Feasibility Analysis for Project 5: Enhance Mexico Wastewater Collection System to Reduce Flows into the Tijuana River

Technical Memorandum

USMCA Mitigation of Contaminated Tijuana Transboundary Flows Project

Prepared for:

EPA

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

ADF	average daily flow
AHWTP	Arturo Herrera Wastewater Treatment Plant
BOD	biochemical oxygen demand
CESPT	Comisión Estatal de Servicios Públicos de Tijuana
EID	Environmental Impact Document
EPA	United States Environmental Protection Agency
ERG	Eastern Research Group, Inc.
ITP	South Bay International Wastewater Treatment Plant
LMWTP	La Morita Wastewater Treatment Plant
MGD	million gallons per day
mg/L	milligrams per liter
NADB	North American Development Bank
O&M	operation and maintenance
PB1-A	Pump Station 1-A
PB1-B	Pump Station 1-B
PB-CILA	CILA Pump Station
SAB	San Antonio de los Buenos
SBOO	South Bay Ocean Outfall
USMCA	United States–Mexico–Canada Agreement

EXECUTIVE SUMMARY

PG Environmental conducted a feasibility analysis of Project 5, "Enhance Mexico Wastewater Collection System to Reduce Flows into the Tijuana River," one of 10 proposed projects identified to mitigate transboundary wastewater flows in the Tijuana River watershed under the United States–Mexico–Canada Agreement (USMCA). 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 purpose of Project 5 is to provide the facilities necessary to collect sanitary wastewater from the Tijuana metropolitan area and treat it in Mexico, thereby minimizing the flow of untreated wastewater into the Tijuana River and the Pacific Ocean. Project 5 will upgrade and expand the wastewater collector sewers, wastewater pump stations, and treatment facilities in Mexico to accommodate all sanitary wastewater flow from the current and future population of the city. PG considered both (1) targeted upgrades to specific collector sewers identified by the Comisión Estatal de Servicios Públicos de Tijuana (CESPT) as in need of rehabilitation and (2) a system-wide upgrade.

After receiving and validating unit project construction costs developed by CESPT and provided by the North American Development Bank, PG conducted a desktop analysis to estimate capital costs for each sub-project. These costs appear reasonable based upon available bid data from similar construction in the U.S. However, the lack of current annual operation and maintenance (O&M) expenditures for the City of Tijuana prevented estimation of the future O&M costs and 40-year life cycle costs for Project 5.

PG evaluated the feasibility and impacts of upgrading the wastewater collection infrastructure within the City of Tijuana: rehabilitating the entire existing Tijuana sanitary system, providing wastewater collection facilities for the currently unserved population, extending the sanitary sewer network to serve future population, and upgrading the collectors that CESPT prioritized for rehabilitation. PG drew the following conclusions on the feasibility of Project 5:

1. The major sources of untreated wastewater in the river are likely to be exfiltration from collectors, discharges from developed but unsewered areas of the city, and pump station failures within the local network. Rehabilitating the priority main collectors, extending sanitary service into developed but unsewered areas, and rehabilitating the pump stations in the local sanitary system will have a net positive effect on the water quality in the estuary and along the coastline. Rehabilitating the collectors will also increase the effectiveness of future wastewater treatment projects by reducing the volume and peak flow rate of wastewater to be treated. More data on the sources of untreated wastewater into the river are necessary to evaluate how much of an impact these projects will have.

2. Rehabilitating the priority collectors identified by CESPT (sub-project 1) is feasible from a construction standpoint. Estimates from CESPT suggest that the capital cost of rehabilitating/replacing the priority collector sewers listed in Appendix B is $149 million.

3. PG concluded that extending sanitary service to developed, but unsewered areas (sub-project 2) is feasible. PG estimates that the capital cost of extending sanitary service is $756 million, which includes indirect costs.

4. Rehabilitating the pump stations in the local sanitary sewer system (sub-project 3) is feasible from a construction standpoint; the associated capital cost is $84 million, which includes indirect costs.

5. Fully rehabilitating and upgrading the sanitary sewer system to serve the current and future population, including rehabilitating local sewer lines, rehabilitating the current lift stations, expanding the sanitary system to account for future growth, and increasing the treatment capacity of the city's treatment plants, would take decades and likely cost several billion dollars. Therefore, PG determined that rehabilitating and upgrading the system is not feasible within the scope of current funding provided by the USMCA, although these upgrades should occur as part of the city's long-term plan.

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 transboundary wastewater flows in the Tijuana River watershed. 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; project implementation schedule; regulatory, engineering, and any possible implementation issues; and social and environmental impacts.

This feasibility analysis specifically addresses Project 5: "Enhance Mexico Wastewater Collection System to Reduce Flows into the Tijuana River." During the analysis, PG consulted with stakeholders and reviewed previous work including the following:

- *Wastewater Collection Improvements for the City of Tijuana, Baja California* (Huitt-Zollars 2019).
- Comisión Estatal de Servicios Públicos de Tijuana (CESPT) cost estimates provided to PG by the North American Development Bank (NADB).

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

This report has been revised and finalized from the draft version based on comments and discussions with EPA. PG has identified additional information, listed below, that would enhance this feasibility analysis and is working with EPA to acquire this information. (This additional information could affect both project feasibility and project costs; this report uses best estimates for those costs, based on information available when it was finalized.)

- Better data on the source volumes and peak flow rates of untreated wastewater discharges into the Tijuana River.
- Current annual O&M expenditures for the City of Tijuana to estimate the future O&M costs and 40-year life cycle costs for Project 5.
- Data on the number and condition of the lift stations that are currently part of the Tijuana sanitary sewer system.
- Assessment of the condition of the Arturo Herrera and La Morita Treatment Plants.

Consistent with the task order scope, PG will work with EPA to develop and analyze several infrastructure alternatives, including a preferred alternative, to mitigate the transboundary wastewater and stormwater flows. The alternatives will include groupings of one or more projects evaluated in the feasibility analyses, scaled if necessary, and will be presented to EPA in the Alternatives Document. Where applicable, the Alternatives Document will also include any changes to the estimated costs or feasibility of this project based on evaluation of the additional information described above.

1.1 Project Purpose

The purpose of Project 5 is to provide the facilities necessary to collect sanitary wastewater from the Tijuana metropolitan area and treat it in Mexico, thereby minimizing the flow of untreated wastewater into the Tijuana River and the Pacific Ocean. Project 5 considered minimizing current discharges to the river by fixing collectors that are leaking sewage into the river or at risk of collapse, by expanding the sanitary sewer system to service unsewered areas, and by performing a system-wide rehabilitation and expansion of the sanitary sewer system to collect and treat all wastewater discharges from the current and future population.

1.2 Current Conditions

The existing wastewater collection system serving the Tijuana metropolitan area within the Tijuana River watershed collects wastewater from about 89% of city residents (Arcadis 2019). Collected wastewater flows are treated by four wastewater treatment plants, listed below in order of their current average daily flow (ADF) capacities:

1. The South Bay International Wastewater Treatment Plant (ITP), capacity 25 MGD ADF (Arcadis 2019).

2. The San Antonio de los Buenos (SAB) wastewater treatment plant, capacity 25 MGD ADF (Arcadis 2019).

3. The Arturo Herrera Wastewater Treatment Plant (AHWTP), capacity 10.5 MGD ADF (Arcadis 2019; CESPT 2020).

4. The La Morita Wastewater Treatment Plant (LMWTP), capacity 5.8 MGD ADF (Arcadis 2019; CESPT 2020).

The ITP and SAB plants treat wastewater conveyed via the International Collector, which has an annual ADF of about 37 MGD (Arcadis 2019). ITP treats about 25 MGD ADF of the wastewater conveyed by the International Collector. The treated effluent is discharged to the Pacific Ocean via the South Bay Ocean Outfall (SBOO). The remaining flow from the International Collector is routed to Pump Station 1-B (PB1-B). PB1-B pumps these sanitary flows through a conveyance line parallel with the conveyance line from Pump Station 1-A (PB1-A) toward the SAB treatment plant. The SAB plant is currently not equipped to effectively treat the total volume of wastewater conveyed from PB1-B and PB1-A. Therefore, a substantial portion of the wastewater routed toward the SAB plant is discharged via SAB Creek into the Pacific Ocean partially treated or untreated.

The Arcadis report estimates that an average of 4 to 6 MGD of wastewater escapes the sanitary sewer system and flows into the Tijuana River, primarily as a result of sewer system deterioration and pump station mechanical failures (Arcadis 2019). This estimate is consistent with International Boundary and Water Commission sampling data, which indicate that the BOD concentration in the Tijuana River on the Mexico side of the border ranges between 40 and 140 mg/L; compared to a BOD concentration of 387 mg/L in untreated wastewater from the sanitary sewer system. The Huitt-Zollars Environmental Impact Document (EID) identified collector collapses and pump station failures as the primary sources of untreated wastewater discharges into the Tijuana River (Huitt-Zollars 2019).

About 11% of Tijuana's current population does not have access to sanitary service. Therefore, sanitary wastewater generated by this population appears to flow directly to the Tijuana River. This untreated wastewater mixes with other flows in the Tijuana River, including the treated wastewater discharge from LMWTP, the treated wastewater discharge from AHWTP, exfiltrating groundwater, direct flow from unsewered areas, and stormwater runoff from the Tijuana metropolitan area.

During dry weather, river flows up to 23 MGD are intercepted and conveyed to the CILA Pump Station (PB-CILA), which normally routes these flows to PB1-B and to the Pacific Ocean via SAB Creek without further treatment. During wet-weather events where the river flows exceed 23 MGD, PB-CILA is shut off to protect the pumps. When PB-CILA is non-operational, river flows containing untreated wastewater cross the border into the U.S. and flow through the Tijuana River Estuary to the Pacific Ocean. Historically, PB-CILA has operated about 227 days per year (Arcadis 2019). Improvements currently underway at PB-CILA increase its discharge capacity to 35 MGD. Screening and sediment removal facilities are also being added to better protect the pumps at PB-CILA from damage causing by sediment and trash conveyed by the Tijuana River during wet weather. No information is available at this time on how PB-CILA's operating strategy will change once these improvements are completed. However, it appears that the improvements would allow PB-CILA to continue to operate during some wet-weather events.

Population projections from CESPT, discussed in the *Baseline Conditions Summary: Technical Document,* indicate that the City of Tijuana's population is 1.4 million now and will grow to 1.9 million by 2050. Because the Tijuana sanitary sewer system presently serves about 89% of the city population, about 150,000 people living in the metropolitan areas currently do not have sanitary sewer service—and another 500,000 people will need sanitary sewer service by 2050.

1.3 Major Project Elements Considered

PG examined six sub-projects related to Project 5. The first three, intended to mitigate untreated wastewater discharges to the Tijuana River under the current conditions, are as follows:

1. Rehabilitating targeted collector pipelines as identified by CESPT.
2. Extending wastewater collection facilities into developed but unsewered areas.
3. Rehabilitating or replacing existing local pump stations.

The other three sub-projects are intended to rehabilitate the existing local sanitary sewer network, expand the system to provide wastewater service to the projected population in 2050, and increase the effectiveness of wastewater treatment:

4. Rehabilitating or replacing the existing local sanitary sewer system.
5. Expanding the Tijuana sanitary sewer system to account for future growth.
6. Renovating and expanding treatment capacity in Tijuana to treat the wastewater captured by the sanitary system to accepted pollutant removal standards.

2. DESIGN INFORMATION

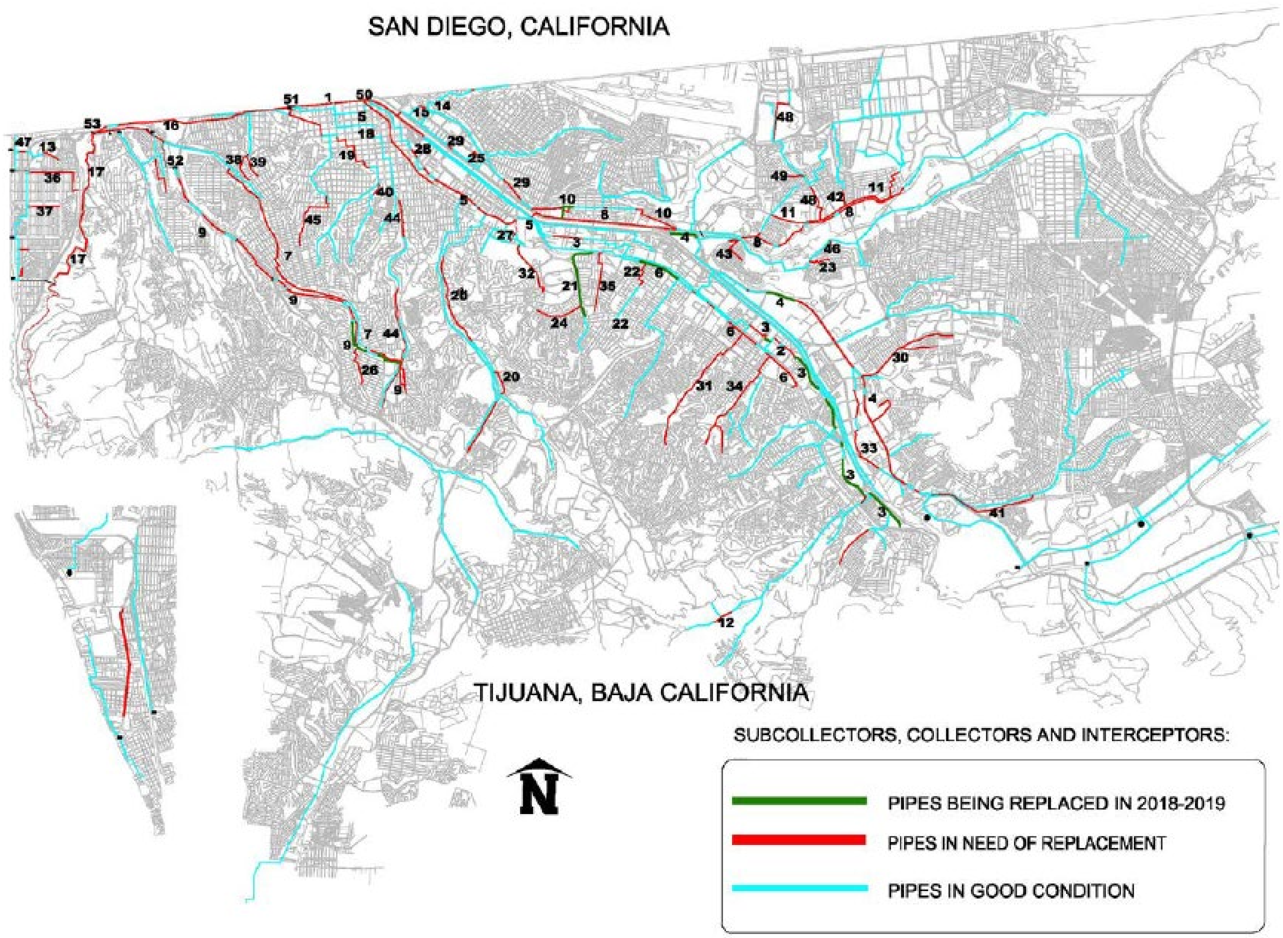
Sections 2.1 through 2.6 provide an overview of the sub-projects to rehabilitate and expand the Tijuana sanitary sewer system.

PG relied on information from the EID developed by Huitt-Zollars for NADB in 2019 (Huitt-Zollars 2019) and on a list of priority collectors identified by CESPT for rehabilitation in 2017 to evaluate the rehabilitation measures proposed for the existing major collector sewers serving Tijuana. PG examined sources of information and determined that the collectors that CESPT identified as high risk (impact > 10) matched the collectors that the EID identified as high risk (risk level 1 or 2)—with the exception of collectors that were rehabilitated in 2018, after the CESPT list was published but before the Huitt-Zollars EID was published.

No data were found on the extent or condition of the remainder of the local sanitary wastewater collection system serving the Tijuana metropolitan area beyond the data discussed in Section 2.1. Therefore, PG performed a theoretical desktop analysis to identify capital costs that might be incurred to renovate a local collection system based upon the size of the Tijuana service area and the population served. This analysis is based on PG's experience in similar-sized metropolitan areas in the U.S., in particular Houston, Texas. Houston's sanitary sewer system is of similar age to the Tijuana system and was constructed using similar pipe materials. The Houston system is also subject to high wastewater temperatures that promote development of hydrogen sulfide, which can attack cementitious pipe materials. Houston also has a large number of wastewater pump stations.

2.1 Sub-Project 1: Rehabilitate Targeted Collector Pipelines as Identified by CESPT

The 2019 EID (Huitt-Zollars 2019) identified 48 individual sections of main collector sewers in Tijuana that are in need of rehabilitation or replacement, as shown in Figure 2-1. Appendix B lists the individual sections of collectors referenced by the numbers shown in Figure 2-1.



Source: Huitt-Zollars 2019

Figure 2-1. Location and Condition of the Targeted Collector Pipes in Tijuana

Replacement of the International Collector is discussed in the Project 3 feasibility analysis. The remaining 47 sections of collector sewers were scored on a 1–4 scale in the 2019 Huitt-Zollars EID based on risk of failure (Huitt-Zollars 2019). A summary of the risk evaluation for each section is presented in Table 2-1, and a list of the individual sections proposed for rehabilitation is presented in Appendix B.

Table 2-1. Risk Characterization of Sections of Pipe in the City of Tijuana

Risk Level	Description	Number of Sections	Total Length (Feet)
1	High risk	4	51,000
2	Bad condition	3	32,000
3	Some deterioration	36	173,000
4	Good condition (rehabilitated in 2018)	4	62,000

PG evaluated the project capital costs estimated for rehabilitation/replacement for those collector sewers that were categorized as risk levels 1–3 and found those costs to be reasonable based upon the limited sewer condition information presented in the 2019 Huitt-Zollars EID and comparison with similar. Those project capital costs are presented in Section 4. PG did not evaluate the project capital costs to rehabilitate/replace the collectors categorized as risk level 4, which are apparently in relatively good condition.

2.2 Sub-Project 2: Extend Wastewater Collection Facilities into Developed But Unsewered Areas

Based on the population data discussed in Section 1.2, about 150,000 people currently living in the Tijuana metropolitan areas currently do not have sanitary sewer service. Given the density of development shown in aerial photography and our experience in communities across the U.S., PG estimates that up to 8 feet of new pipe per person might be needed to provide service in the existing unsewered areas. In comparison, Houston has about 15 feet of sewer per person, but correspondingly less dense development. Therefore, PG estimates that expanding the Tijuana sanitary system to accommodate the currently unserved population will require about 1.2 million feet of new sanitary sewers.

2.3 Sub-Project 3: Rehabilitate or Replace the Existing Local Pump Stations

The Tijuana sanitary sewer system reportedly may have up to 200 local pump stations in the wastewater collection system network. In developing project capital costs, PG has assumed that up to 20% of these existing pump stations (equivalent to 40 pump stations) may need major rehabilitation or replacement. Again, this percentage is consistent with the pump station renovation work required in Houston.

2.4 Sub-Project 4: Rehabilitate or Replace the Existing Local Sanitary Sewer System

As discussed above, 89% of Tijuana's 1,400,000 residents have sanitary sewer service. Based on PG's estimate of up to 8 feet of public sanitary sewer line per person, Tijuana currently has about 10 million feet of publicly owned sanitary sewers. In developing possible project capital costs, PG has assumed that up to 40% (corresponding to 4 million feet) of these existing sewers may need rehabilitation or replacement. This percentage is consistent with the level of sewer system renovation that has occurred in Houston. PG assumed that that renovating the city's local sanitary sewer network would consist of a 75/25 mix of rehabilitation and replacement (respectively), also consistent with the Houston system.

2.5 Sub-Project 5: Expand the Tijuana Sanitary Sewer System to Account for Future Growth

The population of Tijuana is expected to grow to 1.9 million by the year 2050 (as noted in Section 1.2), meaning the Tijuana sanitary sewer system will need to be expanded to serve 500,000 more people. As discussed above, PG estimates that up to 8 feet of new publicly owned sanitary sewer may be needed per person, which is consistent with the amount of new sewer per person presented in Section 2.2. Therefore, in developing project capital costs, PG estimates that 4 million feet of new sanitary sewers will need to be built.

2.6 Sub-Project 6: Expand the Treatment Capacity in Tijuana to Treat the Additional Wastewater Captured by the Sanitary System

For the expansion of the treatment plants in Mexico, PG has limited its desktop analysis effort to determining general treatment plant construction and renovation costs as presented in Section 4. PG has not evaluated specific treatment process alternatives or developed individualized renovation/expansion programs for the SAB plant, AHWTP, or LMWTP for Project 5. In developing project capital costs, PG has estimated that the City of Tijuana will need to add up to 34 MGD of treatment capacity to serve 150,000 current residents in unsewered parts of the Tijuana metropolitan area and 500,000 additional residents as the Tijuana metropolitan area grows. This treatment capacity estimate is based upon the assumption that each new person served would generate 50 gallons of wastewater per day. The current rated average daily treatment capacity of the AHWTP is 10.5 MGD and the rated capacity of the LMWTP is also 5.8 MGD. Both plants are reportedly functioning well. The SAB plant has a design capacity of 25 MGD but is reported to be operating poorly and likely will need to be fully replaced to provide wastewater treatment to the pollutant removal standards desired. Accordingly, PG proposes replacing the SAB plant with a 40 MGD secondary treatment plant and renovating/expanding the AHWTP and LMWTP to a combined rated average daily capacity of 18 MGD. The size of the expansion at each plant will depend on the locations of population growth.

2.7 Engineering Issues

The cost and complexity of installing new sanitary sewers or replacing existing sanitary sewers depends on many factors, including general urban development in the construction area, existing infrastructure that must be protected or moved, and geotechnical issues. Sewer replacement also causes substantial disturbance to construction area residents, businesses, and traffic passing through that must be mitigated as much as is practicable. For failing existing sewers, much of this disturbance can be avoided by rehabilitating sewers rather than replacing them. Rehabilitation is typically much less costly, primarily because of its lesser impact on other assets in the construction area, such as existing utilities and roadways. Replacement is typically limited to situations where the existing asset is greatly undersized or so severely deteriorated that rehabilitation is not feasible.

2.8 Implementation and Regulatory Issues

The renovation of the priority collectors and extension of the sanitary sewer system to unsewered areas of Tijuana will require substantial input from the City, CESPT, permitting agencies, residents in the construction area, local businesses, and those using the businesses in the construction area. However, the 2019 Huitt-Zollars EID did not identify any burdensome environmental regulatory approvals by Mexico regulatory authorities (Huitt-Zollars 2019). Additionally, because the project would take place entirely in Mexico, it is not expected to require any environmental regulatory approvals by U.S. federal, state, or local agencies.

The system-wide rehabilitation and expansion of the sanitary sewer system to fully collect, transport and treat wastewater flows from the current and future population (sub-projects 4, 5, and 6) would require a decades-long implementation timeline and extensive regulatory issues. Therefore, PG determined that the long implementation timeline renders sub-projects 4–6 is not feasible using USMCA funding.

3. PROJECT IMPACT

3.1 Water Quality Impacts

The primary sources of untreated wastewater discharges into the Tijuana River are exfiltration from the main collectors, drainage from unsewered areas of the city, and overflows from underperforming wastewater pump stations, as discussed in Section 1.2. PG expects that implementing sub-projects 1–3 would have a positive effect on water quality in the Tijuana River by addressing the primary sources:

1. Sub-project 1: Rehabilitating the targeted collectors will reduce exfiltration from these sewers and by reducing the risk of collector sewer collapses that result in untreated wastewater overflows into the Tijuana River.

2. Sub-project 2: Expanding sanitary service to unsewered areas will collect sewage that would otherwise flow into the Tijuana River.

3. Sub-project 3: Rehabilitating or replacing the existing pump stations would reduce the untreated wastewater discharges caused by pump failures.

The Tijuana River is not diverted to PB-CILA during wet weather; therefore, implementing sub-projects 1, 2, and 3 would reduce the raw sewage load that enters the Tijuana River Estuary. The reduction in untreated wastewater loads in wet-weather transboundary flows would have a positive effect on water quality in the estuary when transboundary flows occur. Additionally, implementing sub-projects 1, 2, and 3 would have a positive impact on beaches in southern San Diego County during the wet season (September 8–May 22), including the Navy SEALs training facility.

According to the Scripps Institution of Oceanography, about two-thirds of wet season impacts predicted to result in beach closures are due to untreated wastewater-laden Tijuana River flows (Feddersen et al. 2020). Eliminating the primary sources of untreated wastewater is likely to reduce the frequency of impacts that result in beach closures. Data on the sources of untreated wastewater that enter the river are limited, and more monitoring is needed to determine the extent that fixing the collectors expanding service to unsewered areas, and rehabilitating the pumps will reduce the untreated wastewater in wet-weather transboundary flows.

Implementing sub-projects 1, 2, and 3 would mitigate dry-weather discharges of untreated wastewater into the Tijuana River and have a positive effect on water quality upstream of PB-CILA. It would also have a positive effect on water quality in the estuary when the pumps that are designed to divert the river during dry weather malfunction. If PB-CILA, PB1-A, and PB1-B are operating normally, the river is diverted and transboundary river flows do not occur in dry weather. The diverted river water from PB-CILA is mixed with the raw sewage collected by the sanitary sewer system before routed through PB1-A and PB-1B, then ultimately discharged to the Pacific Ocean via SAB Creek. However, PB-CILA must be shut down if there is a significant pump failure at any of these three pump stations, which results in transboundary flows during dry weather. During these flows, preventing untreated wastewater discharges into the river by implementing sub-projects 1–3 would have a positive effect on estuary water quality.

According to Scripps, almost all dry-weather beach impacts resulting in predicted closures are caused by discharges into the Pacific Ocean via SAB Creek, which are not significantly affected by sub-projects 1, 2, and 3 (Feddersen et al. 2020). Rehabilitating the existing collectors may have a substantial positive effect on the water quality impacts of future treatment plant projects in the Tijuana River watershed.

Implementing sub-projects 4–6 will have a positive effect on water quality in the Tijuana River and the Pacific Ocean. The primary water quality impact of improvements to the sanitary sewer system includes enhancing the capture of wastewater flows and preventing them from entering the Tijuana River. Fully renovating the AHWTP and the LMWTP will maintain the performance level of these facilities. Replacing the SAB plant with a new 40 MGD treatment plant will provide enough capacity to treat the currently untreated wastewater, as well as future wastewater collected in Tijuana, which will substantially improve the water quality of discharges from SAB Creek. According to modeling by Scripps (Feddersen et al. 2020), if untreated wastewater discharges from SAB Creek are reduced to under 10 MGD, impacts predicted to result in beach closures in the U.S. will be eliminated during the dry season, and be reduced by about one-third during the wet season.

3.2 Sediment Impacts

PG determined that sediment loads that enter the estuary are primarily due to stormwater runoff flows in the Tijuana River during wet-weather events. Project 5 does not significantly affect these stormwater flows. Therefore, the wastewater collection and treatment system improvements proposed for Project 5 will not significantly affect the amount of sediment transported by the Tijuana River and ultimately deposited in the estuary or discharged to the Pacific Ocean.

3.3 Trash Impacts

Trash deposition in the estuary generally occurs due to wet-weather transboundary stormwater flows in the Tijuana River. Therefore, the impact of Project 5 on trash volumes carried to the estuary is negligible.

3.4 Non-Water-Quality Environmental Impacts

In conjunction with the feasibility assessments, ERG is currently preparing an EID that will describe the potential environmental impacts of the 10 proposed projects (including Project 5), focusing on impacts in the U.S. or caused by activities in the U.S. Based on a review of existing available information, Project 5 is not expected to trigger any non-water-quality environmental impacts of concern in the U.S.[1] The EID will include a more thorough evaluation of potential non-water-quality impacts in the U.S.

3.5 Social Impacts

Under Project 5, long-term positive socioeconomic impacts to affected populations in both the U.S. and Mexico (e.g., reduced public health risk and increased economic activity in coastal areas,

[1] 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.

expanded sewer service to unserved communities in Mexico) are expected to outweigh the negative, localized impacts during construction in Mexico (e.g., temporary increase in noise, equipment/dust emissions, and traffic). The ERG EID will include a more thorough evaluation of potential socioeconomic impacts in the U.S.

Project 5 would reduce contaminated transboundary flows near border infrastructure where the Tijuana River crosses into the U.S. Some of the priority collector upgrades take place in the canyons and upgraded collectors would reduce the amount of untreated wastewater that currently exfiltrates from the system and flows to the U.S. side of the border. This reduction in untreated wastewater flows is likely to have a net positive impact on U.S. Customs and Border Protection operations by reducing the pools of untreated wastewater in the canyon collectors that the agents are exposed to.

4. COST IMPACT ANALYSIS

PG developed comparative project construction cost estimates for Project 5 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.*

PG costs for construction are based on typical construction constraints in urban locations, including conflicts with existing utilities, traffic management, dust management, noise control, and normal soft-ground subsoil conditions. No information on unusual subsoil anomalies at construction locations, such as bedrock or high water tables, was available to PG, so PG did not factor such anomalies into the capital cost estimates. In developing the cost estimates, PG relied on manufacturers' cost information, bid tabulations from similar projects in the U.S. and Mexico in recent years, and R.S. Means Heavy Construction Cost Data 2020. PG's estimates are based on a 2020 *Engineering News-Record* (ENR) value of 11455. PG assumed that all construction could be accomplished in existing public rights-of-way; therefore, land/easement acquisition costs were not included. Project capital cost was based on project construction cost multiplied by a factor of 1.4 to account for project engineering and owner administration costs. That total was multiplied by a general contingency factor of 1.5 to account for unanticipated construction, unknown subsoils, and other factors. Therefore, project capital cost equals project construction cost × 1.4 × 1.5, which is equivalent to project construction cost × 2.1.

The project construction costs for rehabilitating or replacing the individual priority wastewater collectors were developed by CESPT in 2020 and provided to PG by NADB. These costs appear reasonable based on the limited information available about the current conditions of the collector sewers. PG applied the following unit project construction costs to estimate the overall construction costs for Project 5:

- Rehabilitating/replacing existing local sanitary sewers: $100/foot
- Rehabilitating/replacing existing pump stations (0.5 to 2.0 MGD): $1 million/station
- Rehabilitating the existing AHWTP and LMWTP: $3/gallon of capacity
- Extending sewer service to unserved populations: $300/foot
- Replacing the SAB plant: $6/gallon of capacity

The project construction costs PG assumed for the desktop analysis of renovating the existing local sanitary sewer network, extending sanitary service to unsewered areas, renovating pump stations, and renovating the three wastewater treatment plants in Mexico will cost approximately half the construction costs obtained from recent construction bids for comparable work in the U.S.

Table 4-1 and summarizes the capital and life cycle costs that PG estimated for Sub-projects 1; Table 4-2 and summarizes the capital and life cycle costs that PG estimated for Sub-projects 2 and 3 combined. An itemized cost impact analysis for each project is provided in Appendix A. PG does not have the data on the current O&M expenditures in the City of Tijuana, and therefore could not determine the O&M costs of implementing sub-projects 1, 2, and 3.

4.1 Sub-Project 1: Rehabilitate the Priority Collectors, Expand the Sanitary Sewer System to Serve Developed But Unsewered Areas and Rehabilitate the Existing Pump Stations

Table 4-1. Sub-project 1 Costs

Category	Item	Cost
Construction Costs	Rehabilitate collectors at EID risk level 1	$34,000,000
	Rehabilitate collectors at EID risk level 2	$7,000,000
	Rehabilitate collectors at EID risk level 3	$30,000,000
	Total construction cost	**$71,000,000**
Indirect cost	Rehabilitate collectors at EID risk level 1	$37,600,000
	Rehabilitate collectors at EID risk level 2	$7,800,000
	Rehabilitate collectors at EID risk level 3	$33,000,000
	Total indirect cost	**$78,000,000**
Total capital costs		**$149,000,000**

Source: CESPT 2020

4.2 Sub-Project 2: Expand the Sanitary Sewer System to Serve Developed But Unsewered Areas

Table 4-2. Sub-projects 2 Costs

Category	Item	Cost
Construction Costs	Expand the sanitary sewer system to serve developed but unsewered areas	$360,000,000
	Total construction cost	**$360,000,000**
Indirect cost	Engineer and Administrative Contingency	$144,000,000
	Contingency	$252,000,000
	Total indirect cost	**$396,000,000**
Total capital costs		**$756,000,000**

4.3 Sub-Project 3: Rehabilitate the Existing Pump Stations

Table 4-3. Sub-project 3 Costs

Category	Item	Cost
Construction Costs	Rehabilitate the Existing Pump Stations	$40,000,000
	Total construction cost	**$40,000,000**
Indirect cost	Engineer and Administrative Contingency	$16,000,000
	Contingency	$28,000,000
	Total indirect cost	**$44,000,000**
Total capital costs		**$84,000,000**

4.4 Sub-Projects 4, 5 and 6: Fully Rehabilitate the Local Sanitary Sewer Network, Expand it to Serve the Current and Future Population

PG used the desktop analysis of sub-projects 4, 5, and 6 to estimate the cost of fully upgrading the local sanitary system, expanding the sanitary system to account for the projected population, and treating the wastewater collected by the sanity system. PG's desktop analysis estimated that implementing sub-projects 4, 5, and 6 will cost several billion dollars.

5. DISCUSSION

5.1 Feasibility

PG determined that replacing the collectors that CESPT identified for both short- and medium-term rehabilitation (sub-project 1) is technically feasible. PG also determined that rehabilitating the collectors would have a net positive social effect on the Mexico side of the border, as discussed in Section 3.5. Additionally, failure to rehabilitate collectors that need repair is likely to increase the amount of sewage that exfiltrates to the Tijuana River, which may affect the effectiveness of current and future infrastructure designed to improve water quality on both the U.S. and Mexico sides of the border.

PG determined that rehabilitating the remainder of Tijuana local sanitary sewer network and expanding it to serve entire current and future populations (sub-projects 4 through 6) is technically feasible but would likely require an extended period to complete. From a construction cost versus environmental benefit perspective, it appears that the initial focus of Project 5 should be rehabilitating/replacing the major collector sewers identified in Appendix B within the next 10 years (sub-project 1). The second priority for construction should be extending sewer service to developed, but unsewered areas in the Tijuana metropolitan area within the next 20 years (sub-project 2) and renovating and replacing the existing pump stations within the existing system (sub-project 3). The remaining sewer renovations and replacement, expansions for future growth, and wastewater treatment plant renovations and expansions should then follow over the next 40 years (sub-projects 4 through 6).

5.2 Other Stakeholder Information

PG did not identify other impacts from implementation of Project 5.

6. CONCLUSION

PG evaluated the feasibility and impacts of upgrading the wastewater collection infrastructure within the City of Tijuana. PG's evaluation included rehabilitating the entire existing Tijuana sanitary system, expanding the existing system to provide service to the current unserved population and future population, and upgrading the collectors that CESPT prioritized for rehabilitation. PG drew the following conclusions on the feasibility of Project 5:

1. The present major sources of untreated wastewater in the river are exfiltration from collectors, developed but unsewered areas of the city, and pump failures at pump stations within the local network. Rehabilitating the priority main collectors, extending sanitary service into developed but unsewered areas, and rehabilitating the pump stations in the local sanitary system will have a net positive effect on the water quality in the estuary and along the coastline. Additionally, the rehabilitation of the collectors increases the effectiveness of future wastewater treatment projects by not diluting the untreated wastewater. More data on the sources of untreated wastewater into the river are needed to evaluate how much of an impact these projects will have.

2. Rehabilitating the priority collectors identified by CESPT (sub-project 1) is feasible from a construction standpoint. Estimates from CESPT suggest that the capital cost of rehabilitating/replacing the priority collector sewers listed in Appendix B is $149 million.

3. Extending sanitary service to developed, but unsewered areas (sub-project 2) is feasible from a construction standpoint. PG estimates that the capital cost of extending sanitary service is $756 million, which includes indirect costs.

4. Rehabilitating the pump stations in the local sanitary sewer system (sub-project 3) is feasible from a construction standpoint. PG estimates that the associated capital cost is $84 million, which includes indirect costs.

5. Fully rehabilitating and upgrading the sanitary sewer system to serve the current and future population including rehabilitating local sewer lines (sub-project 4), expanding the sanitary system to account for future growth (sub-project 5), and increasing the treatment capacity of the city's treatment plants (sub-project 6) would take decades and likely cost several billion dollars. Therefore, rehabilitating and upgrading the system is not feasible within the scope or current level of funding provided by the USMCA, although these upgrades should occur as part of the long-term infrastructure renewal plan for the City of Tijuana.

7. SUGGESTED NEXT STEPS

1. Conduct further monitoring to assess the sources of untreated discharges into the river, and what water quality impacts the implementation of Project 5 will have on transboundary flows.

2. Identify what areas of the city are currently unsewered and develop a plan to extend service to them.

3. Identify and prioritize which pump stations need rehabilitation or replacement.

8. REFERENCES

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APPENDIX A: Itemized Cost Impact Analysis

Subproject 1: Rehabilitating Targeted Collectors - Opinion of Probable Cost

EID Risk Level	Category	Item	Cost (Including Tax) ($)
1	Construction Costs	Rehabilitate Risk Level 1 Collectors	$34,144,790
	Indirect Cost	Subtotal	$34,144,790
		Engineer and Administrative Contingency, 40% of subtotal	$13,657,916
		Subtotal (Including Engineering)	$47,802,706
		Contingency, 50% of Subtotal (Including Engineering)	$23,901,353
		Total Indirect Costs	$37,559,269
		Total Level 1 Capital Costs	**$71,700,000**
2	Construction Costs	Rehabilitate Risk Level 2 Collectors	$7,089,108
	Indirect Cost	Subtotal	$7,089,108
		Engineer and Administrative Contingency, 40% of subtotal	$2,835,643
		Subtotal (Including Engineering)	$9,924,751
		Contingency, 50% of Subtotal (Including Engineering)	$4,962,376
		Total Indirect Costs	$7,798,019
		Total Level 2 Capital Costs	**$14,900,000**
3	Construction Costs	Rehabilitate Risk Level 3 Collectors	$29,545,971
	Indirect Cost	Subtotal	$29,545,971
		Engineer and Administrative Contingency, 40% of subtotal	$11,818,388
		Subtotal (Including Engineering)	$41,364,359
		Contingency, 50% of Subtotal (Including Engineering)	$20,682,179
		Total Indirect Costs	$32,500,568
		Total Level 3 Capital Costs	**$62,000,000**
Total Cost		Total Construction Costs	$70,779,868
		Total Engineer and Administrative Contingency, 40% of subtotal	$28,311,947
		Total Contingency, 50% of Subtotal (Including Engineering)	$49,545,908
		Total Indirect Costs	**$77,900,000**
		Total Capital Costs	**$149,000,000**

Sub-project 2: Rehabilitating and Expanding the Tijuana Sanitary Sewer System - Opinion of Probable Cost from Desktop Analysis

Category	Quantity	Unit	Unit Price ($/Unit)	Cost ($)
Construction Costs	1,200,000	LF	300	$360,000,000
		Total Construction Costs		**$360,000,000**
Indirect Costs		Engineer and Administrative Contingency, 40% of subtotal		$144,000,000
		Subtotal (With Engineering)		$504,000,000
		Total Contingency, 50% of Subtotal (Including Engineering)		$252,000,000
		Total Indirect Costs		**$396,000,000**
		Total Capital Costs		**$756,000,000**

Sub-project 3: Rehabilitating and Expanding the Tijuana Sanitary Sewer System - Opinion of Probable Cost from Desktop Analysis

Category	Quantity	Unit	Unit Price ($/Unit)	Cost ($)
Construction Costs	40	Station	1,000,000	$40,000,000
		Total Construction Costs		**$40,000,000**
Indirect Costs		Engineer and Administrative Contingency, 40% of subtotal		$16,000,000
		Subtotal (With Engineering)		$56,000,000
		Total Contingency, 50% of Subtotal (Including Engineering)		$28,000,000
		Total Indirect Costs		**$44,000,000**
		Total Capital Costs		**$84,000,000**

APPENDIX B: List of Priority Collectors

Note: *All Estimated Costs are From Cost Estimates Developed by CESPT and Provided to PG Environmental by NADB, Risk Tiers are from WASTEWATER COLLECTION IMPROVEMENTS FOR THE CITY OF TIJUANA, BAJA CALIFORNIA: TRANSBOUNDARY ENVIRONMENTAL INFORMATION DOCUMENT*

Exchange Rate 1 USD = 20 Pesos

Figure 1-1 ID Number	Collector Name	EID Risk Level	Diameter(s) (cm)	Cost (Present Value) (pesos)	Cost (Including Tax) (pesos)	Cost (Present Value) ($)	Cost (Including Tax) ($)
2	Interceptor Poniente (tramos faltantes)	1	107,91,76,45,38	185,760,475	215,482,151	$9,290,000	$10,800,000
7	Oriente (Buena Vista)	1	107	45,526,000	52,810,160	$2,280,000	$2,640,000
15	Emisor Antiguo a presión	1	107	110,084,000	127,697,440	$5,500,000	$6,380,000
16	Emisor SAAS (2da etapa) a gravedad	1	152	247,332,800	286,906,048	$12,400,000	$14,300,000
4	Colector Sánchez Taboada (tramos faltantes)	2	107,91,76,30	4,914,000	5,700,240	$246,000	$285,000
8	INV Nuevo	2	53, 45,38,30	73,049,600	84,737,536	$3,650,000	$4,240,000
18	Colector Carranza	2	45,53,61,76	44,262,400	51,344,384	$2,210,000	$2,570,000
5	Poniente Antiguo	3	45,38	42,489,408	49,287,713	$2,120,000	$2,460,000
10	Industrial	3	76,61,45	77,771,200	90,214,592	$3,890,000	$4,510,000
11	San Martín-Cañón del Sainz	3	30,76	6,477,527	7,513,932	$324,000	$376,000
12	De las Nieves (tramos faltantes)	3	45,30	4,316,000	5,006,560	$216,000	$250,000
13	Zapata (tramos faltantes)	3	30	530,400	615,264	$26,500	$30,800
14	Padre Kino (aportación local)	3	61	3,767,400	4,370,184	$188,000	$219,000
17	Colector Central	3	61	2,730,000	3,166,800	$137,000	$158,000
19	Colector Ensenada	3	45,38,25	30,365,400	35,223,864	$1,520,000	$1,760,000
21	Subcolector Ermita (2da etapa)	3	30, 38	5,584,800	6,478,368	$279,000	$324,000
22	Subcolector El Lago	3	30	2,688,400	3,118,544	$134,000	$156,000
23	Subcolector Lomas Campestre	3	30	5,564,000	6,454,240	$278,000	$323,000
24	Colector Pasteje (Tramo en Zona Río)	3	61	5,168,800	5,995,808	$258,000	$300,000
25	Subcolector Obrera	3	38	11,996,400	13,915,824	$600,000	$696,000
26	Torres de Agua Caliente	3	45	5,512,000	6,393,920	$276,000	$320,000
27	Lateral Zona Río	3	61	109,200	126,672	$5,460	$6,330
28	Oriente Viejo	3	30, 61	26,036,400	30,202,224	$1,300,000	$1,510,000
29	Cochimies	3	45,38	32,708,000	37,941,280	$1,640,000	$1,900,000
30	Rosario Salado	3	45	33,810,400	39,220,064	$1,690,000	$1,960,000
31	Campestre	3	38	10,155,600	11,780,496	$508,000	$589,000
32	La Campiña	3	45	19,364,800	22,463,168	$968,000	$1,123,000
33	Trigarante	3	45,30	34,153,600	39,618,176	$1,710,000	$1,980,000
34	Las Palmas	3	30	7,207,200	8,360,352	$360,000	$418,000
35	Parque México Sur	3	30	8,080,800	9,373,728	$404,000	$469,000
36	Parque Azteca Sur	3	38,30	5,577,000	6,469,320	$279,000	$323,000
37	Progreso	3	25	2,613,000	3,031,080	$131,000	$152,000
38	Unión	3	20	1,761,500	2,043,340	$88,100	$102,000
39	Yucatan	3	20	997,750	1,157,390	$49,900	$57,900
40	Florido	3	76,61,53	51,542,400	59,789,184	$2,580,000	$2,990,000
41	Tecnológico	3	61	9,045,400	10,492,664	$452,000	$525,000
42	Alamos	3	20	3,071,250	3,562,650	$154,000	$178,000
43	Fundadores	3	25	21,270,600	24,673,896	$1,060,000	$1,230,000
44	Maclovio Herrera	3	25	6,372,600	7,392,216	$319,000	$370,000
45	Torres del Lago	3	30	650,000	754,000	$32,500	$37,700
46	Pacifico	3	61	1,474,200	1,710,072	$73,700	$85,500
47	Garita	3	30, 45, 61	27,088,750	31,422,950	$1,350,000	$1,570,000
48	Plazas	3	25	1,361,100	1,578,876	$68,100	$78,900