediment will be removed from the diverted river water at either the 82-million-gallon storage basin or the APTP's aerated sediment chambers, as shown in Tables 2-2 and 2-4, respectively. Sediment accumulated in the basin will be removed (or dredged) from the basin about every 10 to 30 years, temporarily stockpiled at an onsite dredging area, and hauled away for disposal. Sediment removed from the APTP's aerated sediment removal chambers will be dewatered and hauled away for disposal. For the purposes of this feasibility analysis, PG has assumed that the sediment removed during preliminary treatment (and dewatered sludge from the APTP) will be trucked to a landfill in the area for disposal. However, other options for sediment disposal may be available. The 2020 *Feasibility Study for Sediment Basins Tijuana River International Border to Dairy Mart Road Final Feasibility Report* identified the Miramar Landfill or Nelson Sloan Quarry as the two most feasible disposal options for sediment collected from the Tijuana River on the U.S. side of the border (Stantec 2020).

The Miramar Landfill is presently used for disposal of sediment from the Goat Canyon sediment basin and charges a tipping fee of $30 per ton (Stantec 2020). The annual sediment volume removed from Goat Canyon upon which Stantec's estimates were based is less than the sediment loads present during wet weather in the Tijuana River. It is unknown whether the Miramar Landfill would accept the larger amounts of sediment associated with Project 1.

The 2016 *Nelson Sloan Management and Operations Plan and Cost Analysis* developed by AECOM evaluated the feasibility of using sediment from the Tijuana River or the canyons to fill and restore the Nelson Sloan Quarry (AECOM 2016). The report analyzed three total volumes of sediment disposal: 100,000 cubic yards, 1,000,000 cubic yards, and 2,000,000 cubic yards. Sediment processing would be required to separate trash from the sediment that is used to fill the quarry. Additionally, a grading permit would likely be required to use the sediment to fill the quarry. AECOM estimates that the total cost per cubic yard for transporting and disposing of the excavated sediment at the 100,000-cubic-yard, 1,000,000-cubic-yard, and 2,000,000-cubic-yard tiers is $40.23, $23.09, and $19.74, respectively (AECOM 2016). All three disposal costs represent significant savings compared to disposing of the sediment at the San Antonio de los Buenos Wastewater Treatment Plant (SABTP) plant or Miramar Landfill. Therefore, disposing of sediment at the Nelson Sloan Quarry should be further evaluated as an option for implementation of Project 1.

The mechanical bar screens at the river diversion and APTP will remove trash from the diverted river water, particularly during wet-weather operation. The collected trash is proposed to be hauled by truck to the Miramar Landfill for disposal. The disposal cost of the trash is estimated at $30 per ton (Stantec 2020).

3. PROJECT IMPACT

3.1 Water Quality Impacts

Based on PG's analysis of flow data from the IBWC flow gauge at the border, transboundary flows occurred an average of 153 days per year from January 1, 2016, to December 31, 2019. On average, these transboundary flows totaled about 17.5 billion gallons of flow per year. Table 3-1 presents the estimated impact that Project 1 (35 MGD, 60 MGD, 100 MGD, and 163 MGD) would have on the average number of days per year with transboundary flow, the average total volume of transboundary flow per year, and the annual loadings of BOD_5 and sediment.

The APTP is expected to remove 50% of BOD from the influent river water due to removal of colloidal and suspended biodegradable organics. PG estimated the annual BOD_5 reductions in the Tijuana River using flow sources data provided by CESPT and water quality monitoring data from IBWC (IBWC 2020). Based on this data, PG made the following assumptions:

1. For transboundary flows less than 25 MGD, 40% of the flow in the river is composed of untreated wastewater.
2. For transboundary flows of 25 MGD and greater, there is 10 MGD of untreated wastewater in the river.
3. The untreated wastewater has an average concentration of 400 mg/L of BOD_5.

Refer to the *Baseline Conditions Summary: Technical Document* for information about these assumptions.

The APTP is expected to remove about 90% of sediment from the influent river water. PG estimated the sediment loads in transboundary river flows using information on flow sources from CESPT, preliminary correlations derived from wet-weather monitoring data from San Diego State University and Southern California Coastal Water Research Project, and the USACE (2020) Phase 2 Study (refer to the *Baseline Conditions Summary: Technical Document* for details).

Table 3-1. Project 1 Impacts on Transboundary Flows in the Tijuana River

Parameter of Transboundary Flow in Tijuana River	Current Conditions[4]	35 MGD, Shutoff at 60 MGD	60 MGD, Shutoff at 120 MGD	100 MGD, Shutoff at 100 MGD	163 MGD, Shutoff at 163 MGD
Flow days (days/year)	153	73	46	27	20
Percent change	*N/A*	*-53%*	*-70%*	*-82%*	*-87%*
Flow volume (million gallons/year)	17,500	15,800	14,200	14,000	13,100
Percent change	*N/A*	*-10%*	*-19%*	*-20%*	*-25%*
BOD_5 load (tons/year)	1,670	871	502	454	337
Percent change	*N/A*	*-48%*	*-70%*	*-73%*	*-80%*
Sediment load (tons/year)	187,000	186,000	184,000	184,000	183,000
Percent reduction	*N/A*	*<-1%*	*-2%*	*-2%*	*-2%*

[4] "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.

The flows in the river during high flow events mostly consist of stormwater runoff, and the raw sewage present in the river is more dilute. High flow events, which can bring flow rates above 1 billion gallons per day, will not be captured by Project 1 and cause the highest sediment loadings. For these reasons, Project 1 offers more significant reductions to the total annual transboundary BOD loading than to the total annual transboundary sediment loading. Refer to the *Baseline Conditions Summary: Technical Document* for more discussion and analysis of transboundary flows in the Tijuana River main channel and their correlation to precipitation events of varying magnitudes.

The Scripps analysis simulated scenarios in which all flows up to 35 MGD, 100 MGD, and 163 MGD were eliminated from the Tijuana River to estimate the resulting reduction in beach closures at the Imperial Beach Pier (Feddersen et al. 2020). Each option had little impact on beach closures; the same should be true for the 60 MGD treatment option. The Scripps results also show that impacts predicted to result in beach closures during the dry (tourist) season are caused primarily by discharges from SAB Creek that migrate northward along the coast, so diverting flows from the Tijuana River would have little if any dry (tourist) season impacts at the Imperial Beach Pier. The Scripps results also indicate that these conclusions would apply for all southern San Diego County beaches, as well as the U.S. Navy SEALs training facility in Coronado, California.

The USACE Phase 2 study suggests that extreme weather events, such as the 100-year storm, have a more significant impact on the estuary in terms of sediment deposition than smaller, more frequent storm events. Project 1, as proposed in Section 2, will not mitigate the impacts from extreme weather events because of the shutoff protocols described in Section 2.1.1.

Due to the additional flow rates that Project 1 proposes to discharge through the SBOO, PG used an updated flow dispersion model to understand potential impacts to the coast. The results of the model indicate that 60 MGD of advanced primary effluent will not necessitate more stringent effluent limitations to protect the beneficial uses of the receiving water.

3.2 Sediment Impacts

As discussed in previous sections, Project 1 will remove minor amounts of sediment from the Tijuana River during wet weather (refer to Table 3-1 above).

3.3 Trash Impacts

Trash removal is not a primary objective of Project 1, but trash in the river flow will be captured and removed at the intake structure, storage basin, and/or preliminary treatment at the APTP. The primary purpose of removing trash at these locations is to protect the new conveyance and treatment facilities from being damaged or needing to be shut down prematurely. Most trash will be intercepted and removed at the intake structure; refer to Section 2.1.1 for intake structure design considerations and Section 2.1.2 for engineering issues related to trash removal. However, some rough estimates for costs associated with trash disposal have been incorporated into the sub-project 1 cost estimate (refer to Table 4-1).

3.4 Non-Water-Quality Environmental Impacts

In conjunction with the feasibility assessment, ERG is currently preparing an Environmental Impact Document (EID) that will describe the potential environmental impacts of the 10 proposed projects (including Project 1), focusing on impacts in the U.S. or caused by activities in the U.S. Based on a review of existing available information, Project 1 would have the potential to result in impacts of concern.[5] Sub-projects 1 and 2 would have potential adverse impacts to federally listed species and least Bell's vireo critical habitat; the ability to avoid adverse effects through mitigation is not yet determined. Diversion of substantial portions of the river flow could create downstream ecological effects that need further evaluation in coordination with Tijuana River Estuary stakeholders. Sub-project 2 could also result in adverse effects on important natural resource areas such as floodplains and the coastal zone. Project 1 (particularly sub-projects 1 and 2) could also face opposition from public and various stakeholders about potential environmental impacts.

The EID, and subsequent EIS, will include a more thorough evaluation of potential non-water-quality impacts in the U.S.

3.5 Social Impacts

With implementation of Project 1 (not including sub-project 2), the long-term positive socioeconomic impacts to affected populations (e.g., reduced public health risk and increased economic activity in coastal areas) are expected to outweigh the negative, localized impacts during construction (e.g., temporary increase in noise, equipment/dust emissions, and traffic) and long-term operation of the APTP (e.g., increase in truck traffic and sludge disposal).

The inclusion of sub-project 2 would substantially increase the negative socioeconomic impacts to affected populations, both during construction (e.g., more extensive noise, emissions, and traffic in closer proximity to residential areas) and during long-term operation (e.g., potential odor, vector-borne illness, visual, and flood risk impacts; associated potential impact to nearby property values; potential disproportionate adverse impact to minority populations). It is unclear whether the long-term positive socioeconomic impacts driven by improved water quality in downstream areas would outweigh these negative socioeconomic impacts.

Project 1 would not resolve impacts on CBP operations and workforce resulting from exposure to contaminated transboundary flows near border infrastructure and may introduce new challenges for CBP agents working near the main channel. Because Project 1 will not reduce the amount of wastewater discharged from SAB Creek and will not reduce impacts from large transboundary flows in the Tijuana River, it will result in little to no reduction in impacts on southern San Diego County beaches and U.S. Navy SEALs training personnel.

The EID, and subsequent EIS, will include a more thorough evaluation of potential socioeconomic impacts associated with Project 1.

[5] ERG considered the following "impacts of concern" to be indicators of potentially significant environmental impacts that warrant detailed review during preparation of the EID, the subsequent National Environmental Policy Act process, and related consultations and resource-specific studies: disproportionate, adverse effects on minority and/or low-income communities; potential for adverse effects on federally listed threatened or endangered species or their critical habitat; adverse effects on tribal/cultural resources; adverse effects on important natural resource areas such as wetlands, floodplains, coastal zones, and significant fish or wildlife habitat; modification, diversion, and/or alteration of the main course of the Tijuana River; criteria pollutant emissions that exceed Clean Air Act General Conformity Rule *de minimis* thresholds; and significant public controversy about a potential environmental impact.

4. COST IMPACT ANALYSIS

PG developed comparative project construction cost estimates for Project 1 to a Class V level of accuracy in accordance with AACE International's recommended practice No. 17R-97 (AACE International 2020). According to this system, Class V estimate accuracy can range from +40%/ -20% to as high as +200%/-100%. Based on the information that was reviewed, the estimated accuracy goal for construction in the U.S. is +50%/-25%, meaning actual construction costs may range from 50% higher than the estimated cost to 25% lower. Because there are fewer sources of cost data for construction in Mexico, the estimated accuracy goal for construction in Mexico was +100%/-50%, meaning actual construction costs may range from 100% higher than the estimated cost to 50% lower. More details on this methodology can be found in the *Baseline Conditions Summary: Technical Document.*

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 the sum of project construction cost and equipment/material cost × 1.4 × 1.5, which is equivalent to the sum of project construction cost and equipment/material cost × 2.1. For project construction cost data, PG used manufacturers' cost information, EPA Cost Curves (U.S. EPA, 1980), adjustments for a 2020 *Engineering News-Record* (ENR) construction cost index of 11,455, third-party costing data and manufacturers' information.

O&M costs include equipment and labor costs associated with treatment plant O&M activities. Disposing of significant quantities of sediment, grit, and sludge (especially for the 100 MGD and 163 MGD designs) will account for a significant portion of the O&M costs. Solids disposal costs have been estimated to be about $100 per cubic yard based on information provided by the SBWRP operations staff. O&M costs related to energy, personnel, chemicals, monitoring, and maintenance are based on previous feasibility studies and O&M cost data provided by the ITP, PG applied an inflation factor of 2% annually, as well as an interest rate of 3% annually, to calculate the life cycle cost over a 40-year lifespan for all three sub-projects.

Tables 4-1 through 4-3 summarize the life cycle costs that were estimated for each sub-project. The full itemized cost impact analyses for each project are provided in Appendix A.

Table 4-1. Tijuana River Diversion System (Sub-Project 1): Life Cycle Cost Summary

Category	Item	Estimated Cost of 35 MGD Peak Flow Design	Estimated Cost of 60 MGD Peak Flow Design	Estimated Cost of 100 MGD Peak Flow Design	Estimated Cost of 163 MGD Peak Flow Design
Capital costs	Equipment/material costs	$2,600,000	$3,900,000	$5,400,000	$5,800,000
	Construction costs	$5,600,000	$8,800,000	$12,600,000	$13,800,000
	Indirect costs	$9,000,000	$14,000,000	$19,800,000	$21,600,000
	Total capital costs	**$17,200,000**	**$26,700,000**	**$37,800,000**	**$41,200,000**
Annual O&M	Personnel	$100,000	$120,000	$150,000	$200,000
	Maintenance	$120,000	$120,000	$120,000	$120,000
	Energy	$20,000	$30,000	$40,000	$50,000
	Total annual O&M costs	**$240,000**	**$270,000**	**$310,000**	**$370,000**

Major upgrade at 10 years	Pump replacement and/or upgrades	$3,600,000	$6,750,000	$10,800,000	$12,000,000
Life cycle factors	Interest rate	3%	3%	3%	3%
	Inflation rate	2%	2%	2%	2%
	Total life cycle used	40 years	40 years	40 years	40 years
Total life cycle cost		**$28,000,000**	**$41,000,000**	**$57,000,000**	**$63,000,000**

Table 4-2. 82-Million-Gallon Storage Basin (Sub-Project 2): Life Cycle Cost Summary

Category	Item	Estimated Cost of 35 MGD Peak Flow Design	Estimated Cost of 60 MGD Peak Flow Design	Estimated Cost of 100 MGD Peak Flow Design	Estimated Cost of 163 MGD Peak Flow design
Capital costs	Equipment/material costs	$3,500,000	$4,100,000	$4,400,000	$5,300,000
	Construction costs	$30,700,000	$31,000,000	$31,300,000	$31,500,000
	Indirect costs	$37,600,000	$38,600,000	$39,300,000	$40,500,000
	Total capital costs	**$71,800,000**	**$73,700,000**	**$75,000,000**	**$77,300,000**
	Rip rap replacement	$40,000	$40,000	$40,000	$40,000
	Pump maintenance	$150,000	$180,000	$210,000	$250,000
	Energy	$130,000	$200,000	$250,000	$300,000
	Personnel	$200,000	$200,000	$200,000	$200,000
	Total annual O&M costs	**$520,000**	**$620,000**	**$700,000**	**$800,000**
Major upgrade at 20 years	New pumping equipment and weir walls	$10,100,000	$20,400,000	$22,400,000	$28,200,000
Life cycle factors	Interest rate	3%	3%	3%	3%
	Inflation rate	2%	2%	2%	2%
	Total life cycle used	40 years	40 years	40 years	40 years
Total life cycle cost		**$97,000,000**	**$111,000,000**	**$116,000,000**	**$130,000,000**

Table 4-3. New APTP (Sub-Project 3): Life Cycle Cost Summary

Category	Item	Estimated Cost of 35 MGD Peak Flow Design	Estimated Cost of 60 MGD Peak Flow Design	Estimated Cost of 100 MGD Peak Flow Design	Estimated Cost of 163 MGD Peak Flow Design
Capital costs	Equipment/material costs	$8,400,000	$9,300,000	$18,500,000	$22,700,000
	Construction costs	$26,300,000	$34,700,000	$57,900,000	$73,900,000
	Indirect costs	$38,200,000	$48,400,000	$84,000,000	$106,300,000
	Total capital costs	**$72,900,000**	**$92,400,000**	**$160,400,000**	**$202,900,000**
Annual O&M	Personnel	$2,000,000	$2,700,000	$2,850,000	$3,750,000
	Energy	$600,000	$770,000	$900,000	$1,100,000
	Chemicals	$1,200,000	$1,500,000	$1,700,000	$2,200,000
	Grit/sludge disposal	$720,000	$1,500,000	$1,620,000	$2,250,000
	Monitoring	$200,000	$260,000	$330,000	$400,000
	Maintenance	$600,000	$770,000	$900,000	$1,100,000
	Total O&M costs	**$5,300,000**	**$7,500,000**	**$8,300,000**	**$10,800,000**
Major upgrade at 20 years	Equipment replacement and/or upgrades	$40,000,000	$60,000,000	$80,000,000	$100,000,000
	Interest rate	3%	3%	3%	3%

Life cycle factors	Inflation rate	2%	2%	2%	2%
	Total life cycle used	40 Years	40 Years	40 years	40 years
Total life cycle cost		**$280,000,000**	**$390,000,000**	**$496,000,000**	**$640,000,000**

5. DISCUSSION

5.1 Feasibility

The primary objective of Project 1 is to divert and treat river water from the Tijuana River during wet-weather flow conditions to protect the Tijuana River Estuary and coastal communities from contaminated transboundary flows. PG assessed the feasibility of three sub-projects, discussed individually below. Note that the implementation of sub-projects 1 and 3 can be considered with or without the implementation of sub-project 2.

Presented in Section 4 of this report, implementation costs associated with Project 1 are very significant. At the 100 MGD and 163 MGD peak design flow rates, the capital costs associated with constructing just the river diversion system and APTP (without the storage basin) are expected to exhaust the majority or all of the available USMCA funding, thereby inhibiting implementation of other projects. Note that Project 1 does not mitigate any effects from untreated or undertreated sewage discharged to SAB Creek, a primary objective of the USMCA Mitigation of Contaminated Tijuana Transboundary Flows Project.

5.1.1 Sub-Project 1: Tijuana River Diversion System

Based on available information, PG has determined that a new river diversion system in the U.S. to capture up to 35 MGD, 60 MGD, 100 MGD, or 163 MGD of transboundary flows from the Tijuana River can be constructed at the proposed location (refer to Figure 2-1). However, PG acknowledges that the dynamic flow conditions in the Tijuana River may present unforeseen design challenges. Therefore, PG recommends the use of a physical model to simulate the anticipated flow conditions before the final design for the river diversion system is finalized.

5.1.2 Sub-Project 2: 82-Million-Gallon Storage Basin

For the reasons described below, PG has determined that constructing an off-channel 82-million-gallon storage basin to equalize flow rates and provide sediment removal for the diverted flow is technically feasible but not practical. PG also anticipates that many implementation and regulatory issues—described in Section 2.2.3—will delay, complicate, and potentially prevent implementation of sub-project 2.

The proposed APTP's physical-chemical treatment system can be started up and shut down as necessary to handle varying wet-weather flows in the Tijuana River; therefore, equalized flow from the storage basin is not required for reliable APTP performance. PG anticipates the APTP's overall removal of TSS will be about 90% when influent TSS concentrations are less than 500 mg/L. This estimate includes 25% removal in the sediment removal chambers followed by an additional 85% removal in ballasted flocculation. Therefore, the APTP can achieve efficient sediment removal without the addition of the storage basin.

5.1.3 Sub-Project 3: New APTP

PG has determined that a new ballasted flocculation APTP can be constructed at the ITP to treat the diverted flows up to 35 MGD, 60 MGD, 100 MGD, or 163 MGD. Because of the minimal footprint necessary for ballasted flocculated treatment units, PG expects the APTP to fit into the available land area in the north area of the ITP. Performance at all four peak flow rates is expected to be capable of producing effluent quality that consistently satisfies anticipated NPDES effluent limits for the proposed treatment process.

As discussed in Section 2.4, management of significant volumes of sediment and solids will be a challenge for the operators, but since the new APTP liquid treatment process will only operate between 107 and 133 days per year on average, downtime during the dry season is expected to ease this burden.

5.2 Other Stakeholder Information

Reducing transboundary flows in the Tijuana River channel continues to be a primary concern among stakeholders in the U.S., who have generally expressed support for a U.S.-side river diversion system. During stakeholder discussions, CBP expressed preference for Mexico-side projects to reduce interference with its patrol operations. Ongoing communications should continue to examine ways for Project 1 to be implemented in a way to alleviate CBP's concerns. Additionally, CBP described a planned project to build a retractable gate and bridge structure across the Tijuana River channel as an extension of the border fence. How the structure may affect flow rates in the river remains unclear but will need to be considered in the final design for Project 1.

6. CONCLUSION

The primary objective of Project 1 is to divert and treat river water from the Tijuana River during wet-weather flow conditions in order to protect the Tijuana River Estuary and coastal communities from contaminated transboundary flows. PG determined that sub-projects 1 and 3 are feasible to construct and operate. PG determined that sub-project 2 is technically feasible to construct and operate but may not improve the performance of Project 1 and is likely to present additional implementation challenges. Section 5.2 contains further discussion about the feasibility of each sub-project. Section 4 presents the estimated costs associated with each sub-project.

To estimate the expected sediment loadings at various flow rates, PG used wet-weather water quality data from the recent data collected by the SCCWRP. However, the universe of currently available wet-weather water quality data for transboundary flows in the Tijuana River is very limited. Therefore, it is vitally important that more data be obtained to better understand water quality in the Tijuana River (particularly sediment loadings) and to make more informed cost estimates for Project 1.

The primary advantages of Project 1 are as follows (refer to Table 3-1):

1. Substantial reduction in the number of transboundary flow days.
2. Slight reduction in the total volume of transboundary flow per year.
3. Significant reduction in total transboundary BOD_5 loading per year.
4. Minor reduction in average total transboundary sediment loading per year.

The challenges associated with Project 1 are as follows:

1. Capital, O&M, and total life cycle costs will be relatively high.
2. Residuals management (sediment disposal) is costly and relies on the availability of trucks and drivers, which are already in short supply for the ITP's current solids disposal needs.
3. Construction and operation of the 82-million-gallon storage basin will present additional regulatory barriers and environmental impacts (noise, emissions, traffic, odors, vector-borne illness, visual impacts, flood risks, decline in property values, etc.).
4. Project 1 does not reduce the sediment load in transboundary flows during large wet weather events. Therefore, massive sediment quantities from large wet weather flows would continue to adversely impact the Tijuana Estuary.
5. Improvement in San Diego–area surf water quality is not expected because large volumes of untreated or partially treated wastewater will continue to be discharged to the Pacific Ocean via SAB Creek. Therefore, reduced impacts to U.S. Navy SEALs training personnel are also not expected.
6. Diversion of substantial volumes of Tijuana River flow may create adverse downstream ecological effects.

7. Project 1 would not resolve impacts on CBP operations and workforce resulting from exposure to contaminated transboundary flows near border infrastructure and may introduce new challenges for CBP agents working near the main channel.

7. SUGGESTED NEXT STEPS

Several activities would improve the feasibility analysis and reduce any uncertainty and assumptions described above, facilitating implementation of Project 1:

1. PG and/or EPA should consult with a design engineering firm experienced in the design of river diversion systems. PG recommends the use of a physical model in the final design process to more specifically evaluate hydrology, sediment accumulation, and other factors that may affect the design, operation, and maintenance of the river diversion system.

2. Before any wet-weather flow diversion or treatment systems are designed, more water quality data are needed to better understand pollutant characteristics in the Tijuana River.

3. Although ballasted flocculation was chosen as the proposed treatment technology, PG also evaluated the potential of using CMDFs in its place. CMDFs offer many of the same benefits as ballasted flocculation including high average TSS removal rates, small footprint, and rapid startup. However, CMDFs are a less established technology than ballasted flocculation, and are mainly used in tertiary treatment applications. Additionally, excess sediment can damage CMDFs, making them possibly unsuitable for treating river water with high TSS concentrations. If CMDFs are to be further considered for Project 1, more analysis (including bench testing and/or a pilot study) will be needed.

4. If CBP implements retractable gate and bridge structures, an assessment is needed to determine whether these affect flow rates in the river, which may influence the final design for Project 1.

5. PG and/or EPA should further evaluate using the Nelson Sloan Quarry for sediment disposal.

8. REFERENCES

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APPENDIX A: Itemized Cost Impact Analysis

Project 1, Sub-project 1: Tijuana River Diversion System (35 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Internal Lift Screw Pumps - 84-inch	2	ct	$600,000	$1,200,000	Manufacturer information
	Shotcrete for channel armering	174240	sq ft	$6.00	$1,045,440	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	170	CY	$150.00	$25,500	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	150	CY	$250.00	$37,500.00	RS Means, increased for excavation
	Gravity Pipe RCP (48-inch), elevated with tressel	800	Ft	$260.00	$208,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$125,822	
	Total Equipment/Materials Costs				**$2,600,000**	
Construction Costs	Internal Lift Screw Pumps - 84-inch	2	ct	$1,200,000	$2,400,000	Manufacturer information
	Site Clearing-Grubbing	8	acre	$24,200	$193,600	RSM 31.13.1.1. line 0020 x 4.0 difficulty factor x 1.094 San Diego location factor
	Excavation	8	acre	$25,000	$200,000	BPJ
	Rough Grading	8	acre	$13,240	$105,920	RSM RSM 31.22.13 line 250 x 4.0 difficulty factor x 1.094 San Diego location factor
	Shotcrete for channel armering	174240	sq ft	$4.00	$696,960	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	170	CY	$250.00	$42,500	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	150	CY	$500.00	$75,000	RS Means, increased for excavation
	Gravity Pipe RCP (48-inch), elevated with tressel	800	Ft	$520.00	$416,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$206,499	
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$1,238,994	
	Total Construction Costs				**$5,600,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$8,200,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$3,280,000	
	Subtotal (With Engineering)				$11,480,000	
	Contingency 50%	50%			$5,740,000	
	Total Indirect Costs				**$9,000,000**	
	Total Capital Costs				**$17,200,000**	
O&M Costs	Personnel				$100,000	EPA Cost Curves; ENR adjusted
	Maintenance				$120,000	Capdet, adjusted for anticipated operation time
	Energy				$20,000	Capdet, adjusted for anticipated operation time
	Total Annual O&M Costs				**$240,000**	
Life Cycle Cost	Total Capital Cost				$17,200,000	
	Annual O&M Costs				$240,000	
	Service Life				40	
	Present Value of Service Life O&M				$7,642,701	
	Major Upgrade(s) Cost at 20 years				$3,600,000	New pumps
	Present Value of Major Upgrade(s)				$2,944,465	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$28,000,000**	

Project 1, Sub-project 1: Tijuana River Diversion System (60 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Internal Lift Screw Pumps - 96-inch	3	ct	$750,000	$2,250,000	Manufacturer information
	Shotcrete for channel armoring	174240	sq ft	$6.00	$1,045,440	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	260	CY	$150.00	$39,000	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	180	CY	$250.00	$45,000.00	RS Means, increased for excavation
	Gravity Pipe RCP (66-inch), elevated with trestle	800	Ft	$400.00	$320,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$184,972	
	Total Equipment/Materials Costs				**$3,900,000**	
Construction Costs	Internal Lift Screw Pumps - 96-inch	3	ct	$1,500,000	$4,500,000	Manufacturer information
	Site Clearing-Grubbing	8	acre	$24,200	$193,600	RSM 31.13.1.1. line 0020 x 4.0 difficulty factor x 1.094 San Diego location factor
	Excavation	8	acre	$25,000	$200,000	BPJ
	Rough Grading	8	acre	$13,240	$105,920	RSM 31.22.13 line 250 x 4.0 difficulty factor x 1.094 San Diego location factor
	Shotcrete for channel armoring	174240	sq ft	$4.00	$696,960	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	260	CY	$250.00	$65,000	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	180	CY	$500.00	$90,000	RS Means, increased for excavation
	Gravity Pipe RCP (66-inch), elevated with trestle	800	Ft	$800.00	$640,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$324,574	
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$1,947,444	
	Total Construction Costs				**$8,800,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$12,700,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$5,080,000	
	Subtotal (With Engineering)				$17,780,000	
	Contingency 50%	50%			$8,890,000	
	Total Indirect Costs				**$14,000,000**	
	Total Capital Costs				**$26,700,000**	
O&M Costs	Personnel				$120,000	EPA Cost Curves; ENR adjusted
	Maintenance				$120,000	Capdet, adjusted for anticipated operation time
	Energy				$30,000	Capdet, adjusted for anticipated operation time
	Total Annual O&M Costs				**$270,000**	
Life Cycle Cost	Total Capital Cost				$26,700,000	
	Annual O&M Costs				$270,000	
	Service Life				40	
	Present Value of Service Life O&M				$8,598,039	
	Major Upgrade(s) Cost at 20 years				$6,750,000	New pumps
	Present Value of Major Upgrade(s)				$5,520,872	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$41,000,000**	

Project 1, Sub-project 1: Tijuana River Diversion System (100 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Internal Lift Screw Pumps - 108-inch	4	ct	$900,000	$3,600,000	Manufacturer information
	Shotcrete for channel armoring	174240	sq ft	$6.00	$1,045,440	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	370	CY	$150.00	$55,500	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	230	CY	$250.00	$57,500.00	RS Means, increased for excavation
	Gravity Pipe RCP (84-inch), elevated with trestle	800	Ft	$460.00	$368,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$256,322	
	Total Equipment/Materials Costs				**$5,400,000**	
Construction Costs	Internal Lift Screw Pumps - 108-inch	4	ct	$1,800,000	$7,200,000	Manufacturer information
	Site Clearing-Grubbing	8	acre	$24,200	$193,600	RSM 31.13.1.1. line 0020 x 4.0 difficulty factor x 1.094 San Diego location factor
	Excavation	8	acre	$25,000	$200,000	BPJ
	Rough Grading	8	acre	$13,240	$105,920	RSM 31.22.13 line 250 x 4.0 difficulty factor x 1.094 San Diego location factor
	Shotcrete for channel armoring	174240	sq ft	$4.00	$696,960	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	370	CY	$250.00	$92,500	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	230	CY	$500.00	$115,000	RS Means, increased for excavation
	Gravity Pipe RCP (84-inch), elevated with trestle	800	Ft	$920.00	$736,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$466,999	
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$2,801,994	
	Total Construction Costs				**$12,600,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$18,000,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$7,200,000	
	Subtotal (With Engineering)				$25,200,000	
	Contingency 50%	50%			$12,600,000	
	Total Indirect Costs				**$19,800,000**	
	Total Capital Costs				**$37,800,000**	
O&M Costs	Personnel				$150,000	EPA Cost Curves; ENR adjusted
	Maintenance				$120,000	Capdet, adjusted for anticipated operation time
	Energy				$40,000	Capdet, adjusted for anticipated operation time
	Total Annual O&M Costs				**$310,000**	
Life Cycle Cost	Total Capital Cost				$37,800,000	
	Annual O&M Costs				$310,000	
	Service Life				40	
	Present Value of Service Life O&M				$9,871,822	
	Major Upgrade(s) Cost at 20 years				$10,800,000	New pumps
	Present Value of Major Upgrade(s)				$8,833,395	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$57,000,000**	

Project 1, Sub-project 1: Tijuana River Diversion System (163 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Internal Lift Screw Pumps - 120-inch	4	ct	$1,000,000	$4,000,000	Manufacturer information
	Shotcrete for channel armoring	174240	sq ft	$6.00	$1,045,440	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	430	CY	$150.00	$64,500	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	250	CY	$250.00	$62,500.00	RS Means, increased for excavation
	Gravity Pipe RCP (108-inch), elevated with trestle	800	Ft	$490.00	$392,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$278,222	
	Total Equipment/Materials Costs				**$5,800,000**	
Construction Costs	Internal Lift Screw Pumps - 120-inch	4	ct	$2,000,000	$8,000,000	Manufacturer information
	Site Clearing-Grubbing	8	acre	$24,200	$193,600	RSM 31.13.1.1. line 0020 x 4.0 difficulty factor x 1.094 San Diego location factor
	Excavation	8	acre	$25,000	$200,000	BPJ
	Rough Grading	8	acre	$13,240	$105,920	RSM 31.22.13 line 250 x 4.0 difficulty factor x 1.094 San Diego location factor
	Shotcrete for channel armoring	174240	sq ft	$4.00	$696,960	RSM 03.37.13.30 line 0500 x 1.094 San Diego location factor
	Concrete slab for intake and upper receiving structure	430	CY	$250.00	$107,500	RS Means, increased for excavation
	Concrete walls for intake and upper receiving structure	250	CY	$500.00	$125,000	RS Means, increased for excavation
	Gravity Pipe RCP (108-inch), elevated with trestle	800	Ft	$980.00	$784,000	PG Cost Data
	Allowance for Unquantified Line Items	5%			$510,649.00	
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$3,063,894	
	Total Construction Costs				**$13,800,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$19,600,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$7,840,000	
	Subtotal (With Engineering)				$27,440,000	
	Contingency 50%	50%			$13,720,000	
	Total Indirect Costs				**$21,600,000**	
	Total Capital Costs				**$41,200,000**	
O&M Costs	Personnel				$200,000	EPA Cost Curves; ENR adjusted
	Maintenance				$120,000	Capdet, adjusted for anticipated operation time
	Energy				$50,000	Capdet, adjusted for anticipated operation time
	Total Annual O&M Costs				**$370,000**	
Life Cycle Cost	Total Capital Cost				$41,200,000	
	Annual O&M Costs				$370,000	
	Service Life				40	
	Present Value of Service Life O&M				$11,782,497	
	Major Upgrade(s) Cost at 20 years				$12,000,000	new pumps
	Present Value of Major Upgrade(s)				$9,814,883	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$63,000,000**	

Project 1, Sub-project 2: 82 Million Gallon Storage Basin (35 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Gabions, galvanized steel mesh mats, stone filled, 12 in deep	3,733	SY	70.5	$263,200	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	18 in minimum thickness, not grouted	3,733	SY	107	$399,467	RS Means 2020 - page 289 - 31 37 13.10 Line 0200
	Effluent Pumping Equipment				$1,400,000	Capdet; ENR adjusted
	Gabions for Weir Walls	1,600	SY	70.5	$112,800	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	Allowance for Unquantified Line Items	5%			$1,289,339	
	Total Equipment/Materials Costs				**$3,500,000**	
Construction Costs	Sediment, excavation/loading	400,000	CY	11	$4,400,000	Stantec (From Bids)
	Sediment, Hauling/disposal	400,000	CY	43	$17,200,000	Stantec (From Bids)
	Machine Place for slope protection	3,733	LCY	70	$261,310	RS Means 2020 - page 289 - 31 37 13.10 Line 0100
	Effluent Pumping Structure				$750,000	Capdet; ENR adjusted
	Land Acquisition	100	Acre	10000	$1,000,000	Allowance for floodplain land purchase
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$7,083,393	
	Total Construction Costs				**$30,700,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$34,200,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$13,680,000	
	Subtotal (With Engineering)				$47,880,000	
	Contingency 50%	50%			$23,940,000	
	Total Indirect Costs				**$37,600,000**	
	Total Capital Costs				**$71,800,000**	
O&M Costs	Rip Rap Replacement	370	SY	107	$40,000	10% perimeter rip rap replacement
	Pump Maintenance				$150,000	Capdet estimate, adjusted for anticipated operation time
	Energy				$130,000	Capdet estimate, adjusted for anticipated operation time
	Personnel				$200,000	Staffing allowance
	Total Annual O&M Costs				**$520,000**	
Life Cycle Cost	Total Capital Cost				$71,800,000	
	Annual O&M Costs				$520,000	
	Service Life				40	
	Present Value of Service Life O&M				$17,079,185	
	Major Upgrade(s) Cost at 20 years and Sediment Removal				$10,100,000	New pumps and weir walls at 20 years
	Present Value of Major Upgrade(s) and Sediment Removal				$8,260,860	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$97,000,000**	

Project 1, Sub-project 2: 82 Million Gallon Storage Basin (60 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Gabions, galvanized steel mesh mats, stone filled, 12 in deep	3,733	SY	70.5	$263,200	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	18 in minimum thickness, not grouted	3,733	SY	107	$399,467	RS Means 2020 - page 289 - 31 37 13.10 Line 0200
	Effluent Pumping Equipment				$2,000,000	Capdet; ENR adjusted
	Gabions for Weir Walls	1,600	SY	70.5	$112,800	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	Allowance for Unquantified Line Items	5%			$1,331,839	
	Total Equipment/Materials Costs				**$4,100,000**	
Construction Costs	Sediment, excavation/loading	400,000	CY	11	$4,400,000	Stantec (From Bids)
	Sediment, Hauling/disposal	400,000	CY	43	$17,200,000	Stantec (From Bids)
	Machine Place for slope protection	3,733	LCY	70	$261,310	RS Means 2020 - page 289 - 31 37 13.10 Line 0100
	Effluent Pumping Structure				$1,000,000	Capdet; ENR adjusted
	Land Acquisition	100	Acre	10000	$1,000,000	Allowance for floodplain land purchase
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$7,158,393	
	Total Construction Costs				**$31,000,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$35,100,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$14,040,000	
	Subtotal (With Engineering)				$49,140,000	
	Contingency 50%	50%			$24,570,000	
	Total Indirect Costs				**$38,600,000**	
	Total Capital Costs				**$73,700,000**	
O&M Costs	Rip Rap Replacement	370	SY	107	$40,000	10% perimeter rip rap replacement
	Pump Maintenance				$180,000	Capdet estimate, adjusted for anticipated operation time
	Energy				$200,000	Capdet estimate, adjusted for anticipated operation time
	Personnel				$200,000	Staffing allowance
	Total Annual O&M Costs				**$620,000**	
Life Cycle Cost	Total Capital Cost				$73,700,000	
	Annual O&M Costs				$620,000	
	Service Life				40	
	Present Value of Service Life O&M				$20,363,644	
	Major Upgrade(s) Cost at 20 years and Sediment Removal				$20,400,000	New pumps and weir walls at 20 years
	Present Value of Major Upgrade(s) and Sediment Removal				$16,685,302	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$111,000,000**	

Project 1, Sub-project 2: 82 Million Gallon Storage Basin (100 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Gabions, galvanized steel mesh mats, stone filled, 12 in deep	3,733	SY	70.5	$263,200	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	18 in minimum thickness, not grouted	3,733	SY	107	$399,467	RS Means 2020 - page 289 - 31 37 13.10 Line 0200
	Effluent Pumping Equipment				$2,300,000	Capdet; ENR adjusted
	Gabions for Weir Walls	1,600	SY	70.5	$112,800	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	Allowance for Unquantified Line Items	5%			$1,359,339	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$4,400,000**	
Construction Costs	Sediment, excavation/loading	400,000	CY	11	$4,400,000	Stantec (From Bids)
	Sediment, Hauling/disposal	400,000	CY	43	$17,200,000	Stantec (From Bids)
	Effluent Pumping Structure				$1,250,000	Capdet; ENR adjusted
	Machine Place for slope protection	3,733	LCY	70	$261,310	RS Means 2020 - page 289 - 31 37 13.10 Line 0100
	Land Acquisition	100	Acre	10000	$1,000,000	Allowance for floodplain land purchase
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$7,233,393	
	Total Construction Costs				**$31,300,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$35,700,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$14,280,000	
	Subtotal (With Engineering)				$49,980,000	
	Contingency 50%	50%			$24,990,000	
	Total Indirect Costs				**$39,300,000**	
	Total Capital Costs				**$75,000,000**	
O&M Costs	Rip Rap Replacement	370	SY	107	$40,000	10% perimeter rip rap replacement
	Pump Maintenance				$210,000	Capdet estimate, adjusted for anticipated operation time
	Energy				$250,000	Capdet estimate, adjusted for anticipated operation time
	Personnel				$200,000	Staffing allowance
	Total Annual O&M Costs				**$700,000**	
Life Cycle Cost	Total Capital Cost				$75,000,000	
	Annual O&M Costs				$700,000	
	Service Life				40	
	Present Value of Service Life O&M				$22,305,004	
	Major Upgrade(s) Cost at 20 years and Sediment Removal				$22,400,000	new pumps and weir walls
	Present Value of Major Upgrade(s) and Sediment Removal				$18,321,115	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$116,000,000**	

Project 1, Sub-project 2: 82 Million Gallon Storage Basin (163 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Gabions, galvanized steel mesh mats, stone filled, 12 in deep	3,733	SY	70.5	$263,200	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	18 in minimum thickness, not grouted	3,733	SY	107	$399,467	RS Means 2020 - page 289 - 31 37 13.10 Line 0200
	Effluent Pumping Equipment				$3,100,000	Cadet; ENR adjusted
	Gabions for Weir Walls	1,600	SY	70.5	$112,800	RS Means 2020 - page 289 - 31 36 13.10 Line 0600
	Allowance for Unquantified Line Items	5%			$1,401,199	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$5,300,000**	
Construction Costs	Sediment, excavation/loading	400,000	CY	11	$4,400,000	Stantec (From Bids)
	Sediment, Hauling/disposal	400,000	CY	43	$17,200,000	Stantec (From Bids)
	Effluent Pumping Structure				$1,400,000	Cadet; ENR adjusted
	Machine Place for slope protection	3,733	LCY	70	$261,310	RS Means 2020 - page 289 - 31 37 13.10 Line 0100
	Land Acquisition	100	Acre	10000	$1,000,000	Allowance for floodplain land purchase
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$7,278,393	
	Total Construction Costs				**$31,500,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$36,800,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$14,720,000	
	Subtotal (With Engineering)				$51,520,000	
	Contingency 50%	50%			$25,760,000	
	Total Indirect Costs				**$40,500,000**	
	Total Capital Costs (163 MGD)				**$77,300,000**	
O&M Costs	Rip Rap Replacement	370	SY	107	$40,000	10% perimeter rip rap replacement
	Pump Maintenance				$250,000	Capdet estimate, adjusted for anticipated operation time
	Energy				$300,000	Capdet estimate, adjusted for anticipated operation time
	Personnel				$200,000	Staffing allowance
	Total Annual O&M Costs				**$800,000**	
Life Cycle Cost	Total Capital Cost				$77,300,000	
	Annual O&M Costs				$800,000	
	Service Life				40	
	Present Value of Service Life O&M				$26,275,670	
	Major Upgrade(s) Cost at 20 years and sediment removal				$28,200,000	new pumps and weir walls; sediment removal
	Present Value of Major Upgrade(s) and sediment removal				$23,064,976	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$130,000,000**	

Project 1, Sub-project 3: New Advanced Primary Treatment Plant (35 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
	Headworks - Screens				$560,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Headworks - Grit Chambers				$830,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Ballasted Flocculation	2	25 MGD	500000	$1,000,000	Manufacturer Information
	Sludge Storage				$530,000	EPA Cost Curves; ENR adjusted; Capdet verified
Equipment/Materials Costs	Sludge Thickening				$290,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Dewatering				$2,100,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Conveyor				$1,320,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Pumping				$250,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Effluent Discharge Piping - 60 in	300	ft	400	$120,000	EPA Cost Curves; ENR adjusted
	Allowance for Unquantified Line Items	5%			$1,362,500	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$8,400,000**	
	Headworks - Screens				$640,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Headworks - Grit Chambers				$970,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Ballasted Flocculation				$1,500,000	Manufacturer Information
	Sludge Storage				$1,220,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Thickening				$960,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Dewatering				$1,400,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Conveyor				$560,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Processing				$2,620,000	EPA Cost Curves; ENR adjusted; Capdet verified
	Sludge Pumping				$250,000	EPA Cost Curves; ENR adjusted; Capdet verified
Construction Costs	Effluent Discharge Piping - 60 in	300	ft	600	$180,000	EPA Cost Curves; ENR adjusted
	Site Improvements				$1,000,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals				$550,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping				$2,000,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical				$2,200,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls				$1,000,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities				$750,000	Allowance to expand existing ITP facilities
	Laboratories				$500,000	Allowance to expand existing ITP facilities
	Controls & SCADA Building				$1,950,000	Allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$6,075,000	
	Total Construction Costs				**$26,300,000**	
	Subtotal (Equipment/Materials + Construction)				$34,700,000	
Indirect Costs	Engineer and Administrative Contingency, 40% of subtotal	40%			$13,880,000	
	Subtotal (With Engineering)				$48,580,000	
	Contingency 50%	50%			$24,290,000	
	Total Indirect Costs				**$38,200,000**	
	Total Capital Costs				**$72,900,000**	
	Personnel				$2,000,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Energy				$600,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
O&M Costs	Materials (Chemicals)				$1,200,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Monitoring				$200,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Maintenance				$600,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Sludge/Grit Disposal	7200	CY	100	$720,000	Based on SBWRP grit disposal cost
	Total Annual O&M Costs (35 MGD)				**$5,300,000**	
	Total Capital Cost				$72,900,000	
	Annual O&M Costs				$5,300,000	
	Service Life				40	
	Present Value of Service Life O&M				$174,023,836	
Life Cycle Cost	Major Upgrade(s) Cost at 20 years				$40,000,000	
	Present Value of Major Upgrade(s)				$32,716,278	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost (35 MGD)				**$280,000,000**	

Project 1, Sub-project 3: New Advanced Primary Treatment Plant (60 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
Equipment/Materials Costs	Headworks - Screens				$700,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Headworks - Grit Chambers				$750,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Grit dewatering and loading facility				$650,000	BPJ
	Ballasted Flocculation				$1,250,000	Manufacturer Information, Capdet verified
	Sludge Storage				$530,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Thickening				$290,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Dewatering				$1,600,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Conveyor				$1,300,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Pumping				$350,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Effluent Discharge Piping - 72 in	300		500	$150,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Allowance for Unquantified Line Items	5%			$1,713,250	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$9,300,000**	
Construction Costs	Headworks - Screens				$800,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Headworks - Grit Chambers				$1,400,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Grit dewatering and loading facility				$1,800,000	BPJ
	Ballasted Flocculation				$2,100,000	Manufacturer Information, Capdet verified
	Sludge Storage				$1,400,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Thickening				$1,000,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Dewatering				$1,100,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Conveyor				$600,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Processing Building				$2,800,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Pumping				$300,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Effluent Discharge Piping	300		750	$225,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Site Improvements				$1,200,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals				$720,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping				$2,700,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical				$2,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls				$1,550,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities				$900,000	allowance to expand existing ITP facilities
	Laboratories				$800,000	allowance to expand existing ITP facilities
	Controls & SCADA Building				$2,500,000	allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$8,008,500	
	Total Construction Costs				**$34,700,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$44,000,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$17,600,000	
	Subtotal (With Engineering)				$61,600,000	
	Contingency 50%	50%			$30,800,000	
	Total Indirect Costs				**$48,400,000**	
	Total Capital Costs				**$92,400,000**	
O&M Costs	Personnel				$2,700,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Energy				$770,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Materials (Chemicals)				$1,500,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Monitoring				$260,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Maintenance				$770,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Sludge/Grit Disposal	15,000	CY	100	$1,500,000	SBWRP grit disposal cost
	Total Annual O&M Costs				**$7,500,000**	
Life Cycle Cost	Total Capital Cost				$92,400,000	
	Annual O&M Costs				$7,500,000	
	Service Life				40	
	Present Value of Service Life O&M				$246,260,146	
	Major Upgrade(s) Cost at 20 years				$60,000,000	
	Present Value of Major Upgrade(s)				$49,074,416	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$390,000,000**	

Project 1, Sub-project 3: New Advanced Primary Treatment Plant (100 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
	Headworks - Screens		SY		$1,350,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Headworks - Grit Chambers		SY		$1,330,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Ballasted Flocculation	2	50 MGD	1350000	$2,700,000	Manufacturer Information, Capdet verified
	Sludge Storage				$1,150,000	EPA Cost Curves; ENR adjusted, Capdet verified
Equipment/Materials Costs	Sludge Thickening				$675,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Dewatering				$4,410,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Conveyor				$2,970,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Pumping				$750,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Effluent Discharge Piping - 72 in	300		500	$150,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Allowance for Unquantified Line Items	5%			$3,002,500	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$18,500,000**	
	Headworks - Screens				$1,500,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Headworks - Grit Chambers				$2,670,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Ballasted Flocculation				$4,200,000	Manufacturer Information, Capdet verified
	Sludge Storage				$2,650,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Thickening				$2,240,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Dewatering				$2,940,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Conveyor				$1,260,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Processing Building				$5,600,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Pumping				$750,000	EPA Cost Curves; ENR adjusted, Capdet verified
Construction Costs	Effluent Discharge Piping	300		750	$225,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Site Improvements				$1,950,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals				$1,150,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping				$4,300,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical				$4,450,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls				$2,480,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities				$1,350,000	allowance to expand existing ITP facilities
	Laboratories				$1,100,000	allowance to expand existing ITP facilities
	Controls & SCADA Building				$3,750,000	allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$13,369,500	
	Total Construction Costs				**$57,900,000**	
	Subtotal (Equipment/Materials + Construction)				$76,400,000	
Indirect Costs	Engineer and Administrative Contingency, 40% of subtotal	40%			$30,560,000	
	Subtotal (With Engineering)				$106,960,000	
	Contingency 50%	50%			$53,480,000	
	Total Indirect Costs				**$84,000,000**	
	Total Capital Costs				**$160,400,000**	
	Personnel				$2,850,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Energy				$900,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
O&M Costs	Materials (Chemicals)				$1,700,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Monitoring				$330,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Maintenance				$900,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Sludge/Grit Disposal	16200	CY	100	$1,620,000	SBWRP grit disposal cost
	Total Annual O&M Costs				**$8,300,000**	
	Total Capital Cost				$160,400,000	
	Annual O&M Costs				$8,300,000	
	Service Life				40	
	Present Value of Service Life O&M				$269,910,963	
Life Cycle Cost	Major Upgrade(s) Cost at 20 years				$80,000,000	
	Present Value of Major Upgrade(s)				$65,432,555	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$496,000,000**	

Project 1, Sub-project 3: New Advanced Primary Treatment Plant (163 MGD) - Opinion of Probable Cost

Category	Item	Quantity	Unit	Unit Price	Cost ($)	Source/Description
	Headworks - Screens		SY		$1,690,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Headworks - Grit Chambers		SY		$1,700,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Ballasted Flocculation	2	50 MGD		$1,900,000	Manufacturer Information, Capdet verified
	Sludge Storage				$1,550,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Thickening				$911,000	EPA Cost Curves; ENR adjusted, Capdet verified
Equipment/Materials Costs	Sludge Dewatering				$5,950,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Conveyor				$4,000,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Pumping				$1,010,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Effluent Discharge Piping - 96 in	300	ft	600	$180,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Allowance for Unquantified Line Items	5%			$3,787,550	5% of equipment/materials and construction line items
	Total Equipment/Materials Costs				**$22,700,000**	
	Headworks - Screens				$1,880,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Headworks - Grit Chambers				$3,400,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Ballasted Flocculation				$2,900,000	Manufacturer Information, Capdet verified
	Sludge Storage				$3,450,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Thickening				$3,020,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Dewatering				$3,970,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Conveyor				$1,700,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Processing Building				$7,560,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Sludge Pumping				$1,010,000	EPA Cost Curves; ENR adjusted, Capdet verified
Construction Costs	Effluent Discharge Piping	300	ft	900	$270,000	EPA Cost Curves; ENR adjusted, Capdet verified
	Site Improvements				$2,630,000	EPA Manual CD-53, 1980, ENR adjusted
	Misc. Metals				$1,550,000	EPA Manual CD-53, 1980, ENR adjusted
	Piping				$5,800,000	EPA Manual CD-53, 1980, ENR adjusted
	Electrical				$6,000,000	EPA Manual CD-53, 1980, ENR adjusted
	Controls				$3,350,000	EPA Manual CD-53, 1980, ENR adjusted
	Shop & Garage Facilities				$1,820,000	allowance to expand existing ITP facilities
	Laboratories				$1,490,000	allowance to expand existing ITP facilities
	Controls & SCADA Building				$5,060,000	allowance to expand existing ITP facilities
	General Contractor, Mob/Demob, Ins, Bonds, Gen Admin, Profit	30%			$17,058,000	
	Total Construction Costs				**$73,900,000**	
Indirect Costs	Subtotal (Equipment/Materials + Construction)				$96,600,000	
	Engineer and Administrative Contingency, 40% of subtotal	40%			$38,640,000	
	Subtotal (With Engineering)				$135,240,000	
	Contingency 50%	50%			$67,620,000	
	Total Indirect Costs				**$106,300,000**	
	Total Capital Costs				**$202,900,000**	
	Personnel				$3,750,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Energy				$1,100,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
O&M Costs	Materials (Chemicals)				$2,200,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Monitoring				$400,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Maintenance				$1,100,000	EPA cost curves, manufacturer information, adjusted for estimated sediment loads
	Sludge/Grit Disposal	22500	CY	100	$2,250,000	SBWRP grit disposal cost
	Total Annual O&M Costs				**$10,800,000**	
	Total Capital Cost				$202,900,000	
	Annual O&M Costs				$10,800,000	
	Service Life				40	
	Present Value of Service Life O&M				$354,614,610	
Life Cycle Cost	Major Upgrade(s) Cost at 20 years				$100,000,000.00	
	Present Value of Major Upgrade(s)				$81,790,694	
	Interest Rate				3%	
	Inflation Rate				2%	
	Location Adjustment Factor				1.0	United States
	Total Life Cycle Cost				**$640,000,000**	