

Puerto Rico Aqueduct and Sewer Authority



FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

To satisfy the requirements of Section 7.07 of the 2012 Master Agreement of Trust by and between PRASA and Banco Popular de Puerto Rico, as Trustee, and the requirements between PRASA, the Government of Puerto Rico and the Puerto Rico Fiscal Agency and Financial Advisory Authority.

December 2019

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY



Melissa L. Pomales, PE, ENV SP, PMP
Director
Arcadis Caribe, PSC



Luis A. Santiago, PE
Area Leader/Operations Manager, Water
Arcadis Caribe, PSC



José E. Rosich, PE, PMP
Sr. Project Manager
Arcadis Caribe, PSC

**FISCAL YEAR 2019
CONSULTING
ENGINEER'S REPORT
FOR THE PUERTO
RICO AQUEDUCT AND
SEWER AUTHORITY**

Prepared for:

Efraín Acosta

Executive Director of Finance

Puerto Rico Aqueduct and Sewer Authority

PO Box 7066

San Juan, PR 00916-7066

Prepared by:

Arcadis Caribe, P.S.C.

48 Carr 165 OFC 401

Guaynabo, PR 00968

Tel 787 777 4000

Fax 787 792 8931

Our Ref.:

W925.01

Date:

December 2019

This document is intended only for the use of the individual or entity for which it was prepared and may contain information that is privileged, confidential and exempt from disclosure under applicable law. Any dissemination, distribution or copying of this document is strictly prohibited.

CONTENT

Acronyms and Abbreviations.....	viii
DISCLAIMER	xiii
STATEMENT OF DISCLOSURE	xiii
Executive Summary.....	ES-1
E.1. Introduction	ES-1
E.2. Puerto Rico's Current Fiscal Situation.....	ES-1
E.3. Organizational Updates and Changes.....	ES-2
E.4. Condition of System.....	ES-4
E.5. O&M Practices and Strategic Plan	ES-6
E.6. Capital Improvement Program and Regulatory Compliance	ES-9
E.7. Insurance Program	ES-10
E.8. System Assets and Financial Analysis	ES-11
E.9. Conclusions	ES-16
1 Introduction	1-1
1.1 Introduction	1-1
1.2 Consulting Engineer's Report Purpose and Requirement.....	1-1
1.3 Conventions.....	1-2
1.4 Acronyms	1-2
2 Puerto Rico's Current Fiscal Situation	2-1
2.1 Overview	2-1
2.2 Puerto Rico Oversight, Management and Economic Stability Act (PROMESA) and PRASA's Fiscal Plan	2-2
3 Organizational Updates and Changes.....	3-1
3.1 Introduction	3-1
3.2 Updates and Changes in PRASA's Organization and Management.....	3-2
3.2.1 Board of Directors (Governing Board).....	3-2
3.2.2 Executive Management Team.....	3-4
3.2.3 Staffing Profile	3-5
3.2.4 Labor Relations	3-7

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

3.2.5 Training.....3-12

3.3 Conclusions3-13

4 Condition of System4-1

4.1 Introduction4-1

4.2 Facility Inspections.....4-1

4.2.1 Inspections Methodology.....4-2

4.2.2 Inspection Results4-3

4.3 Buried Infrastructure4-31

4.3.1 Water Meters4-31

4.3.2 Water Distribution System.....4-32

4.3.3 Non-Revenue Water.....4-32

4.3.4 Wastewater Collection System.....4-39

4.4 Conclusions4-43

5 O&M Practices and Strategic Plan.....5-1

5.1 Introduction5-1

5.2 O&M Costs.....5-1

5.3 Support Departments and Regional O&M Highlights5-2

5.3.1 Department Updates5-3

5.3.2 Regional Updates: Challenges and Initiatives.....5-15

5.4 Strategic Plan.....5-21

5.4.1 Key Performance Indicators5-21

5.5 On-Going Programs and Initiatives.....5-23

5.5.1 Integrated Maintenance Program (IMP)5-23

5.5.2 Non-Revenue Water Reduction Program5-25

5.5.3 Comprehensive Energy Management Program.....5-29

5.6 Treatment Plant Automation Program5-30

5.7 Conclusions5-31

6 Capital Improvement program and Regulatory Compliance Status6-1

6.1 Introduction6-1

6.1.1 PRASA's CIP Status.....6-1

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

6.2	CIP Implementation Management	6-2
6.3	CIP: Project Distribution and Costs	6-2
6.3.1	Project Classification and Prioritization	6-3
6.3.2	CIP Metrics and KPIs	6-4
6.4	Six-Year CIP (FY2019-FY2024)	6-5
6.4.1	Water System Projects	6-8
6.4.2	Wastewater System Projects	6-8
6.4.3	Adaptation for Climate Change and Resilience	6-8
6.4.4	Other Projects: Hurricane Repairs, R&R, Buildings, Energy Optimization, and Others ..	6-8
6.5	CIP and Current Regulatory Compliance	6-10
6.5.1	2015 USEPA Consent Decree Modifications	6-12
6.5.2	2006 PRDOH Drinking Water Settlement Agreement Renegotiation between PRASA and PRDOH.....	6-13
6.5.3	Consent Decrees and Agreements Progress Reports	6-14
6.6	Future Regulations and Other Regulatory Requirements	6-24
6.7	Conclusions	6-25
7	Insurance Program	7-1
7.1	Introduction	7-1
7.2	Risk Management.....	7-1
7.2.1	PRASA Insurance Department.....	7-2
7.2.2	Identification of Risk	7-2
7.3	Assessment of Insurance Program.....	7-3
7.3.1	Property Insurance	7-3
7.3.2	Crime	7-6
7.3.3	General Liability.....	7-8
7.3.4	Automobile Liability.....	7-9
7.3.5	Umbrella and Excess Liability	7-11
7.3.6	Directors and Officers Liability.....	7-11
7.3.7	Employment Practices Liability.....	7-13
7.3.8	Premises Pollution Liability.....	7-14
7.3.9	Accident Liabilities for Travel and Divers	7-14

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

7.3.10	Cyber Liability	7-15
7.4	Owner Controlled Insurance Program	7-15
7.4.1	Contractors All Risk –Completed value Builder's Risk.....	7-16
7.4.2	Commercial General Liability	7-18
7.4.3	Commercial Umbrella Liability.....	7-19
7.4.4	Contractor's Pollution Liability	7-19
7.4.5	Professional Liability.....	7-19
7.5	Conclusions	7-19
8	System Assets and Financial Analysis	8-1
8.1	Introduction	8-1
8.2	System Assets	8-1
8.3	PRASA's Rate Structure.....	8-2
8.3.1	Additional Provisions for Rate Increases.....	8-6
8.4	FY2019 Preliminary Results and FY2020-FY2024 Forecast	8-7
8.4.1	Operating Revenues.....	8-8
8.4.2	Authority Revenues (Other Sources of Revenues).....	8-17
8.4.3	Operational (Current) Expenses.....	8-17
8.5	Debt Service	8-28
8.5.1	Master Agreement of Trust.....	8-28
8.5.2	Debt Service Coverage	8-30
8.6	Reserve and Funds Deposit Requirements.....	8-34
8.6.1	Debt Service Reserve Funds	8-34
8.6.2	Operating Reserve Fund	8-34
8.6.3	Capital Improvement Fund	8-35
8.6.4	Construction Fund.....	8-36
8.6.5	Commonwealth Payments Fund	8-36
8.6.6	Surplus Fund and Rate Stabilization Account.....	8-37
	Conclusions.....	8-37
9	Conclusions and Recommendations	9-1
9.1	Considerations and Assumptions	9-1

TABLES

Table ES-1. PRASA Metrics vs. Water/Wastewater Utilities Benchmarks	ES-7
Table ES-2. FY2019 KPI Goals and Results.....	ES-7
Table ES-3. PRASA's Proposed Fiscal Plan Annual Rate Adjustments by Customer Type	ES-12
Table ES-4. Finalized Renegotiated Terms for SRF and RD Debt.....	ES-14
Table ES-5. FY2019 Debt Service Obligations and Preliminary Results (\$, Thousands)	ES-14
Table ES-7. FY2019 - FY2024 Debt Service Coverage.....	ES-15
Table 3-1. PRASA's Governing Board Members as of September 30, 2019	3-3
Table 4-1. Percent of Assets Inspected by Asset Category.....	4-2
Table 4-2. Summary of Inspections by Region	4-2
Table 4-3. WTPs – Comparison of Average Inspections Results for 2008-2019.....	4-4
Table 4-4. FY2019 WTPs – Lowest Rated Facilities and Observations	4-6
Table 4-5. WWTPs – Comparison of Average Inspection Results for 2008-2019	4-14
Table 4-6. FY2019 WWTPs – Lowest Rated Facilities and Observations	4-16
Table 4-7. Wells – Comparison of Average Inspections Results for 2008-2019.....	4-24
Table 4-8. WPSs – Comparison of Average Inspections Results for 2008-2019	4-26
Table 4-9. WWPSs – Comparison of Average Inspections Results for 2008-2019	4-28
Table 4-10. WSTs – Comparison of Average Inspections Results for 2008-2019.....	4-30
Table 4-11. Water Losses and Non-Revenue Water	4-33
Table 4-12 Reported Leaks from FY2014 to FY2019	4-36
Table 4-14. Reported Overflows from FY2014 to FY2019.....	4-40
Table 4-15. Annual Average Backlog of Pending Overflows	4-42
Table 4-16. 2019 vs 2018 Asset Condition Inspections Results Summary	4-43
Table 5-1. PRASA FY2019 O&M Water System Budget Benchmarks	5-2
Table 5-2. PRASA FY2019 O&M Wastewater System Budget Benchmarks	5-2
Table 5-3. New and Future Initiatives and Projects by Operational Region	5-17
Table 5-4. FY2019 PRASA Operations Key Performance Indicators	5-22
Table 5-5. PRASA PPAs	5-30
Table 6-1. Capital Improvement Program FY2019-FY2024 by Category (\$, Million) ¹	6-6
Table 6-2. PRASA's Base CIP Projections FY 2019 - FY 2024 (\$, in Millions) ¹	6-9

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 6-3. Summary of FOG Program Inspections March 2018 to August 20186-19

Table 8-1. Fixed Assets Balance through June 30, 2018 (\$, Millions).....8-1

Table 8-2. Preliminary Fixed Assets Balance through June 30, 2019 (\$, Millions).....8-2

Table 8-3. Fixed Assets Changes (\$, Millions).....8-2

Table 8-4. 2013 Residential Monthly Base Charge per Account (includes first 10 cubic meters of monthly consumption).....8-3

Table 8-5. Residential Volumetric Rate per Cubic Meter8-3

Table 8-6. Residential Environmental Compliance and Regulatory Charge (ECRC)8-3

Table 8-7. Non-Residential Monthly Base Charge per Account.....8-4

Table 8-8. Commercial and Government Volumetric Rate per Cubic Meter.....8-4

Table 8-9. Industrial Volumetric Rate per Cubic Meter8-4

Table 8-10. ECRC for Non-Residential Customers.....8-4

Table 8-11. PRASA's Proposed Fiscal Plan Annual Rate Adjustments by Customer Type8-5

Table 8-12. PRASA's Other Customer Service Charges8-6

Table 8-13. PRASA Operating Revenues (\$, Millions)8-9

Table 8-14. PRASA Service Revenues Net of Subsidies (\$, Millions).....8-9

Table 8-15. Water and Wastewater Subsidized Customer Accounts FY2019.....8-10

Table 8-16. PRASA Customer Accounts.....8-11

Table 8-17. Average Monthly Billed Consumption by Class (1,000 Cubic Meters)8-11

Table 8-18. Average Monthly Consumption per Account (Cubic Meters).....8-11

Table 8-19: Macroeconomic Indicators Assumption for Service Revenue Projection8-12

Table 8-20. 2019 PRASA Fiscal Plan Revenue Enhancing Initiatives (\$, Millions)8-15

Table 8-21. PRASA Operating Expenses (\$, Millions).....8-18

Table 8-22. 2019 PRASA Fiscal Plan Expense Savings Initiatives (\$, Millions).....8-25

Table 8-23. Summary of 2012 MAT DSC Requirements, as amended8-29

Table 8-24. Renegotiated Terms for SRF and RD Debt8-32

Table 8-25. FY2019 Debt Service Obligations and Preliminary Results (\$, Thousands)8-32

Table 8-26. FY2020-FY2024 Debt Service Obligations (\$, Thousands).....8-32

Table 8-27. FY2019 - FY2024 Debt Service Coverage8-33

FIGURES

Figure 3-1. PRASA Regions.....	3-1
Figure 3-2. PRASA Current Executive Management Structure	3-2
Figure 4-1. Water Balance Summary	4-33
Figure 4-2. Island-Wide Weekly Average Leaks Reported and Repaired	4-37
Figure 4-3. Island-Wide Weekly Average Pending Leaks with Duration >7 Days	4-38
Figure 4-4. Island-Wide Weekly Average Overflows Reported and Repaired	4-41
Figure 4-5. Island-Wide Weekly Average Pending Overflows with Duration >7 Days.....	4-42
Figure 5-1. Tank Pressure Management / Visualization Workflow	5-28
Figure 6-1. Six-Year CIP Capital Expenditures by Category	6-7

ACRONYMS AND ABBREVIATIONS

ABT	Additional Bonds Test
ACA	Asset Condition Assessment
AAFAF	Puerto Rico Fiscal Agency and Financial Advisory Authority (Spanish Acronym)
AMR/AMI	Automatic Meter Reading and/or Advanced Metering Infrastructure
AOP	All Other Perils
ASG	General Services Administration of Puerto Rico (Spanish Acronym)
AWWA	American Water Works Association
B	Billion
BOD	Biological Oxygen Demand
BOR	Broker of Record
CAA	Coefficient of Annual Adjustment
CAGR	Compound Annual Growth Rate
CT	Contact Time
CBA	Collective Bargaining Agreement
CCL	Contaminant Candidate List
CCP	Corrosion Control Program
CER	Consulting Engineer's Report
CGI	Commonwealth Guaranteed Indebtedness
CIP	Capital Improvements Program
CSO	Commonwealth Supported Obligations
CSWO	Combined Sewer Overflow
CWA	Clean Water Act
DBP	Disinfection Byproducts
DBPR	Disinfection Byproducts Rule
BPR	Biannual Progress Report
DSC	Debt Service Coverage
ECRC	Environmental Compliance and Regulatory Charge
DMR	Discharge Monitoring Report

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

EPC	Energy Performance Contract
EPL	Excess Employment Practices Liability
ERS	Employee Retirement System
ESCO	Energy Service Companies
FEMA	Federal Emergency Management Agency
FOG	Fats, Oil and Grease
FY	Fiscal Year
GDB	Government Development Bank for Puerto Rico
GIS	Geographic Information System
gpm	gallons per minute
GWUDI	Groundwater Under the Direct Influence of Surface Water
HAA	Haloacetic Acid
HIEPAAA	<i>Hermanidad Independiente de Empleados Profesionales de la Autoridad de Acueductos y Alcantarillados</i>
ILI	Infrastructure Leakage Index
IMP	Integrated Maintenance Program
KPI	Key Performance Indicators
kWh	Kilowatt-Hour
LOC	Line of Credit
LTCP	Long-Term Control Plan
LTP2	Long-Term 3 Projects
LTP3	Long-Term 3 Projects
M	Million
M&V	Measurement and Verification
MAPFRE	MAPFRE PRAICO Insurance Company
MARSH	Marsh Saldaña
MAT	Master Agreement of Trust
MCC	Motor Control Center
MDT	Mobile Data Terminal

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

MG	Million Gallons
MGD	Million Gallons per Day
MRP	Materials Requirement Planning
N	Nitrogen
NMC	Nine Minimum Controls
NPDES	National Pollutant Discharge Elimination System
NPW	Non-Potable Water
NRW	Non-Revenue Water
OCIP	Owner Controlled Insurance Program
O&M	Operation and Maintenance
OMB	Office of Management and Budget of Puerto Rico
OSHA	Occupational Safety and Health Administration
OTC	Operator Training Center
P	Phosphorous
P3	Public Private Partnership
PAN	<i>Programa de Asistencia Nutricional</i>
PMC	Program Management Consultant
PML	Probable Maximum Loss
PO	Purchase Order
POGS	Petroleum, Oil, Gas and Sand
PPA	Power Purchase Agreement
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRDOH	Puerto Rico Department of Health
PREPA	Puerto Rico Electric Power Authority
PROMESA	Puerto Rico Oversight, Management, and Economic Stability Act
PRPB	Puerto Rico Planning Board
PWS	Potable Water Systems
RBC	Rotating Biological Contactor
RD	Rural Development

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

RWI	Raw Water Intakes
R&R	Renewal and Replacement
RFP	Request for Proposal
SAP	Systems, Applications, and Products in Data Processing
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
SEC	Securities and Exchange Commission
SIR	Self-Insured Retention
SIRE	<i>Sistema Integrado de Resultados</i>
SRF	State Revolving Funds
SSO	Sanitary Sewer Overflow
SSOMP	Sewer System Operation & Maintenance Plan
SSSEP	Sanitary Sewer System Evaluation Plan
STS	Sludge Treatment System
SWTR	Surface Water Treatment Rule
TA	<i>Trabajador Alcantarillado</i>
TANF	<i>Programa de Asistencia Temporal para Familias Necesitadas</i>
TOC	Total Organic Carbon
TPL	<i>Terminal Portátil de Lectura</i>
TSO	<i>Trabajador Servicio Operacional</i>
TTHM	Total Tri-halomethane
UIA-AAA	<i>Unión Independiente Auténtica de la Autoridad de Acueductos y Alcantarillados</i>
U.S.	United States
USDA	U.S. Department of Agriculture
USDOJ	U.S. Department of Justice
USEPA	U.S. Environmental Protection Agency
UV	Ultraviolet
VFD	Variable Frequency Drive
WPS	Water Pump Station

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WRO	Water Recovery Office
WST	Water Storage Tank
WTP	Water Treatment Plant
WWPS	Wastewater Pump Station
WWTP	Wastewater Treatment Plant

DISCLAIMER

This Consulting Engineer's Report (CER) considers the six-year financial projections and Capital Improvements Program (CIP) included in the Puerto Rico Aqueduct and Sewer Authority's (PRASA) 2019 Certified Fiscal Plan dated June 25, 2019 (the 2019 PRASA Fiscal Plan), PRASA's October 29, 2019 amended FY2020 Annual Budget and certain restructured debt service obligations.

STATEMENT OF DISCLOSURE

This document was prepared solely for the benefit of and use by PRASA for the discrete purposes set forth herein. PRASA did not request Arcadis to provide, and Arcadis does not offer to provide, nor did or will it provide, any services constituting the services of a "municipal advisor" as defined by the Securities Exchange Act of 1934, as amended by the Dodd-Frank Wall Street Reform and Consumer Protection Act (Pub.L. 111-203, H.R. 4173) and regulations promulgated thereunder, or any successor statute or provisions thereto. Accordingly, Arcadis is not a municipal advisor registered with the U.S. Securities and Exchange Commission (SEC).

In the performance of its services on behalf of PRASA, Arcadis did not intend to create, and hereby expressly denies the creation of, any right on the part of any third party to rely upon this document. Except as otherwise provided by statute not subject to waiver, PRASA is not permitted to distribute copies of this document to third parties without the prior written consent of Arcadis and, further, any such distribution of this document is only for informational purposes, and third parties have no right to rely hereon. Use of this document should not, and does not, absolve the third party from using due diligence in verifying the document's contents. In accordance with the 2012 MAT (as amended). Arcadis will distribute this document to PRASA, the Trustee, and the Puerto Rico Fiscal Agency and Financial Advisory (the Fiscal Agent or AAFAF, by its Spanish acronym).

Arcadis is required to make disclosures stating the limitations of the work contained within the FY2019 CER and its use. In accordance with the Securities Exchange Act of 1934, the following disclosure statements are incorporated into the 2019 CER prepared by Arcadis. This 2019 CER was prepared by Arcadis for PRASA; hereinafter referred to individually as the "Authorized Recipient."

In the performance of its services on behalf of PRASA and any Authorized Recipient, Arcadis is (a) not recommending any action on behalf of the Authorized Recipient to municipal financial products or the issuance of municipal securities; (b) is not acting as a municipal advisor to the Authorized Recipient, and does not owe a fiduciary duty to the Authorized Recipient pursuant to Section 15B of the Securities Exchange Act of 1934, as amended by the Dodd-Frank Wall Street Reform and Consumer Protection Act, with respect to the information and material prepared in connection with this scope of work; and (c) acting for its own interests. PRASA shall engage a registered municipal advisor and shall discuss any information and material prepared in connection with this document with any and all internal and external registered municipal advisors and other financial advisors and experts who the Authorized Recipient deems appropriate before acting on this information and material.

PRASA acknowledges that: (a) it shall retain the services of an independent registered municipal advisor, which, during the past two years, was not associated with Arcadis, and that (b) Arcadis is required to

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

comply with the requirements set forth in the federal Exchange Act, Municipal Advisor Rule (17 CFR 200, 240, 249), which requires that the engineering company (i) receive from the municipal entity a representation in writing that it is represented by, and will rely on the advice of, an independent registered municipal advisor; (ii) provide written disclosure to the municipal entity that Arcadis is not serving as a municipal advisor and, with respect to the municipal entity, is not subject to the statutory fiduciary duty applicable to municipal advisors under the federal Exchange Act, and (iii) provide a copy of such disclosure to the municipal entity's independent registered municipal advisor. Arcadis does not provide opinions on or advocates for using a financial product (issuing debt) or the choice of financial products employed. As such, Arcadis submitted its work products to PRASA for review and approval.

Arcadis devoted effort in the construction and preparation of this document is consistent with (i) the degree of care and skill ordinarily exercised by members of the same profession currently practicing under same or similar circumstances and (ii) the time and budget available for its work in its efforts to endeavor to ensure that the data contained in the 2019 CER is accurate as of the date of its preparation. This document was based on estimates, assumptions and other information developed by Arcadis from its independent research effort, general knowledge of the industry, and information provided by and consultations with the Authorized Recipient and the Authorized Recipient's representatives and consultants. No responsibility is assumed for inaccuracies in reporting by the Authorized Recipient, the Authorized Recipient's agents and representatives, or any third-party data source used in preparing or presenting this study. Arcadis assumes no duty to update the information contained in the 2019 CER unless it is separately retained to do so pursuant to a written agreement signed by Arcadis and PRASA.

This opinion is based upon information provided by, and consultations with, PRASA. Arcadis did not independently verify the accuracy of the information provided by PRASA and others in creating this opinion; however, Arcadis's opinion is based upon the supposition that such sources are reliable, and the information obtained therefrom is appropriate for the analysis undertaken and the conclusions reached. To the extent, the information provided to Arcadis by PRASA and others is not accurate, or not inclusive of all details, the conclusions and recommendations contained in the opinion may vary and are subject to change. Arcadis assumed and assumes no responsibility for inaccuracies in reporting by PRASA or any third-party data source used in preparing such opinion.

Arcadis's findings represent its professional judgment. Neither Arcadis nor its parent corporation, or their respective subsidiaries and affiliates, makes any warranty, expressed or implied, with respect to any information or methods disclosed in the document. Excluding PRASA, whose rights are governed by its contract with Arcadis, no recipient of the document shall have any claim against Arcadis, its parent corporation, and its and their subsidiaries and affiliates, for any liability for direct, indirect, consequential, or special loss or damage arising out of its receipt and use of this document whether arising in contract, warranty (express or implied), tort or otherwise, and irrespective of fault, negligence and strict liability.

No recipient of this document other than the Authorized Recipient may abstract, excerpt, or summarize this document without the prior written consent of Arcadis. Any changes made to this document, or any use of this document not specifically identified within Arcadis's contract with PRASA, or otherwise expressly approved in writing by Arcadis, shall be at the sole risk of the party making such changes or adopting such use.

Arcadis relied on assumptions, forecasts, data and statistics provided by PRASA, its other consultants, and published industry references. Arcadis reviewed the PRASA-prepared forecast over a future six-year

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

period of time and “forward-looking statements.” These statements relate to Arcadis’s expectations, beliefs, intentions, or strategies regarding the future. These statements may be identified by the use of words like “anticipate”, “believe”, “estimate”, “expect”, “intend”, “may”, “plan”, “project”, “will”, “should”, “seek”, and similar expressions. The forward-looking statements reflect Arcadis’s views and assumptions with respect to future events as of the date of this document and are subject to future economic conditions and other risks and uncertainties. Actual and future results and trends could differ materially from those set forth in such statements due to various factors, including, without limitation, those that will be discussed in this 2019 CER. These factors are beyond Arcadis’s ability to control or predict. Accordingly, Arcadis makes no warranty or representation that any of the projected values or results contained in this document will actually be achieved.

Unless otherwise stated, this 2019 CER summarizes the work completed through June 30, 2019 with certain updates provided through November 30, 2019. Changed conditions occurring or becoming known after such date could affect the material presented and the conclusions reached herein to the extent of such changes. Arcadis has no responsibility for updating this report for changes that occur after the date of the report.

This document is qualified in its entirety by, and should be considered in light of, these limitations, conditions, and considerations.

EXECUTIVE SUMMARY

E.1. Introduction

The Puerto Rico Aqueduct and Sewer Authority (PRASA) is a public utility responsible for the production and distribution of potable water and collection, treatment, and disposal of a large portion of domestic and industrial pretreated wastewaters in Puerto Rico. PRASA serves a population of approximately 3.2 million residents¹ plus over 5 million visitors annually. PRASA owns a large variety of assets, including land, buildings, dams, wells, water and wastewater treatment facilities and pump stations, ocean outfalls, buried infrastructure, vehicles, equipment, and water meters.

Arcadis Caribe, PSC (Arcadis), has been retained by PRASA as their Consulting Engineer for the preparation of the Consulting Engineer's Report (CER) to satisfy the reporting requirements specified in Section 7.07 of the Master Agreement of Trust (MAT), as amended, by and between PRASA and Banco Popular de Puerto Rico as Trustee, and the requirements between PRASA and the Government of Puerto Rico.

As required by Section 7.07 of the MAT, unless the Senior Bonds have been rated investment grade by at least two Rating Agencies for 24 consecutive months, the Consulting Engineer shall prepare a CER to document the current condition and changes, if any, in PRASA's operation and the performance of the water and wastewater systems (the System). Also, PRASA must maintain a continuous disclosure policy with its Fiscal Agent (Puerto Rico Fiscal Agency and Financial Advisory Authority, or AAFAF by its Spanish acronym) and satisfy certain reporting requirements throughout the fiscal year (FY). To comply with this reporting requirements, Arcadis has prepared this CER for FY2019 (2019 CER or the Report). PRASA's fiscal year begins on July 1st and ends June 30th. FY2019 is the fiscal year from July 1, 2018 through June 30, 2019.

E.2. Puerto Rico's Current Fiscal Situation

Over the past several years, the Government of Puerto Rico has faced a challenging financial situation. As a result, PRASA has also been adversely affected. In addition to the economic downturn that has been experienced in Puerto Rico, like many other municipal water and wastewater utilities around the world, PRASA is facing several major challenges including service affordability, aging infrastructure, high volume of non-revenue water (NRW), regulatory mandates, and increasing renewal and replacement (R&R) needs. The fiscal situation has been further exacerbated by the devastation caused by Hurricanes Irma and María (the 2017 Hurricanes) and delays in recovery efforts.

The high costs of infrastructure repairs combined with the lack of customer understanding of the value of water services (as an essential service, the public resists paying for higher service rates), makes it very difficult for water and wastewater utilities to achieve a break-even operation while maintaining affordable service rates. Because of the complexity of the System it operates, PRASA has inherently high operating costs and a significant need for capital investments with limited financial resources.

¹ Source: U.S. Census Bureau as of July 1, 2018.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The Government's fiscal situation and ratings downgrades by the Rating Agencies had a major impact on PRASA, as each downgrade also resulted in a downgrade for PRASA's bonds, thereby limiting its ability to access the capital markets to obtain financing to cover its immediate capital improvement program (CIP) related expenses. In FY2016, after exhausting its surplus operating income and reserves to cover a portion of its unfunded CIP, PRASA was forced to essentially postpone and eventually terminate the execution of all CIP projects.

On May 25, 2016, the United States (U.S.) Congress enacted Puerto Rico Oversight, Management and Economic Stability Act, also known as PROMESA. PROMESA addresses Puerto Rico's debt by establishing an oversight board, a process for restructuring debt, and expedited procedures for approving critical infrastructure projects. Among other mandates, the Oversight Board oversees the development of budgets and fiscal plans for Puerto Rico's Central Government and its instrumentalities, including PRASA.

On June 25, 2019, the Oversight Board certified a revised version of PRASA's Fiscal Plan, pursuant to Section 201(d)(2) of PROMESA (the 2019 PRASA Fiscal Plan). For this Report and the analysis included herein, Arcadis used the Oversight Board's certified 2019 PRASA Fiscal Plan with modifications as noted in the Report. The 2019 PRASA Fiscal Plan covers a period of six years (preliminary results for FY2019 and projections for FY2020 through FY2024) and has been developed to promote PRASA's mission which is to provide high quality drinking water and sanitary sewer service at the lowest possible cost. It provides for the required investment for the necessary infrastructure to restore the System after the 2017 Hurricanes impact and ensure compliance with required standards while promoting a much-needed economic growth throughout the island, the timely execution and implementation of its measures, and PRASA's long-term financial self-sustainability plan.

The 2019 PRASA Fiscal Plan outlines cash management levers that PRASA will use to improve its liquidity, including but not limited to increasing revenues, decreasing expenses, increasing collections, and securing federal funding from disaster relief programs related to the 2017 Hurricanes recovery process. To do so, PRASA will rely on three main key focus areas: (i) affordable safe supply and treatment of water, (ii) resilient, reliable, and efficient infrastructure and (iii) organizational and fiscal sustainability. PRASA's management identified several new efforts and initiatives to achieve these goals and objectives, which could provide additional financial benefits. The initiatives in the FY2019 PRASA Fiscal Plan include, among others, the implementation and execution of a Public-Private Partnership Project for the optimization of PRASA's metering system and the improvement of its customer service activities (the P3 Project), reduction of NRW, rate adjustments, government accounts collections, pension/labor reform (pending ratification by the Government of Puerto Rico), and restructuring of its debt.

E.3. Organizational Updates and Changes

PRASA is organized into five operational Regions (North, South, East, West and Metro), is managed by an Executive Management Team that provides the day to day management oversight and coordination for all institutional activities and governed by a multi-disciplinary Board. The organization includes various departments including, but not limited to finance, human resources, customer services, purchasing and logistics, and information systems.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The current organization has been able to operate, manage and maintain the System, despite experiencing major operational and financial challenges. Key PRASA leadership includes its Executive President, Strategic and Corporate Planning Vice President, Operations Vice President, Administration Vice President, and Infrastructure Executive Director, as well as the five Regional Executive Directors and Department Directors.

The following material change was reported by PRASA during FY2019 and the first quarter of FY2020 regarding its organization and changes in leadership and management: Cheryl Ortiz McCormick was appointed as Interim Executive Director for the South Region in replacement of Eng. Hector Gierbolini, whose term expired during FY2019.

PRASA's Governing Board, as restructured following Act 68-2016, is composed of eight members, which include:

- Four independent directors appointed by the Governor of Puerto Rico, comprising of:
 - One engineer licensed to practice in Puerto Rico with ten years of practice experience
 - One authorized legal advisor with at least ten years of experience in Puerto Rico and admitted to practice in the Government
 - One member with a wide knowledge and experience in the field of corporate finance
 - One professional with expertise in any fields related functions delegated to PRASA
- One Puerto Rico Fiscal Agency and Financial Advisory (AAFAF by its Spanish acronym) representative as per Act 2-2017
- One private citizen representing the PRASA's customers, and
- Two ex-officio members, the Executive Director of the Association of Mayors, and the Executive Director of the Federation of Mayors.

Board members serve staggered terms: two members shall hold office for five years and two members for six years. As the terms of office of the four Board members appointed by the Governor expire, the Governor shall appoint their successors following the same candidate identification mechanism. None of the members appointed by the Governor may hold such office for more than three terms.

The following material change as it relates to PRASA's Governing Board was reported by PRASA during FY2019 and the first quarter of FY2020: José A. Rivera Rodríguez replaced Gretchen Hau, Esq. as Executive Director of the Mayors Association. One Board position remains vacant (Independent Director with expertise in any fields related functions delegated to PRASA).

In FY2019, PRASA's customer accounts per employee ratio (434) decreased by 6.9% from FY2018 (466) but remained within the industry's range; this can be attributed to the slight reduction of staff and customer accounts. Although PRASA has reduced staff levels below Management's optimum staffing presented in the 2019 PRASA Fiscal Plan, the staffing mix is not adequate. For example, PRASA continues to struggle to fill key staffing needs in the Operations Department (i.e. operators for treatment facilities, system maintenance personnel, electromechanical and meter readers). PRASA must consider the impact of the employee retirement programs and population migration which will continue to affect not only its existing staff, but also its ability to recruit capable replacement workforce. Filling certain vacant

position could help PRASA reduce overtime costs and address System Operation and Maintenance (O&M) needs.

E.4. Condition of System

During FY2019, Arcadis assessed the condition of PRASA's System through an inspection program that included a selection sample of the major elements of the System. The purpose of these assessments was to identify the overall condition of the facilities to determine if they were being operated and maintained in a manner to achieve their operating goals, and to evaluate if PRASA's CIP is aligned with identified needs. Facilities were rated based on their condition as unacceptable, poor, adequate, or good.

Given the significant reduction in capital and renewal and replacement investment over the past years, Arcadis performed asset condition assessments of a selection of WTP and WWTP facilities that were highly impacted during the 2017 Hurricanes. Arcadis visited 31% of water treatment plants (WTPs), and 39% wastewater treatment plants (WWTPs) to perform assessments of the facilities. These assessments were conducted from February 2019 to August of 2019. Subsequently, Arcadis also evaluated the compliance performance results for all PRASA WTPs and WWTPs for the period of January 1, 2018 through December 31, 2018. In addition, Arcadis performed asset condition assessments of a sample of auxiliary facilities (about 3% of wells, water storage tanks, and pump stations). In total, 173 facilities were assessed out of the 3,816 facilities that comprise the System, excluding active raw water intakes (RWIs).

PRASA operates 113 WTPs where it treats raw water from reservoirs, rivers, and groundwater, to produce potable water for its customers. The WTP facilities range in size from several thousand gallons per day up to 100 million gallons per day (MGD). The total potable water production from WTPs for FY2019 was approximately 542 MGD.

Overall, the WTPs are in adequate condition and, to the extent that the physical structures and operational/process controls are maintained or improved, they are expected to continue to serve their intended purpose of providing potable water supply in compliance with applicable regulations. However, facility ratings decreased in equipment/maintenance, operations/process control and staff/training criteria compared to the 2017 inspections. This decline in ratings is likely an effect of the lack of the capital and R&R improvements due to the fiscal situation and budget limitations. The greatest concern currently is the physical condition of the facilities which continue to deteriorate and were damaged during the 2017 Hurricanes.

Although the WTPs are performing better with respect to compliance with limits of the Safe Drinking Water Act and effluent discharge parameters, PRASA must continue to implement corrective measures to mitigate the production of disinfection by-products. Moreover, PRASA should address the shortcomings identified during inspections to improve the physical condition of its facilities, achieve/maintain continuous and consistent compliance, and optimize O&M expenses. Additionally, upgrades and/or improvements to the sludge treatment systems in WTPs are necessary to meet the permanent limits established under existing permits. Furthermore, PRASA should continue to standardize processes and provide additional tools and training to operators regarding process controls and actions to facilitate and improve plant operations and performance, as well as optimize O&M expenses. Also, PRASA should consider operational improvements including new process equipment and process automation considering that operators continue to depend on manual operations for several processes, a practice that has been found to be inefficient.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA currently operates 51 WWTPs. The facilities range in size from several thousand gallons per day up to 80 MGD. The island-wide design treatment capacity is approximately 403 MGD and the treated wastewater for FY2019 was approximately 209 MGD. In level of treatment, PRASA has seven plants designed to provide tertiary or advanced treatment, 38 plants are designed to provide secondary treatment, and the remaining six facilities (which account for 230 MGD of treatment capacity) provide primary treatment only under existing 301 (h) waivers with the United States Environmental Protection Agency (USEPA). The WWTPs generally range from poor to adequate condition, with compliance and equipment/maintenance as the categories of primary concern. There were nine facilities (45% of the WWTPs inspected) rated as poor compared to one in 2017; the remaining 55% were rated as adequate. Process control continues to be a challenge in some of the facilities, even though plant operators indicated that standard operating procedures and control strategies are followed. Regarding the compliance criteria, the overall rating decreased significantly (43%) since the previous inspection. Bringing facilities into consistent and sustained compliance with discharge parameters, addressing the shortcomings identified during inspections and additional operational improvements including new process equipment, process automation and process control optimization are some of the measures that PRASA must undertake to continue to improve and maintain the condition of its facilities. Also, PRASA must plan and make the necessary improvements to be able to meet permanent limits once the terms for consent decree interim limits end.

PRASA owns and operates over 3,000 ancillary facilities. No significant changes were noted in the overall evaluation of ancillary facilities with most scoring on the lower end of adequate rating. Approximately 13% of the visited wastewater pump stations (WWPSs) have recorded overflows during the evaluation period. Prompt identification and actions enabled by remote monitoring should help PRASA mitigate overflows in the System, and adding pre-treatment (screens, comminutors) and preventive maintenance to facilities would help lessen overflows. The number of sanitary overflows continues to be high compared to U.S. benchmarks. PRASA has continued to improve its response time and attention/repair effectiveness to minimize the duration of these overflow events and their environmental impact. PRASA is implementing sanitary sewer evaluations and repair plans to reduce levels of infiltration and inflow (I/I) that must be treated in their WWTPs. The progress of this initiative has been affected as well by the ongoing fiscal situation.

Most of the deficiencies identified for ancillary facilities can be addressed through PRASA's R&R program and may not require major capital improvements. Finally, future regulatory requirements may require either the implementation of significant capital improvements to include and achieve additional treatment capabilities at well facilities, or the closure of certain wells.

PRASA continues to address its leak detection and monitoring practices, and leak occurrences. Currently, PRASA is remotely monitoring levels of a number of tanks in the distribution system to avoid tank overflows and improve the water balance in the distribution system. PRASA continues conducting periodic water audits which are used to implement controls and develop action items to address NRW. PRASA estimates the FY2019 total water production at approximately 542 MGD and NRW at approximately 349 MGD. Of the total volume of NRW, unbilled authorized consumption was about 7 MGD while water losses, which total an estimated 342 MGD, consist of approximately 39.4 MGD in apparent (commercial) losses and 302.7 MGD in real (physical) losses. PRASA projects that water audits and NRW estimated values will be refined as metering efforts (both at the production point and customer service points) get underway.

Some of the actions and projects to be implemented by PRASA to achieve additional reductions in NRW and water losses as included in the 2019 PRASA Fiscal Plan are: 1) the P3 Project for metering system modernization and customer service optimization and enhancement; and 2) Physical Losses Reduction initiatives. Furthermore, the 2019 PRASA Fiscal Plan Water Recovery Office (WRO) initiatives: pressure management and optimization; water leak reduction (reported and unreported); water storage tank overflow avoidance; and data quality improvement (reduce estimation) shall help reduce physical water losses. Nevertheless, significant capital investments and R&R funded budgets are required to accelerate the NRW program and address leak occurrences in both a corrective and preventive manner. PRASA's goal is to reduce water production by at least 10% (from 507 MGD) by 2024.

E.5. O&M Practices and Strategic Plan

Arcadis assessed the adequacy of PRASA's O&M practices based on compliance with regulatory requirements, interviews with PRASA personnel, and facility observations by field inspectors obtained through the 2019 asset condition assessment effort previously described. Overall, Arcadis found PRASA's O&M practices to be adequate. However, staff mix optimization and process control continue to be challenges PRASA's operations.

Despite of all the challenges faced by PRASA in FY2018 and slow recovery in FY2019, most of the facilities are operational and continue to serve their intended purpose of providing potable water supply and treating used water. However, the 2017 Hurricanes affected the conditions of most of PRASA's facilities; therefore, it is imperative that projects necessary to address the damages and improve and strengthen System conditions be implemented in order to ensure the sustainable production of safe drinking water and treatment of wastewater in compliance with applicable regulations. PRASA continues to address operational challenges resulting from intermittent power supply and budget constraints.

PRASA's FY2019 O&M expenses preliminary projection for the water and wastewater system (combined) prior to expected reimbursement from the 2017 Hurricanes is approximately \$782M, of which \$694M are directly related to the O&M of the System. The other \$87M were related to commercial activities and provision of customer services, including but not limited to staffing and operation of customer service offices island-wide; meter reading; connection and disconnection services; invoice preparation, printing and distribution; and customer service call centers, amongst others. PRASA estimates that during FY2019 approximately 73% of its System O&M budget (\$507M) was allocated to the water system and the remaining 27% (\$188M) to the wastewater system. As presented in **Table ES-1**, PRASA's FY2019 O&M budgets are within the industry standards, mostly around the median benchmark results published by the American Water Works Association in 2018.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table ES-1. PRASA Metrics vs. Water/Wastewater Utilities Benchmarks

Benchmark Category	2018 Benchmarks ¹			PRASA ²
	Top Quartile	Median	Bottom Quartile	
Water O&M Cost per Account	\$318	\$470	\$641	FY2017: \$319 FY2018: \$461 FY2019: \$411
Water O&M Cost per MG Processed	\$1,778	\$2,425	\$3,337	FY2017: \$2,100 FY2018: \$3,074 FY2019: \$2,561
Water O&M Cost per 100 miles of pipe	\$2,022,662	\$2,904,472	\$4,148,850	FY2017: \$2,652,680 FY2018: \$3,855,281 FY2019: \$3,404,467
Wastewater O&M Cost per Account	\$243	\$353	\$491	FY2017: \$194 FY2018: \$275 FY2019: \$246
Wastewater O&M Cost per MG Treated	\$1,607	\$2,318	\$3,581	FY2017: \$1,848 FY2018: \$2,798 FY2019: \$2,460
Wastewater O&M Cost per 100 miles of pipe	\$1,951,950	\$2,698,845	\$3,641,448	FY2017: \$2,745,356 FY2018: \$3,509,624 FY2019: \$3,130,358

¹ Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

² Includes total operation and maintenance costs, less depreciation and costs related to customer (commercial) services. PRASA reported values include payroll and related, power, chemicals, Superaqueduct O&M contract fee, insurance and other expenses, less capitalized operating expenses.

Table ES-2 presents a summary of PRASA's KPIs goals and results. In FY2018, PRASA had a lower than normal compliance score of 29% on its KPIs on an island-wide basis, mostly because of impacts of Hurricanes Irma and María. In FY2019, PRASA's KPI results improved substantially from FY2018 but remain low as a result of the delays in the recovery efforts and the fiscal situation hindering the implementation of certain initiatives.

Table ES-2. FY2019 KPI Goals and Results

Strategic Plan Initiative	Key Performance Indicator	FY2019 Goals	Results as of June 2019
Fiscal Health	Employees per Connection	3.34 or less Employees per 1,000 connections	2.97
	Overtime	Reduce to 7% or Below	8% ²
	Budget Compliance (Excludes Electricity Costs)	Below 100%	97%

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Strategic Plan Initiative	Key Performance Indicator	FY2019 Goals	Results as of June 2019
Operational Efficiency	Collection vs. Billings	Increase to 96% or Above	102%
	Compliance - Water System	Increase to 99% or Above	99.7%
	Compliance - Wastewater System	Increase to 97% or Above	95.1% ²
	Billing Adjustments	Reduce to 2% or Below	1.5%
	Complaints in Customer Service (per 1000 Actives Accounts)	Reduce to 16.7 or Below	11.81
	Monthly Average of Customers with Service Interruptions (as a Percentage of Total Customers)	Reduce to 5% or Below	17.8% ²
	Customer Service Attention Time (Commercial Office)	Maintain below 30 min.	26:12 min
	Vehicle Availability	Increase to 92% or Above	65% ²
	Average Processing Time of Purchase Orders ¹	Less than 40 days	-
	Preventive vs. Corrective Maintenance Ratio	Increase to 80%	76% ²
	Average Time for Equipment Repairs	Less than 25 days	51.70 days ²
	Reported Leaks	Reduce to 4,598 monthly	4,562
	Reported Overflows	Reduce to 2,298 monthly	2,198
	Repair Time for Leaks	Reduce to 53.0 hrs	120.87 hrs ²
	Repair Time for Overflows	Reduce to 32.0 hrs	53.81 hrs ²
	Average Water Production (MGD)	Reduce to 505 MGD	542 MGD
	Percent of NRW	Reduce to 53.2%	64.4% (Estimated)
Infrastructure and Sustainability	Energy Consumption (Annual)	Reduce to 660.34 MkWh	630.91 MkWh
	Project Progress (CIP) ³	Greater or equal to 0.9	-

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Strategic Plan Initiative	Key Performance Indicator	FY2019 Goals	Results as of June 2019
Organizational Transformation	Cost Performance (CIP) ³	Greater or equal to 0.9	-
	Training (Cumulative Hours per Employee)	More than 26 hrs per year	14.1 hrs ²
	Unplanned Work Effectiveness (Absenteeism)	Reduce to 2.0 days	2.13 days ²
	Planned Work Effectiveness	Reduce to 10%	4%

¹ This KPI was not measured or available due to the impact of the 2017 Hurricanes and delays of reimplementation.

² These KPIs results were still adversely impacted by the 2017 Hurricanes.

³ Due to the suspension of the CIP, the Project and Cost Performance KPIs for FY2019 are not being measured.

PRASA's Operational Initiatives are well developed and address critical aspects of PRASA's operation such as NRW, operational efficiency, and revenue stream. During FY2019, PRASA's main O&M efforts and practices were focused on the reestablishment and stabilization of the System in the aftermath of Hurricanes Irma and María and working with the Federal Emergency Management Agency (FEMA) and the insurance companies. Although some of the FY2019 planned O&M and key PRASA initiatives were restarted, several were delayed or suspended due to the slow recovery efforts or have been modified to meet commitments included in the 2019 PRASA Fiscal Plan.

E.6. Capital Improvement Program and Regulatory Compliance

PRASA has developed a CIP to improve and maintain its water and wastewater infrastructure. The CIP's main objectives are to maintain, modernize and simplify the System to achieve operational efficiency; protect public health; and safeguard environmental quality while enabling continued economic development and meeting all regulatory requirements. In addition, PRASA has included as part of the CIP objectives, the restoration of damaged infrastructure back to its condition prior to the 2017 Hurricanes and the implementation of sustainable measures in the longer-term to harden the System against the impacts of climate change and sea-level rise.

The CIP is a dynamic program that evolves and undergoes revisions as needs and sources of funds are identified, and as projects transition from planning to design, construction and startup phases. In the past, PRASA's CIP has been funded with external financing from bond issuances and federal assistance in accordance with standard utility financing practices, however the 2019 PRASA Fiscal Plan and public policies endorsed by PRASA's Governing Board includes a tapered transition in which financing of the CIP shifts from bonds to self-financing via PRASA's Operating Revenues. PRASA's CIP includes projects that cover major capital improvements identified throughout PRASA's five Operational Regions as well as environmental compliance related projects, island-wide initiatives such as technological advancements, telemetry, preventive maintenance, meter replacement, R&R of the System and Emergency/Permanent Work projects identified under the recovery efforts after the 2017 Hurricanes.

PRASA's CIP continues on hold, except for some R&R projects and the initial bidding of some emergency projects. The lack of capital investment over the past five years has resulted in degradation of the System's physical condition which could lead to a critical infrastructure situation in the near future. Also,

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA could once again be subject to significant non-compliance events with regulatory mandates or administrative orders. In the long-term, the cost of capital projects may also increase as vendors may price-in the risks associated with delays in payment or non-payments to contracted projects, or due to higher construction demand.

The 2019 PRASA Fiscal Plan includes a modified six-year CIP covering the planning period from FY2019 through FY2024 which includes adjustments resulting from negotiations with Regulatory Agencies, Emergency/Permanent Work projects, and the necessary investment to address PRASA's infrastructure needs to ensure adequate operation and sustainability of the System. The approval and execution of this six-year CIP is contingent upon funding access and availability. The six-year CIP for FY2019 through FY2024, as included in the 2019 PRASA Fiscal Plan, consists of a total of 584 projects totaling \$2,410.5M.

The planned CIP along with the O&M initiatives are generally in alignment with the System needs. It includes projects identified through PRASA's 2014 Master Plan and measures to increase System resilience and strengthening. The six-year CIP adequately addresses the requirements of existing consent decrees and agreements and considers proposed modifications to said consent decrees and agreements, as recently negotiated or in negotiations by and between PRASA and Regulatory Agencies. However, there are additional R&R and CIP needs to address: 1) buried infrastructure improvements including, but not limited to, additional wastewater collection system repairs or improvements that PRASA may be required to implement to bring these into compliance, and 2) future regulations that may impact PRASA's System. The impact of these future regulations may require significant operational and capital investments. As the impact of future regulations becomes more defined, CIP modifications will be required to adequately accommodate resulting needs.

E.7. Insurance Program

To meet the requirements of the MAT as it relates to PRASA's insurance program, Arcadis reviewed PRASA's current insurance coverage and determined its adequacy considering the type and value of PRASA's fixed assets. Also, provided are some outstanding recommendations to PRASA's insurance coverage from a previous evaluation made by MARSH Saldaña, Inc. (MARSH) and validated or commented on by AON, PRASA's Broker of Record (BOR) in FY2016. The BOR for FY2017 and FY2018, Lone Star Insurance Producers, LLC (Lone Star), was consulted to verify if the recommendations were addressed in the policy renewals or if they were not adopted. In FY2019, PRASA changed its BOR from Lone Star to Goas & Associates, Inc (GOAS). They were consulted as well to verify if the recommendations were addressed in the FY2019 and/or FY2020 policy renewals. PRASA maintained GOAS as its BOR for the 1st quarter of FY2020 and changed to *Fedelta Insurance* as its BOR for the rest of FY2020 following the recommendation of the Insurance Commissioner Office.

Furthermore, the policies for FY2019 suffered changes, in some cases significant changes in coverage and primarily in premiums, as an effect of the upshot of the hurricanes that struck Puerto Rico in September 2017. In addition to the 2017 Hurricanes, insurance companies may have dealt with other catastrophic events impacting the Caribbean and the United States. The vast damages and losses suffered by the insured directly impacted the insurance market and resulted in premiums increases, stricter subscription guidelines and risk assessments.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA was adversely impacted and implementation of the Property Insurance Policy was warranted and put forth. PRASA was able to collect the \$300M coverage in the policy from the Insurance for the Hurricane María event. About half went to cover business interruption and the remaining will be used for projects. Moreover, PRASA is in the process of negotiations with the insurance companies for the claims regarding Hurricane Irma and post hurricane extreme rain event. PRASA can claim up to the limit of \$300M for each event. The claim amounts are subject to verification, adjustments, and acceptance by the insurance companies. As a result, and triggered by the claims resulting from the damages caused by the 2017 Hurricanes, there were significant changes to the FY2019 Property policy coverage and premiums. The only local insurance company to participate in this policy was MAPFRE; to pursue better probabilities for similar coverages the account was placed in the London markets (International). The premium for coverage under this policy tripled, increasing to \$16,112,931. The market cited the recent losses, damages, actual state of the infrastructure and the uncertainty of actual values, as well as the indeterminate value and risk exposure of underground assets as reasons for the dramatic increase. Besides the increase in premium, another important change in the Property Policy is that the deductible quadrupled to \$100M, which makes the deductible 33% of the total claim that can be reimbursed by the insurance company compared to the 8% figure in the FY2018 Property Policy. In addition, the definition for Flood in the first layer changed to exclude damages by "Wind Driven Water". Finally, the \$25,000 deductible for the "Boiler and Machinery" is eliminated and is subject to the \$100M policy deductible. Another significant change was in the Crime policy in which the deductibles for each crime coverage increased 650% from \$10,000 to \$75,000. This escalation on crime coverage deductibles resulted from Chubb's Head Office instructions, applicable to all the accounts they manage. Also, for FY2020 the Umbrella and Excess Liability Policy increase the limit of coverage to \$60M per occurrence with same coverage and Self-Insured Retention (SIR) but with a 12.6% Policy premium increase to \$850,000.

The insurance program covering PRASA's exposures to risks of accidental property and liability losses arising from on-going operations provides reasonable coverage. However, several recommendations to PRASA's insurance program are provided. Several recommendations have been provided as part of the evaluation and summarized in the conclusions (section E.9).

E.8. System Assets and Financial Analysis

PRASA's capital assets include depreciable capital assets, "Construction (Work) in Progress", land, and easements. PRASA's ending book value of capital (fixed) assets as of June 30, 2018, inclusive of registered impairment losses caused by the 2017 Hurricanes and net of accumulated depreciation, amounts to \$6,447M. Following the Restoration Cost Approach outlined by GASB 42, the calculated impairment loss (net of insurance recoveries) registered in FY2018 totaled \$184M. The preliminary ending book value of capital (fixed) assets as of June 30, 2019 amounts to \$6,237M (net of accumulated depreciation, and subject to change).

PRASA's base and volumetric rate structures for Residential customers and Non-Residential customers (Commercial, Industrial, and certain Government customer classes) were approved on July 15, 2013, and were further amended on December 18, 2013. Furthermore, to cover all projected operating expenses, CIP needs, and debt service obligations (assuming debt restructuring, or new external financing is attained), the 2019 PRASA Fiscal Plan includes a series of moderate rate adjustments (as required by the Oversight Board). The 2019 PRASA Fiscal Plan adjustments, included in **Table ES-3**, are calculated separate from the base and volumetric amounts, as compounded percentages of the total customer

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

invoice amount. Additional adjustments are projected to be implemented annually on July 1st of each year through FY2024.

Table ES-3. PRASA's Proposed Fiscal Plan Annual Rate Adjustments by Customer Type

Customer Type	Annual Rate Increase FY2019 – FY2023	Rate Increase FY2024
Residential	2.5%	2.0%
Commercial	2.8%	2.0%
Industrial	3.5%	2.0%
Government	4.5%	2.0%

Arcadis reviewed the financial information provided by PRASA, the 2019 PRASA Fiscal Plan and the amendment that incorporates the benefit of the federal debt restructuring as approved by PRASA's Governing Board in October 2019. Arcadis assessed financial preliminary results for FY2019 and the reasonableness of PRASA's assumptions in the preparation of the financial projections from FY2020-FY2024 (the forecast period or the Forecast); and the sufficiency of the revenues necessary to support the projected operations and capital costs as shown in Exhibit 1, including O&M expenses, debt service payments, and required deposits in compliance with the MAT, as amended. Additionally, the Forecast illustrates the anticipated debt service coverage (DSC) for the forecast period.

PRASA's annual Operating Revenues are presented on a cash basis as required by the MAT. PRASA's preliminary Operating Revenues for FY2019 and Operating Revenues for FY2020 through FY2024 net of 1) the 2019 PRASA Fiscal Plan revenue enhancing initiatives and 2) the expected insurance reimbursement from revenue loss from the September 2017 Hurricanes impact, on a cash basis, range from \$1,050.2M in FY2019 to \$1,183M in FY2024.

PRASA's Operating (Current) Expenses are presented on an accrual basis as required by the MAT. PRASA's preliminary Operational Expenses for FY2019 and operating expense projections for FY2020 to FY2024 net of (i) capitalized expenses, (ii) the 2019 PRASA Fiscal Plan expense reduction initiatives, and (iii) the September 2017 Hurricanes impact, range from \$781.7M in FY2019 to \$726.7M in FY2024.

PRASA's outstanding debt includes Senior Bonds (the 2008 Series A and B Senior Lien Revenue Bonds, Revenue Refunding Bonds 2008 Series A and B, and the 2012 Series A and B Senior Lien Revenue Bonds; Commonwealth Guaranteed Indebtedness (CGI) which consists of existing obligations which are guaranteed by the Commonwealth of Puerto Rico, the United States Department of Agriculture (USDA) Rural Development (RD) bonds and USEPA State Revolving Funds (SRF) loan debt, among others; and Commonwealth Supported Obligations (CSO). The Puerto Rico Public Finance Corporation (PFC) has an outstanding note, the proceeds of which were used to finance the construction of the North Coast Superaqueduct System (the "PFC Superaqueduct Note"), which is considered CSO under the MAT, subordinate to the payment of Senior, Senior Subordinate and Subordinate Indebtedness and to CGI debt. The PFC Superaqueduct Note is contractually payable "solely" from Commonwealth budgetary appropriations. Until 2006, the Commonwealth (directly or indirectly through budgetary appropriations) had made all the debt service payments on the CGI and CSO, including the PFC Superaqueduct Note. In 2006, in order to help alleviate its budget constraints, the Commonwealth requested that PRASA, as part

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

of its actions to restore its operations to financial self-sufficiency, recommence, in respect of the CGI and begin, in respect of the PFC Superaqueduct Note, to make debt service payments on said obligation during fiscal years where sufficient funds are available. The PFC Superaqueduct Note remains, nevertheless, a limited obligation of PRASA, payable solely from appropriations made by the Government.

Upon execution of the Seventh Supplemental Agreement of Trust dated as of July 26, 2019, the following amendments were made regarding the CGI:

1. Amendment to Section 1.02 of the MAT, Definition of "Commonwealth Guaranteed Indebtedness" was amended to read as follows: *"Commonwealth Guaranteed Indebtedness" shall mean any obligations of the Authority that are designated as Commonwealth Guaranteed Indebtedness by the Authority and Authority's Puerto Rico Aqueduct and Sewer Authority Revenue Refunding Bonds, Series 2088 but shall not include any loans from the United States Department of Agriculture, Rural Development, Rural Utilities Service or obligations of the Authority to the Puerto Rico Infrastructure Financing Authority evidencing revolving loans pursuant to the Puerto Rico Water Pollution control and Drinking Water Treatment Revolving Funds or any loans granted by the Commonwealth Revolving Funds under the provisions of the Federal Clean Water Act of 1972, as amended and the Federal Safe Drinking Water Act of 1996, as amended.*
2. Amendment to Section 2.20 of the MAT (new paragraph regarding Trustee notifications to each Fiduciary for, and Holder of (as applicable), Other System Indebtedness), amendment to Section 8.10 of the MAT regarding Waivers of Events of Default.
3. Amendment to Section 2.20 of the MAT (new paragraph regarding Trustee notifications to each Fiduciary for, and Holder of (as applicable), Other System Indebtedness).
4. Amendment to Section 8.10 of the MAT regarding Waivers of Events of Default.

On June 30, 2016, PRASA entered into various forbearance agreements with both (i) USDA and (ii) the Puerto Rico Infrastructure Financing Agency (PRIFA), the Environmental Quality Board (EQB) and the Department of Health (DOH) (all three for the SRFs), which were later extended in various occasions until July 2019 when an agreement was reached between all parties. Renegotiated terms of PRASA's SRF and RD debt obligations, reclassified as Senior Level Debt per the Seventh Supplemental Agreement of Trust dated as of July 26, 2019, are summarized in **Table ES-4**.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table ES-4. Finalized Renegotiated Terms for SRF and RD Debt

Debt Category	SRF	RD
Outstanding Debt		
Balances including future loans of \$26M for SRF and accrued interests for RD	\$595,777,017.21	\$402,931,464.55
Term	30 years	40 years
Rate	0% until year 10 and 1.0% thereafter	2.0%
Payment Terms	Bi-annual principal only payment of \$5M in Years 1-10; bi-annual principal and interest payments of \$13.7M in Years 11-30	Bi-annual principal and interest payments of \$5M in Years 1-10; increasing to \$8.5M in Years 11-40
Maturity Date	7/1/2049	7/1/2059
Debt Level	Senior	Senior

A summary of PRASA's debt service obligations and projections for FY2019 and the forecast period are presented in **Tables ES-5** and **ES-6**, respectively.

Table ES-5. FY2019 Debt Service Obligations and Preliminary Results (\$, Thousands)

Debt Category	FY2019 Obligations ¹	FY2019 Preliminary Results ²
Senior Debt	\$230,790	\$230,790
Senior Subordinated Debt	-	-
Subordinated Debt	-	-
Commonwealth Guaranteed Indebtedness (CGI)	87,916	45,674
Commonwealth Supported Obligations (CSO)	8,999	-
Total	\$327,705	\$276,464

¹ Considers the full debt service obligations due in FY2019 per amortization schedule.

² Considers forbearance agreements for SRF and RD debt and no payment of CSO (PFC Superaqueduct related debt, payable from Commonwealth appropriations). As provided in the MAT, the obligation to make CSO payments is not cumulative and therefore does not carry forward to future periods, and failure to make the payments or required deposits related to this debt is not an event of default under the MAT.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table ES-6. FY2020-FY2024 Debt Service Obligations (\$, Thousands)

Debt Category ¹	FY2020 Projection	FY2021 Projection	FY2022 Projection	FY2023 Projection	FY2024 Projection
Senior Debt	\$250,791	\$250,790	\$250,789	\$250,788	\$250,787
Senior Subordinated Debt	-	-	-	-	-
Subordinated Debt	-	-	-	-	-
Commonwealth Guaranteed Indebtedness (CGI)	20,920	25,956	27,935	28,360	31,962
Commonwealth Supported Obligations (CSO)	-	-	-	-	-
Total Debt	\$271,711	\$276,746	\$278,724	\$279,148	\$282,749

¹ Considers the July 2019 renegotiated agreements for SRF and RD debt service relief as included in PRASA's Governing Board-approved amended FY2020 Annual Budget. Assume no payment of CSO or PFC Superaqueduct related debt, payable from Commonwealth appropriations. As provided in the MAT the obligation to make CSO payments is not cumulative and therefore does not carry forward to future periods, and failure to make the payments or required deposits related to this debt is not an event of default under the MAT.

The debt service coverage (DSC) results presented in **Table ES-7** for the forecast period have been calculated using the Rate Covenant requirements per the MAT, as amended, and debt service obligations.

Table ES-7. FY2019 - FY2024 Debt Service Coverage

Debt Service Level	DSC Requirement	FY2019 Preliminary DSC	FY2020 DSC	FY2021 DSC	FY2022 DSC	FY2023 DSC	FY2024 DSC
Senior Debt ¹	2.50	4.55	4.10	4.42	4.54	4.58	4.72
Senior Subordinated Debt ¹	2.00	4.55	4.10	4.42	4.54	4.58	4.72
Subordinated Debt ¹	1.50	4.55	4.10	4.42	4.54	4.58	4.72
All Obligations ²	1.00	0.98	1.00	0.97	1.00	1.00	1.00

¹ DSC calculated with respect to Operating Revenues.

² DSC calculated with respect to Authority Revenues.

FY2019 preliminary DSC results consider the forbearance agreements payment obligations and that PRASA will not pay the CSO debt; while the Forecast DSC results consider the renegotiated debt obligations, changes in the debt level of the SRF and RD debt, and that PRASA will not pay CSO debt. PRASA's Operating Revenues and Authority Revenues are projected to be sufficient to meet Senior Lien debt service payments during the forecast period. While PRASA does not project to meet All Obligations in FY2019 or FY2021, Authority Revenues shall be sufficient to meet DSC on All Obligations in FY2020 and FY2022 through FY2024. Final DSC for FY2019 will be recalculated after the issuance of the FY2019 Audited Financial Statement to determine if PRASA was able to comply with all its obligations.

E.9. Conclusions

In preparation of this Report and the conclusions contained herein, Arcadis has relied on certain assumptions and information provided by PRASA with respect to the conditions which may exist or events which may occur in the future. Arcadis believes the information and assumptions are reasonable but has not independently verified information provided by PRASA and others. To the extent that actual future conditions differ from those assumed herein or provided by others, the actual results will vary from those forecasts.

Arcadis has made several considerations and assumptions (as provided throughout this Report); some of the most notable are as follows:

1. Arcadis has made no determination as to the validity and enforceability of any contracts, agreements, existing laws, rules, or regulations applicable to PRASA and its operations. However, for purposes of this report, Arcadis has assumed that all such contracts, agreements, laws, rules and regulations will be fully enforceable in accordance with their terms.
2. PRASA will continue the current policies of employing qualified and competent personnel; properly operating and maintaining the System in accordance with generally accepted industry practices; and of operating the System in a prudent and sound businesslike manner.
3. The proposed CIP reflects the general needs of the System, the CIP will be largely implemented as planned and reflected in this Report, and PRASA will make modifications to the CIP investment forecast if the overall System condition is negatively affected by the investment levels projected in future years.

Set forth below are the most relevant opinions which Arcadis has reached regarding the review of PRASA's System, CIP and financial projections as per the 2019 PRASA Fiscal Plan.

1. PRASA has reached below the optimum staffing level stipulated by the Executive Management Team but its staffing mix is not yet optimal. For example, PRASA continues to face challenges in filling critical operational staff needs in its Operations Department (i.e., plant operators, electromechanical staff, System maintenance staff and meter readers), which results in overtime hours, delayed repairs, or understaffed/deficient services. PRASA shall further assess its staff mix and implement a more targeted training and workforce development program to allow internal staff re-assignments thereby decreasing existing staffing needs. Also, PRASA may need to reevaluate their compensation package to critical positions in need, such as plant operators and electromechanical, in order to compete with the market and retain personnel (PRASA has indicated that they have begun the process of reevaluating existing compensation packages).
2. PRASA continues to assess administrative and operational performance, and to implement organizational and policy changes, focusing on customer service, System performance, and budget controls. KPI and metrics being measured, along with stronger management oversight continue to contribute to operational and organizational improvements, although KPI results are below established goals.
3. Arcadis visited a total of 173 facilities throughout PRASA's five Operational Regions between February and August of 2019, to conduct a condition assessment of water and wastewater facilities. In overall, facilities were found to be in the adequate range although the physical condition continues

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

to deteriorate as capital improvements and R&R actions are limited due to the fiscal situation and budget limitations.

- Overall, the WTPs are in adequate condition and, to the extent that the physical structures and operational/ process controls are maintained or improved, they are expected to continue to serve their intended purpose of providing potable water supply in compliance with applicable regulations. Facility ratings decreased in equipment/maintenance, operations/process control and staff/training criteria compared to the 2017 inspections. The greatest concern currently is the physical condition of the facilities, which continues to deteriorate as capital and R&R improvements are delayed. Also, even though the WTPs are performing better with respect to compliance with limits of the SDWA and effluent discharge parameters, PRASA must continue to implement corrective measures to mitigate the production of disinfection by-products. Moreover, PRASA should address the shortcomings identified during inspections to improve the physical condition of its facilities, achieve/maintain continuous and consistent compliance, and optimize O&M expenses.
 - The WWTPs generally range from poor to adequate condition with compliance and equipment/maintenance as the categories of primary concern. There were nine facilities rated as poor compared to one in 2017 and from the remaining facilities rated as adequate. The greatest concern currently is the physical condition of the facilities, which continues to deteriorate as capital and R&R improvements are delayed. Also, despite some of the NPDES parameters having interim limits, the results showed that there were still many exceedances. Therefore, improvements are necessary not only to meet current interim limits but also future permanent, and more stringent limits. PRASA should verify the flood zone levels at all WWTPs to identify vulnerabilities of assets in these facilities and determine if the potential flood risks merit mitigation actions.
 - No significant changes were noted in the overall evaluation of ancillary facilities with most scoring on the lower end of adequate rating. Approximately 13% of the visited wastewater pump stations (WWPSs) have recorded overflows during the evaluation period. Prompt identification and actions enabled by remote monitoring should help PRASA mitigate overflows in the System, and adding pre-treatment (screens, comminutors) and preventive maintenance to facilities would help lessen overflows. Most of the deficiencies identified for ancillary facilities can be addressed through PRASA's R&R program and may not require major capital improvements. Finally, future regulatory requirements may require either the implementation of significant capital improvements to include and achieve additional treatment capabilities at well facilities, or the closure of certain wells.
4. The number of water leaks and sanitary overflows continue to be high when compared to U.S. benchmarks. However, PRASA has continued to improve its response time and attention/repair effectiveness, excluding the latter years because of the impacts and the after effect of the 2017 Hurricanes. PRASA continues to work on and improve its leak detection and monitoring practices and continues to aggressively address leak occurrences. Currently, PRASA is remotely monitoring levels of a number of tanks in the distribution system to avoid tank overflows and improve the water distribution balance and continues conducting periodic water audits which are used to implement the necessary controls and develop action items to address NRW. Also, PRASA is implementing the 2019 PRASA Fiscal Plan WRO initiatives, which shall help reduce physical water losses. Additionally,

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA is implementing sanitary sewer evaluations and repair plans to reduce levels of I/I that must be treated in their WWTPs. However, the progress of this initiative has been affected as well by the ongoing fiscal situation.

5. PRASA is redefining their NRW goals and metrics to phase out calculations that still use estimation methods, moving towards use of real measurements. Furthermore, the provision of meters or other mechanisms to measure the water discarded as part of the programmed drainages will further improve accounting for the volume of NRW in the System. Additionally, the Physical Losses Reduction initiatives along with the PRASA's P3 project will further support PRASA's efforts to reduce NRW. Lastly, significant capital investments and R&R funded budgets are required to accelerate the NRW program and address leak occurrences in both a corrective and preventive manner.
6. Except for buried infrastructure improvement needs, PRASA's six-year CIP along with the O&M initiatives are in alignment with the System needs and adequately addresses all mandated requirements of existing consent decrees and agreements with Regulatory Agencies. The CIP also includes funding for minor repair projects and PRASA's R&R program, as well as funding for recovery efforts and for System resilience/strengthening. Most of the investment included for the CIP is related to Emergency/Permanent Work projects. However, as noted in previous reports, given PRASA's high rate of leaks and overflows and continuing aging infrastructure, additional funds and a reactivation and acceleration of the R&R program are required to reduce/minimize these incidences. Hence, PRASA may need to further re-prioritize its funding and capital projects to address these critical System issues, as well as to address future regulations and other regulatory requirements of which impacts are not yet known. Finally, PRASA's six-year CIP includes funding for maintenance improvements, as well as for other necessary infrastructure projects (i.e., fleet and building renovation, and technological improvements) essential to maintaining and preserving the utility assets.
7. The insurance program covering PRASA's exposures to risks of accidental property and liability losses arising from on-going operations provides reasonable coverage. Also, the Owner Controlled Insurance Program (OCIP) covering PRASA's exposures to risks of accidental property and liability losses arising from construction activities provides reasonable coverage. PRASA should address the following key recommendations:
 - Conduct a PML Study considering new CAT Modellings and parameters. Specially after the lessons learned in the aftermath of the September 2017 Hurricanes.
 - PRASA should consider establishing a fund to cover possible financial losses from any future catastrophic or any non-catastrophic, peril that might affect infrastructure and operations and, therefore, impose an unexpected financial burden.
 - Consideration to Cyber Security Coverage, which is excluded under all current PRASA's Insurance Programs. Also, complete a self-assessment to determine potential areas of weakness as compared to international standards and to determine the potential frequency and severity of a breach.
 - Consideration to Terrorism Coverage, which is excluded under all current PRASA's Insurance Programs.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- PRASA should consider including Fungi and/or Bacteria coverage, which is excluded under General liability and umbrella coverage and other programs.
 - PRASA should consider including a "Claims Preparation Expense" additional coverage sublimit in the OCIP Builder's Risk policy to provide for the necessary and reasonable fees or expenses incurred by the insured's customary auditors, accountants, architects or engineers that may assist the insured proving a claim.
 - PRASA should consider requesting an endorsement to include a "Partial Occupancy Provision" to grant permission for partial occupancy of project areas in the OCIP Builder's Risk Policy. Therefore, coverage will not cease or expire due to the partial occupation of any project area or due to the project's substantial completion.
 - PRASA should consider changing the "Completed Operations" coverage extension to ten years to cover the full statutory limit (Statute of Limitations Law) in the OCIP Commercial General Liability Policy. Currently is for five years from the termination date of the policy or its renewal(s). Should also consider same action for the OCIP Commercial Umbrella Liability Policy.
8. PRASA's Forecast (Exhibit 1) reflects the financial plan certified by the Oversight Board: the FY2019 PRASA Fiscal Plan. Despite PRASA's projected additional revenues, cost savings, new federal funds, and proposed rate increases, the Forecast reflects a total deficit of \$54.6M. PRASA plans to bridge this gap by identifying and securing additional revenue sources or financing, implementing higher rate increases, implementing additional controls in Operating Expenses, modifications to projected deposits to the Capital Improvement Fund, or through a combination of these actions.
- PRASA must continue the implementation and monitoring of Operational Initiatives so that adjustments, if needed, are made on a timely basis to both the program's operational elements and budget projections. Given the status of these initiatives, and considering the coordination, planning and implementation efforts still required to be completed; it is possible that the timing for achieving the projected benefits will not be as expected by PRASA. PRASA should re-evaluate the status and schedule of these initiatives and adjust the Forecast accordingly and/or identify actions to accelerate development and implementation.
9. While Operating Revenues are projected to be sufficient to meet Senior Lien debt service payments and meet Rate Covenant DSC requirements for Senior Lien Debt, Authority Revenues are not sufficient in every year of the forecast period to meet All Obligations per the MAT. Therefore, PRASA is currently not projecting to meet its Rate Covenant requirement of 1.0x coverage of its current obligations throughout the Forecast. PRASA may need to obtain new financing, refinance a portion of their current debt, reduce its projected CIP investments, increase projected annual rate adjustments, or implement additional operational cost controls to meet its obligations. Furthermore, PRASA must consider the overall sustainability and affordability of its rates given the overall economic situation affecting Puerto Rico and recent trends affecting customer consumption profiles.

The probability of PRASA meeting its Forecast is conditioned on the following key assumptions:

- **PRASA's ability to maintain its Service Revenues, billings, and collections in a continuing challenging economic environment** – Continued uncertainty and strain on the economy, population shifts, and changing consumption patterns could continue to cause further declines in

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA's billings (reflected in lower Service Revenues than budgeted) and collections (reflected in higher Adjustment for uncollectibles).

- **PRASA's ability to implement the necessary annual rate increases** – PRASA is projecting to implement annual modest rate increases that will generate about \$690M between FY2019 and FY2024. The actual amount of the rate increases to be implemented by PRASA will depend on their financial results, planned CIP investments, customer base and consumption trends, among others.
- **PRASA's ability to continue to successfully implement the 2019 PRASA Fiscal Plan initiatives** – PRASA's Forecast includes additional revenue enhancing and cost reduction initiatives. Any changes to the funding, framework and execution of these initiatives may significantly alter PRASA's projected financial results. Also, there is a possibility that the projected results and, more specifically, the timing of those results may not be achieved.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

EXHIBIT 1

PRASA FINANCIAL FORECAST PRO FORMA ^a (\$, Thousands)	FY2019 PRELIMINARY ^b	FY2020 ANNUAL BUDGET	FY2021 PROJECTION	FY2022 PROJECTION	FY2023 PROJECTION	FY2024 PROJECTION
OPERATING REVENUES						
1. Service Revenues (Base Fee and Service Charges, Net of Subsidies) ^c	\$995,357	\$1,036,499	\$1,062,752	\$1,090,199	\$1,109,547	\$1,120,030
2. Transfer from / (to) Rate Stabilization Account	0	(20,753)	20,753	(22)	(14,553)	\$4,675
3. Other Income (Miscellaneous/Special Assessments)	2,000	500	800	800	1,100	1,100
4. Fiscal Plan - Revenue Enhancing Initiatives ^d	2,832	12,009	23,973	48,676	53,035	57,190
5. Insurance Reimbursement from Revenue Loss	50,000	0	0	0	0	0
6. Total Operating Revenues [Sum Lines 1-5]	\$1,050,189	\$1,028,255	\$1,108,278	\$1,139,654	\$1,149,129	\$1,182,995
ADDITIONAL REVENUES						
7. Transfer from Budgetary Reserve Fund	0	0	0	0	0	0
8. General Fund Grants/Appropriations/Contributions	0	0	0	0	0	0
9. Reimbursements to the Authority Revenues	0	-	0	0	0	0
10. Total Other Sources of Revenue [Sum Lines 7-9]	\$0	\$0	\$0	\$0	\$0	\$0
11. Total Authority Revenues [Line 6 + Line 10]	\$1,050,189	\$1,028,255	\$1,108,278	\$1,139,654	\$1,149,129	\$1,182,995
OPERATING EXPENSES						
12. Payroll and Benefits	\$321,011	\$326,606	\$330,832	\$334,425	\$337,020	\$338,090
13. Electric Power	136,005	152,523	163,299	168,517	166,140	169,447
14. Maintenance and Repair	50,438	57,418	55,601	56,420	57,244	58,085
15. Chemicals	33,903	33,339	34,872	35,386	35,903	36,430
16. Insurance	19,100	19,284	19,560	19,848	20,137	20,433
17. Other Expenses	150,730	156,914	159,156	161,500	163,858	166,264
18. Fiscal Plan - Cost Saving Initiatives ^e	(11,271)	(12,913)	(26,597)	(29,400)	(31,465)	(32,903)
19. Capitalized Operating Expenses	(7,112)	(27,605)	(28,243)	(28,716)	(28,871)	(29,184)
20. Total Operating Expenses [Sum Lines 12-19]	\$692,804	\$705,566	\$708,480	\$717,979	\$719,966	\$726,661
ADDITIONAL EXPENSES						
21. Hurricane Impact on OPEX ^f	25,393	(65,740)	0	0	0	0
22. Total Additional Expenses [Line 21]	\$25,393	(\$65,740)	\$0	\$0	\$0	\$0
23. Total Operating Expenses [Line 20 + Line 22]	\$718,198	\$639,826	\$708,480	\$717,979	\$719,966	\$726,661
DEPOSITS						
24. Deposit to the Senior Bond Fund ^g	\$230,790	\$250,791	\$250,790	\$250,789	\$250,788	\$250,787
25. Deposit to the Senior Debt Service Reserve Fund	0	0	0	0	0	0
26. Deposit to the Senior Subordinate Bond Fund	0	0	0	0	0	0
27. Deposit to the Senior Subordinate Debt Service Reserve Fund	0	0	0	0	0	0
28. Deposit to the Subordinate Bond Fund	0	0	0	0	0	0
29. Deposit to the Subordinate Debt Service Reserve Fund	0	0	0	0	0	0
30. Deposit to the Current Expense Fund	0	0	0	0	0	0
31. Deposit to the Operating Reserve Fund	36,197	32,384	39,974	3,076	1,013	2,033
32. Deposit to the Capital Improvement Fund (Net of Projected New Federal Funds)	42,472	84,334	114,578	139,875	149,002	171,552
33. Deposit to the Construction Fund	0	0	0	0	0	0
34. Deposit to the Commonwealth Payments Fund ^h	45,674	20,920	25,956	27,935	28,360	31,962
35. Deposit to the Surplus Fund	0	0	0	0	0	0
36. Total Deposits, excluding existing deposits available in the Current Expense Fund [Sum Lines 24-29 and 31-35]	\$355,133	\$388,429	\$431,298	\$421,675	\$429,163	\$456,334
37. Net Authority Revenues After Obligations and Deposits [Line 11-Line 23-Line 36]^h	(\$23,141)	\$0	(\$31,499)	\$0	\$0	\$0
DEBT SERVICE PAYMENTS DUE						
38. Senior (S)	\$230,790	\$250,791	\$250,790	\$250,789	\$250,788	\$250,787
39. DS Coverage Required = 2.50	4.55	4.10	4.42	4.54	4.58	4.72
40. Senior Subordinated (SSUB)	0	0	0	0	0	0
41. DS Coverage Required = 2.00	4.55	4.10	4.42	4.54	4.58	4.72
42. Subordinated (SUB)	0	0	0	0	0	0
43. DS Coverage Required = 1.50	4.55	4.10	4.42	4.54	4.58	4.72
44. Commonwealth Guaranteed Indebtedness (CGI)	45,674	20,920	25,956	27,935	28,360	31,962
45. Commonwealth Supported Obligations (CSO)	0	0	0	0	0	0
46. Debt Not Covered Under the MAT	0	0	0	0	0	0
47. Total Debt Service Including Debt Not Covered Under the MAT, Net of Existing Deposits	\$276,464	\$271,711	\$276,746	\$278,724	\$279,148	\$282,749
48. DS Coverage on All Obligations (Coverage Required = 1.00)	0.98	1.00	0.97	1.00	1.00	1.00

^aNumbers may not add up due to rounding.

^bBased on projected results as presented in PRASA's June 25th, 2019 Revised Fiscal Plan.

^cIncludes additional revenues from rate increases and electronic bill discount, net additional billings from on-going initiatives, and the adjustment for billings not collected (net of collections from prior years).

^dProjected additional revenues from initiatives included in Fiscal Plan: P3 Project, Government Collections, New Disconnection Fee, and Adjustment Policy Revision.

^eProjected expense reductions from initiatives included in Fiscal Plan: Physical Losses Reduction, Universal Healthcare Plan, and Other Expense Reductions. Also includes Pension Reduction and Christmas Bonus Elimination which PRASA does not expect to implement but will work to identify equivalent savings to comply with the proposed total expenses.

^fIncludes amount to be deposited from FEMA funding reimbursement. FEMA funds shall be deposited to the credit of the Current Expense Fund as they are used to reimburse PRASA for Current Expenses.

^gAs adjusted to reflect the benefit of the federal debt restructuring.

^hDeficits to be addressed by PRASA either through additional controls of Operating Expenses, modification to projected deposits to the Capital Improvement Fund, additional rate increases, or through a combination of these actions.

1 INTRODUCTION

1.1 Introduction

The Puerto Rico Aqueduct and Sewer Authority (PRASA) is a public utility responsible for the production and distribution of potable water, and collection, treatment, and disposal of a large portion of domestic and industrial pretreated wastewaters in Puerto Rico. PRASA serves a population of approximately 3.2 million residents² plus over 5 million visitors annually. PRASA can be considered a monopoly since it is the only water and wastewater utility in Puerto Rico, providing water and wastewater service to about 96% and 59% of Puerto Rico's population, respectively. While this is positive in terms of sales of services it also makes PRASA a critical entity for the wellbeing of Puerto Rico. The effective operation of this vital public service is essential to the health and economic prosperity of Puerto Rico and its citizens.

PRASA provides water and wastewater services throughout the island, which has an approximate area of 3,535 square miles. Because Puerto Rico is an island with varied topography, isolated demographic distributions, and a diverse mix of users, PRASA has a somewhat fragmented and localized system of water sources, treatment systems and delivery systems. As a result, PRASA has many more treatment facilities than most utilities serving a similar number of customers, and greater diversity in assets in terms of size, treatment technologies, and age when compared to systems in the United States (U.S.) and Canada, which tend to have more centralized systems with larger regional facilities. The size and diversity of assets add complexity to the management of the water and wastewater systems (collectively, the "System"), and contribute to higher operation and maintenance (O&M) costs compared to other utilities serving similar populations.

Based on the data obtained from PRASA's water and wastewater infrastructure geodatabase latest update (July 2018), PRASA owns and operates: eight dams, 113 Water Treatment plants (WTPs), 141 active Raw Water Intakes (RWIs), 51 Wastewater Treatment Plants (WWTPs), 276 wells, 977 Water Pump Stations (WPSs), 1,552 Water Storage Tanks (WSTs), 839 Wastewater Pump Stations (WWPSs), and more than 20,000 miles of water and wastewater pipelines island-wide³.

1.2 Consulting Engineer's Report Purpose and Requirement

Arcadis Caribe, PSC (Arcadis) has been retained by the PRASA as its Consulting Engineer to assist in the preparation of a Consulting Engineer's Report (CER) to satisfy the reporting requirements specified in Section 7.07 of the Master Agreement of Trust by and between PRASA and Banco Popular de Puerto Rico as Trustee, as amended.

As required by Section 7.07 of the MAT, unless the Senior Bonds have been rated investment grade by at least two Rating Agencies for 24 consecutive months, the Consulting Engineer shall prepare a CER to document the current condition and changes, if any, in PRASA's operation and the performance of the System. As a result of the credit downgrades of PRASA's bonds to non-investment grade level in FY2013

² Source: U.S. Census Bureau as of July 1, 2018.

³ Source: PRASA Geographical Information System (GIS), updated July 2018, considers elimination of Vega Baja WTP and RWIs.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

and FY2014, and in compliance with the MAT, Arcadis prepared this CER for FY2019 (2019 CER or the Report).

1.3 Conventions

PRASA's fiscal year begins on July 1st and ends June 30th. Throughout this 2019 CER, fiscal year is identified as "FY" followed by the calendar year in which the fiscal year ends, i.e., FY2019 is the fiscal year from July 1, 2018 through June 30, 2019.

1.4 Acronyms

A listing of acronyms or abbreviations of terms used in this report is included in the Table of Contents.

2 PUERTO RICO'S CURRENT FISCAL SITUATION

2.1 Overview

Over the past several years, the Commonwealth of Puerto Rico has faced a challenging financial situation. As a result, PRASA has also been adversely affected. In addition to the economic downturn that has been experienced in Puerto Rico, like many other municipal water and wastewater utilities around the world, PRASA is facing several major challenges including service affordability, aging infrastructure, high volume of non-revenue water (NRW), regulatory mandates, and increasing renewal and replacement (R&R) needs.

The high costs of infrastructure repairs combined with lack of customer understanding of the value and cost of water services (as an essential service, the public resists paying for higher service rates), makes it very difficult for water and wastewater utilities to achieve a break-even operation while maintaining affordable service rates. Because of the complexity of their water and wastewater systems (hereinafter referred to collectively as the System) it operates, PRASA has inherently higher operating costs and capital investments needs than other utilities in North America.

To remain consistent with its mission of providing service at an affordable cost, from 2005 through 2016 PRASA financed its Capital Improvement Program (CIP) with revenue bonds and federal assistance provided by the United States Environmental Protection Agency (USEPA) State Revolving Fund (SRF) Program and United States Department of Agriculture (USDA) Rural Development (RD) Program. During this period, PRASA also successfully completed two bond transactions, in 2008 and 2012, issuing over \$3,000 million (M) in revenue bonds. In the midst of the Central Government's fiscal situation, during 2015, PRASA attempted to issue additional revenue bonds. However, the conditions for the bond issuance were not favorable as the Government's fiscal situation and rating downgrades had a major impact on PRASA's own bond ratings. Combined with other external factors, this limited PRASA's ability to access the capital markets to obtain financing to cover its immediate CIP related expenses.

PRASA used operating revenues to cover expenses related to its CIP projects for some time, assuming it would be able to access the municipal market in due course. However, PRASA's current rate structure was designed primarily to cover operational expenses and debt service, and only a limited maintenance budget. Without the ability to secure additional funding and after expending its surplus operating income to cover a portion of its unfunded CIP, PRASA was forced to essentially postpone and eventually terminate the execution of all CIP projects in FY2016. More than 140 infrastructure projects, with an investment totaling about \$600M were suspended and eventually cancelled and thousands of private sector workers are estimated to have lost their jobs because of the CIP suspension. Moreover, roughly \$150M was owed to CIP contractors and consultants at the beginning of FY2017. As of FY2019, PRASA paid off all outstanding payments due to contractors and CIP consultants.

2.2 Puerto Rico Oversight, Management and Economic Stability Act (PROMESA) and PRASA's Fiscal Plan

On May 25, 2016, the United States (U.S.) Congress enacted Puerto Rico Oversight, Management and Economic Stability Act, also known as PROMESA. PROMESA addresses Puerto Rico's debt by establishing an oversight board, a process for restructuring debt, and expedited procedures for approving critical infrastructure projects. The Oversight Board established under this Act oversees the development of budgets and fiscal plans for Puerto Rico's Central Government and its instrumentalities, including PRASA. Also, it may issue subpoenas, certify voluntary agreements between creditors and debtors, seek judicial enforcement of its authority, impose penalties, and enforce territorial laws prohibiting public sector employees from participating in strikes or lockouts. The Oversight Board's responsibilities include:

- Certifying fiscal plans for entities designated as "covered entities" by the Board as well as the Government's Fiscal Plan
- Approving annual budgets
- Enforcing budgets and ordering any necessary spending reductions
- Reviewing laws, contracts, rules, and regulations for compliance with the fiscal plan

PROMESA also provides Puerto Rico's Government and its instrumentalities two distinct restructuring tools to address the island's fiscal crisis known as Title III and Title VI. Title VI of PROMESA focuses exclusively on restructuring the financial debt and relies on a voluntary group action mechanism to bind dissenting creditors to the agreement of the debtor and requires a supermajority of its creditors to restructure the debt. Whereas Title III of PROMESA is an in-court proceeding that follows a similar framework as a municipality bankruptcy under Chapter 9 of the Bankruptcy Code but is broader in scope. Title III incorporates the bankruptcy cram down power, which allows for a plan of adjustment (to be approved by only a single impaired class) for nonconsenting classes of claims. PRASA currently has not filed for either of these restructuring tools, nor has there been a request to do so by the Oversight Board or the Central Government.

Pursuant to the Oversight Board request/mandate for the submission of a Fiscal Plan, on June 25, 2019, the Oversight Board certified a revised version of PRASA's Fiscal Plan for FY2019 as developed by the Oversight Board, pursuant to Section 201(d)(2) of PROMESA (the 2019 PRASA Fiscal Plan). The 2019 PRASA Fiscal Plan has been developed to promote PRASA's mission of providing high quality drinking water and sanitary sewer service at the lowest possible cost. It provides for the required investment for the necessary infrastructure to restore the System after the impact of the September 2017 Hurricanes and to ensure compliance with required standards while promoting a much-needed economic growth throughout the island, the timely execution and implementation of its measures, and PRASA's long-term financial self-sustainability plan.

For the purposes of this Report and the analysis included herein, Arcadis used PRASA's six-year forecast covering FY2019 through FY2024 (the Forecast), and the certified 2019 PRASA Fiscal Plan as the official and latest fiscal plan, including the October 2019 amendment as approved by PRASA's Governing Board. Considering, however, that it may incur additional modifications. Variances between the Oversight Board certified FY2019 PRASA Fiscal Plan and PRASA's Forecast are noted in this Report.

The 2019 PRASA Fiscal Plan is discussed in more detail in Section 8.

3 ORGANIZATIONAL UPDATES AND CHANGES

3.1 Introduction

As shown in **Figure 3-1**, PRASA is organized into five operational Regions (North, South, East, West, and Metro), as a result of the enactment of Act No. 92 on March 31, 2004 (Act 92-2004).



Figure 3-1. PRASA Regions

PRASA is managed by an Executive Management Team that provides the daily management oversight and coordination for all institutional activities. It is supported by various departments in the organization including, but not limited to, finance, customer services, and information systems. **Figure 3-2** shows PRASA's current organization.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

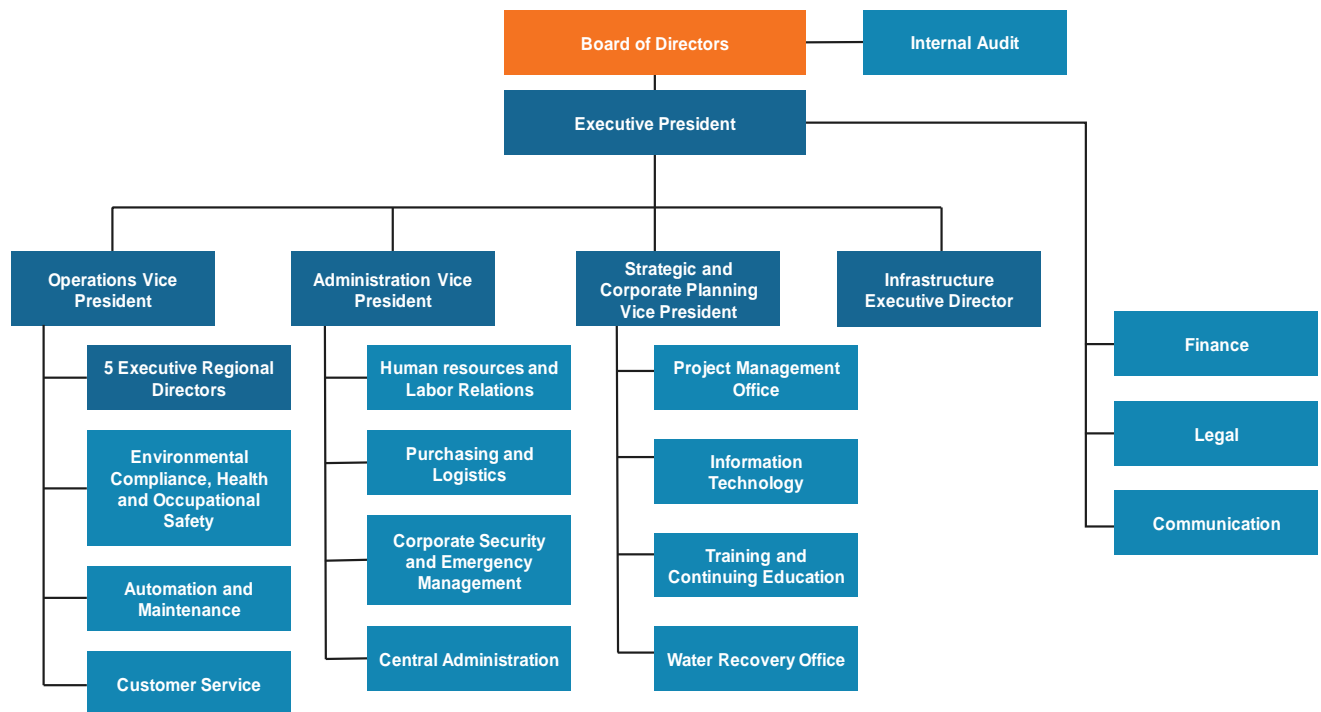


Figure 3-2. PRASA Current Executive Management Structure

3.2 Updates and Changes in PRASA's Organization and Management

3.2.1 Board of Directors (Governing Board)

As presented in **Table 3-1** and pursuant to restructuring as per Act No. 68 of 2016 (Act 68-2016), PRASA's Governing Board, is composed of eight members, which include:

- Four independent directors appointed by the Governor of Puerto Rico, comprising of:
 - a. One engineer licensed to practice in Puerto Rico with ten years of experience,
 - b. One authorized legal advisor with at least ten years of experience in Puerto Rico and admitted to practice in the Government,
 - c. One member with a wide knowledge and experience in the field of corporate finance,
 - d. One professional with expertise in any fields related functions delegated to PRASA.
- One AAFAF representative as per Act 2-2017.
- One Consumer Representative, a private citizen representing the Authority's customers, and
- Two ex-officio members, the Executive Director of the Association of Mayors and the Executive Director of the Federation of Mayors.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Currently, PRASA's Governing Board has two Consumer Representatives since they were selected prior to the enactment of Act 68 and their current term expires in June 2020. However, after their term ends, PRASA's Governing Board will have only one Consumer Representative, as stated by Act 68-2016, bringing the total number of PRASA's Governing Board members to eight, as listed above.

Table 3-1. PRASA's Governing Board Members as of September 30, 2019

Name	Board Position	Position Description	Term Ends
Héctor J. del Río Jiménez, Esq.	President	Independent Director/Finance	July 12, 2022
Gerardo Lorán Butrón, Esq.	Interim Vice-President	AAFAP Representative	Ex Officio
Memphis Cabán Rodríguez, PE	Director	Independent Director/Engineering	July 12, 2021
Alberto J. Castañer Padró, Esq.	Director	Independent Director/Legal	July 12, 2021
Vacant	Director	Independent Director	
José A. Rivera Rodríguez	Director	Executive Director of the Mayors Association	Ex Officio
Isabelo Molina Hernández	Director	Executive Director of the Mayors Federation	Ex Officio
Héctor Sánchez Cardona, PE	Director	Consumer Representative	June 19, 2020
Félix Aponte Ortiz, PhD.	Director	Consumer Representative	June 19, 2020

Except for the Consumer Representative, the AAFAP Representative and the Executive Directors of the Association of Mayors and the Federation of Mayors, all other members of the Board are named by the acting Governor of Puerto Rico, with the advice and consent of the Senate of the Government of Puerto Rico.

Directors appointed by the Governor shall be selected from a list of at least ten candidates, vetted by a recognized executive search firm and according to objective criteria that includes professional and educational backgrounds of the candidates. The customer representative will serve for a three-year term and be chosen through a public selection process under the jurisdiction of and directed by the Puerto Rico Department of Consumer Affairs. Finally, the Governor-designated or elected Board members shall serve staggered terms: two members shall hold office for five years and two members for six years. As the terms of office for these Board members expire, the Governor shall appoint successors for five-year terms, following the same candidate identification mechanism. None of the members appointed by the Governor may hold such office for more than three terms.

PRASA's Governing Board is responsible for making or approving all major decisions taken by PRASA, including overall institutional policies, PRASA's strategies and programs, executive and key management

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

manpower recruitments and removals, approval of union contracts, professional services contracts beyond the limits accorded to the Executive President, and all contract changes that are beyond the limits accorded to the Executive President.

PRASA's Governing Board is assisted by an Internal Audit Unit which is responsible for conducting internal audits for the Board, and by a Board Secretary, who maintains Board records, among other responsibilities.

The following material change as it relates to PRASA's Governing Board was reported by PRASA during FY2019 and the first quarter of FY2020: José A. Rivera Rodríguez replaced Gretchen Hau, Esq. as Executive Director of the Mayors Association. One Board position remains vacant (Independent Director with expertise in any fields related functions delegated to PRASA).

3.2.2 Executive Management Team

Since the enactment of Act 92-2004, PRASA has gone through some management changes at many levels of its organization including the executive level. A summary of PRASA's key Executive Management Team as of the date of this Report, including previous positions held and years of experience, is presented in **Table 3-2**.

Table 3-2. PRASAs Executive Management (as of September 30, 2019)

Name	Current Role	Term Ends	Prior Role	Experience Total/PRASA
Eng. Elí Díaz Atienza	Executive President	February 2022	Private Sector	14 years / 3 year
Eng. Doriel Pagán	Operations Vice President	Indefinite ²	Executive Director North Region	28 years / 26 years
Eng. Ryan Arrieta	Strategic and Corporate Planning Vice-President	Indefinite ²	Private Sector	19 years / 3 year
Keralia Moreda, Esq.	Administration Vice-President	Indefinite ²	Private Sector	14 years / 2 year
Mr. Efraín Acosta	Executive Director of Finance	Indefinite ²	Deputy Exec. Director of Finance PRIDCO	41 years / 15 years
Eng. José J. Rivera	Interim Executive Director for Infrastructure ¹	Indefinite ²	Auxiliary Director for Engineering	22 years / 8 years
Eng. Roberto Martínez	Executive Director Metro Region ¹	December 2019	Deputy Exec. Director Metro Region	32 years / 26 years
Eng. José Rivera	Interim Executive Director North Region ¹	Indefinite ²	Toa Alta Area Director	22 years / 20 years
Cheryl Ortiz McCormick	Interim Executive Director South Region ¹	Indefinite ²	Deputy Exec. Director South Region	21 years / 13 years
Eng. Enrique Rosario	Interim Executive Director East Region ¹	Indefinite ²	Deputy Exec. Director East Region	21 years / 11 years

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Name	Current Role	Term Ends	Prior Role	Experience Total/PRASA
Eng. Joel Lugo	Interim Executive Director West Region ¹	Indefinite ²	Executive Director West Region	20 years / 20 years

¹Legislated positions.

²Indefinite, as per amended Act 40-1945 (Ley 68-2016), which allows Executive Management members to be named as Interim, with no definite term of service.

The following material change was reported by PRASA during FY2019 and the first quarter of FY2020 regarding its organization and changes in leadership and management: Cheryl Ortiz McCormick was appointed as Interim Executive Director for the South Region in replacement of Eng. Hector Gierbolini, whose term expired during FY2019.

3.2.3 Staffing Profile

PRASA's existing staff is categorized into five primary categories described below:

1. Appointed Employees: This category includes the executive staff, deputy and department directors, area directors and administrative assistants that provide support to key management personnel of the utility.
2. Management Employees: These employees manage the day-to-day operations of the utility. They hold management positions both in the central and regional offices.
3. HIEPAAA Employees (*Hermandad Independiente de Empleados Profesionales de la Autoridad de Acueductos y Alcantarillados*): These employees are the unionized professional staff that includes accountants, engineers, insurance specialists, project inspectors, and surveyors.
4. UIA-AAA Employees (*Unión Independiente Auténtica de la Autoridad de Acueductos y Alcantarillados*): These employees are the unionized plant and system operators, maintenance and support staff, meter readers, customer service specialists, and administrative assistants.
5. Temporary Employees: These employees are those that are hired and classified as temporary until formally assigned to a regular position. New hires are placed in a 90-day probationary period. They do not have full benefits during the probationary period. If still employed after probationary period, they either become full-time employees or their temporary employment contract is renewed.

At the end of FY2019, PRASA had a total staff of 4,593, of which 327 are pre-retired under Act 211-2015, as further discussed below. Overall, staff was reduced by 0.7% from FY2018 to FY2019. Based on the total number of employees for FY2019, the ratios of service accounts (counting the water service and sanitary sewer service for the same client, as two separate accounts)⁴ to employees was 434, which represents a decrease of 6.9% compared to FY2018 which was 466. Current industry for combined utilities operations averages range from 367 to 609, with a median of approximately 492 customer

⁴ By the end of FY2019 PRASA had a total 1,232,019 active accounts, 1,231,633 water accounts and 763,194 wastewater accounts.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

accounts per employee⁵. PRASA's customer account per employee ratio falls within the range for the industry.

Table 3-3 shows the staff levels by staff category over the last five fiscal years. Since FY2010, PRASA has implemented staff reduction initiatives, such as early retirement, re-training existing staff from overstaffed positions to reduce the need for new hires and using staff attrition as a means to reduce overall staffing positions.

Table 3-3. Staffing Levels

End of FY	Appointed Employees	Management Employees	HIEPAAA Employees	UIA-AAA	Temporary Employees	Pre-Retired Employees	Total Employees
2015	161	1,011	155	2,635	1,027	-	4,989
2016	159	1,188	149	3,293	9 (UIA)	-	4,798
2017	163	1,195	141	3,146	9 (UIA)	-	4,654
2018	154	1,058	117	2,952	9 (UIA)	335	4,625
2019	162	1,058	123	2,915	8 (UIA)	327	4,593
5-year CAGR	0.15%	1.14%	-5.62%	2.56%	-70.29%	N/A	-2.05%

Source: PRASA Human Resources & Finance Departments

PRASA reported net reduction of staff under 1% from FY2018 to FY2019, including a decrease of 37 UIA-AAA employees and one temporary employee and increase of eight appointed employee and six HIEPAAA employees.

The net reduction of employees reflects the effects of the delay in recovery from the 2017 Hurricanes and the Island's financial situation on PRASA's headcount. PRASA received many resignations from employees that were, for the most part, either emigrating from Puerto Rico or hired into new jobs. During FY2019 PRASA granted permanent positions to about 300 employees, including difficult positions to recruit such as operators and electromechanical staff. However, 15 electromechanical personnel resigned during FY2019.

The Voluntary Pre-Retirement Program seeks to reduce the workforce progressively and voluntarily, thus allowing for the economy to undergo a transition process. This may reduce expenses such as payroll and benefits but requires that the Office of Management and Budget (OMB) evaluate and certify that employees eligible for the program and under consideration result in savings for PRASA. Besides the reduction of expenses, Act 211-2015 stipulates that positions that become vacant upon implementation of the retirement program be eliminated, and that agencies take administrative or operational measures to accommodate for these eliminated positions. However, OMB may authorize to re-staff the position, if determined to be critical, and in accordance with the 2019 PRASA Fiscal Plan submitted by the agency. As it stands, some of the eligible employees currently occupy positions that are managerial or supervisory, which may result in organizational challenges.

⁵Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

As a result of the fiscal crisis compounded by the impacts of the 2017 Hurricanes, AAFAP on behalf of the Puerto Rico Government circulated an Administrative Order (OA-2017-5) on November 7, 2017, which created the ERS⁶ Voluntary Transition Program intended to create an alternate program for eligible employees under the ERS. On April 18, 2018, a second Administrative Order (OA-2018-5; amended on June 29, 2018 as OA-2018-9) was circulated extending the program to a second phase, and on October 23, 2018, a new Administrative Order (OA-2018-13; amended on November 15, 2018 as OA-2018-14) further extended the program by adding a third phase. Employees will have until November 30 and December 15 of 2018, respectively to enroll in the programs. Eligible employees who enroll in the program and voluntarily resign their position shall receive economic incentives consisting of six-months salary, a medical plan, and up to 60 days payout of unused vacation. During the third phase, 92 employees were eligible and were approved of which 41 employees resigned effective November 30, 2018 and 51 resigned, effectively December 31, 2018.

PRASA's revised optimal staffing level to operate and maintain the System, and effectively manage the utility, as presented in the 2019 PRASA Fiscal Plan, stands at approximately 4,800 employees. As shown in **Table 3-3**, at the end of FY2019, PRASA's staff totaled 4,593 employees (of which 327 are pre-retired), which is significantly under PRASA's goal. However, this does not translate into PRASA achieving an optimum staff mix as there are critical staff needs that must be addressed such as treatment facilities operators and electromechanical staff, among others.

Furthermore, PRASA's current hiring plan focuses mainly on employing personnel for the departments impacted the most by the Voluntary Pre-Retirement and general employee resignations. These affected departments include: Maintenance, Customer Service and Operations Departments. Staff position needs identified include but are not limited to field workers; supervisors and electromechanics for the Maintenance Department; and wastewater treatment plant (WWTP) operators, WWTP and water treatment plant (WTP) supervisors, services coordinators, assistant directors, laboratory assistants, and sanitary sewer workers for Operations Department. The deficit in operations personnel has forced the Operations Department to incur in overtime hours to operate facilities, thus impacting payroll metrics. PRASA intends to keep identifying candidates and following hiring procedures to further optimize its staff and address needs in key areas.

3.2.4 Labor Relations

After the commencement of the elected government on January 2017, several laws that affect PRASA's labor relations came into effect. These laws are Act No. 3 of January 23, 2017 (Act 3-2017) and Act No. 26 of April 27, 2017 (Act 26-2017). These laws have supremacy over any other law or agreement regarding the same matters. The aspects of these laws that affect PRASA are discussed in the next sections.

⁶ Employees Retirement System of the Government of Puerto Rico.

3.2.4.1 Act 3 of 2017 – “Ley para Atender la Crisis Económica, Fiscal y Presupuestaria para Garantizar el Funcionamiento del Gobierno de Puerto Rico”

The Government of Puerto Rico, through the enactment of Act 3-2017, declared a fiscal emergency and required that its instrumentalities (i.e., utilities, government agencies, and public corporations such as PRASA) implement certain measures to reduce its expenses. Act 3-2017 has primacy over any other previous law and will remain in place until June 30, 2021 or until certain economic and financial conditions are met. For FY2019, Act 3-2017 still requires, among others, the following measures (note that not all of these measures are applicable to PRASA as a public corporation of the Government of Puerto Rico):

1. No increase in economic benefits to employees (except minor exceptions).
2. No monetary liquidation of vacation days in excess of 60 days
3. No liquidation of sickness days⁷
4. Suspension of non-economic clauses under previous agreements that have an economic impact on the operations budget of the entity.
5. No negotiation of labor union agreements during the tenure of this act.
6. No creation or renovation of career positions
7. Appointed positions will be reduced by 20% unless previously approved by the Executive Director of OMB.
8. No funding for travelling outside Puerto Rico unless approved by the Secretary of Government.
9. No cellular phones or technological services will be provided
10. Reduction of energy consumption by 5% each year.
11. Reduction of potable water consumption by 5% each year, from FY2017 until FY2019, which shall reflect a 15% total reduction in the three years.
12. Reduction of 10% of Contracted services compared to expenses incurred in FY2015-2016 and maintain within that level unless previously approved by the Executive Director of OMB.

According to this Act, any agreement between PRASA and both UIA-AAA and HIEPAAA unionized personnel that has expired or expires during the active period of this law shall be extended until June 30, 2021 in terms of its non-economic clauses and those clauses not affected by Act 3-2017. As per Article 14 of Act 3-2017 those non-economic clauses that have a direct or non-direct economic impact on PRASA's operational budget, shall be suspended. Two explanatory letters from OMB, CC 144-17 and 145-17, were circulated clarifying Article 14 and stating that benefits and economic compensation for employees shall be maintained from the date of ratification of Act 66-2014.

Although these measures represent operational savings for PRASA, some of them affect PRASA's revenues, such as Measure 11 listed above. This measure requires that all agencies, instrumentalities, and public corporations under the executive branch reduce its potable water consumption by 5%, which

⁷ Refer to Table 3-4 for more detail.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

would in turn result in a reduction of revenues for PRASA. This Act also requires that PRASA comply with certain progress reporting requirements to the House of Representatives, the Senate of Puerto Rico, and the Office of the Governor of Puerto Rico. The report shall list all implemented measures and the results obtained. Stricter measures are stipulated in the later approved Act 26-2017 and discussed in further detail in the next section.

3.2.4.2 Act 26 of 2017 – Fiscal Plan Compliance Law

To assure compliance by the Government with the approved Fiscal Plan, Act 26-2017 was enacted. Act 26-2017 superseded all previous laws. This law covers several areas of the Government of Puerto Rico, including PRASA as listed below:

1. Marginal benefits standardization for all public service employees of the Government of Puerto Rico, including public corporations (Article 2.04 of Act 26-2017).
2. No temporary employment (derogation of Act 89-2016).
3. Revision to Mandatory Insurance Fee every two years (Amendment to Article 3 of Act 253-1995).
4. Additional Service Charge on Mandatory Vehicle Insurance (Amendment to Article 7 of Act 253-1995).
5. Transfer of remaining funds at the end of the FY of all government agencies, instrumentalities, and public corporations to the State General Fund.

Measure 1 in the list above standardized the marginal benefits of all government employees. Article 2.04 of Act 26-2017 affects the following marginal benefits:

- Vacation License: accumulation rate and maximum accumulation (depending on applicability of Act 8-2017: Human Resources of the Government of Puerto Rico Transformation and Administration Act)
- Sickness License: accumulation rate and maximum accumulation (depending on applicability of Act 8-2017: Human Resources of the Government of Puerto Rico Transformation and Administration Act)
- Maternity License
- Paternity License
- Breastfeeding Special License
- Unpaid Licenses
- Special Licenses
- Standardization of Holidays (15 holidays)
- Uniform Medical Insurance Employer Contribution (minimum of \$100 contribution)
- Only one bonus: Christmas bonus (\$600 per year)
- Overtime Compensation at a maximum of 1.5 times
- Vacations and Sickness Days Liquidation (no liquidation at the end of the year)

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

This measure reduces operational costs in terms of payroll and benefits, specifically in the vacation, sickness, and overtime compensations, and Christmas Bonus.

Measures 3 and 4 as listed above may also have an impact on fleet operational cost, since they represent a potential increase in the payment of the mandatory vehicle insurance. The amount of increases are not known yet but are already approved by law. **Table 3-4** below compares and summarizes both Acts 3 and 26 of 2017 in terms of the effects these enacted laws have on PRASA.

Table 3-4. Impacts of Acts 3 and 26 of 2017 on PRASA

Category	Act 3-2017	Act 26-2017
Economic Benefits	<ul style="list-style-type: none"> • There will be no increase in economic benefits and no extraordinary monetary compensations as per Act 66-2014. Collective Agreements that have not expired to the date of approval of this law will be extended as stipulated on Article 8 of Act 66-2014. • Vacations accumulated in excess of 60 days shall be used within 6 months after the end of the natural year, otherwise the excess will be lost. Vacation accumulated days up to the date of approval of this law shall be retained by the unionized and non-unionized employee, but accumulated excess shall not be liquidated monetarily. • Sickness day accumulation in excess prior to the approval of this act and during the approval of this act will be frozen to the salary of June 30, 2014. Monetary liquidation will only be performed when the employee leaves public service. After approval of this law, accumulation of excess days by December 31st of each year shall be used by June 30th of the next year. After the latter excess accumulation balance will be lost. • Christmas bonus will be of \$600 each year for all employees of the Central Government and Public Corporations. • All public corporations shall suspend, during the effectiveness of this act, all non-economic clauses under the labor agreements that have a direct or 	<ul style="list-style-type: none"> • Marginal benefits will be the same for all employees of the Executive Branch, including all agencies, instrumentalities, and public corporations of the Government of Puerto Rico, except for the University of Puerto Rico. • Vacations shall be accumulated up to a maximum of 60 days at the end of each natural year. All employees will have the right to enjoy 15 days of vacation each natural year, for which no less than 10 days shall be enjoyed consecutively. If deemed necessary a public corporation shall concede vacations up to a maximum of 50 days in a year to those employees that have accumulated vacation days. • Accumulation of sickness days will be at a rate of 1.25 days per month of service for those employees contracted prior to Act 8-2017. For those contracted after Act 8-2017 the accumulation rate will be 1 day per month. Sickness days shall be accumulated up to a maximum of 90 days per natural year and no monetary liquidation is accepted. • The Christmas bonus will be of \$600 each year for all employees of the Central Government and Public Corporations.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Category	Act 3-2017	Act 26-2017
	<p>indirect economic impact in the operation of the public corporation. Non-economic clauses with economic impact are defined under Act 66-2014.</p>	
Negotiation of Collective Agreements	<ul style="list-style-type: none"> Those agreements that expire before the approval of this act or that expire during the term of this act will only be extended in terms of non-economic clauses that are not affected by this act until June 30, 2021. At the end of the term of this law the labor unions that by July 1st, 2014 were represented in the Executive Branch of the Government will be able to negotiate new collective agreements. 	<ul style="list-style-type: none"> This law has supremacy over any collective agreement or contractual letter that interferes with the dispositions in this law.
Employment Positions	<ul style="list-style-type: none"> All vacant positions that were generated prior or during the effectiveness of this act will remain vacant until June 30, 2017. Vacant positions cannot be filled without the previous authorization of the OMB Director. No new career, regular, and transitory or irregular positions will be created or renewed, unless previously approved by the OMB Director. Appointed positions will be reduced by 20%. 	
Operational Costs	<ul style="list-style-type: none"> The use of public funds for travelling out of Puerto Rico is prohibited unless such travels are necessary for the adequate performance of such entity or that was previously approved by the Secretary of Government. No public funds will be used for the payment of cellphones or technological services. Energy consumption shall be reduced at least by 5% each year. The energy consumption of FY 2015-2016 shall be used as baseline for the calculation of the annual reduction. Potable Water Consumption shall be reduced by 5% each year. The potable water consumption of FY 2015-2016 	<ul style="list-style-type: none"> Mandatory Vehicle Insurance Fee will potentially increase, due to additional service fee and fee revision every two years. This will be reflected in the operation and maintenance costs of PRASA's fleet. All government instrumentalities, agencies and public corporations of the Executive Branch, except for the University of Puerto Rico, shall transfer a specific amount, as stipulated by the designated committee, from the surplus revenue at the end of each economic year to the State General Fund.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Category	Act 3-2017	Act 26-2017
	shall be used as baseline for the calculation of the annual reduction.	
	<ul style="list-style-type: none"> Contract Agreements of Professional or Bought Services shall be reduced by at least 10% compared to FY 2015-2016. Contract Agreements of professional services of more than \$10,000 in the same FY shall be previously authorized by the Governor or a representative. 	
Purchase Costs	<ul style="list-style-type: none"> All purchase costs shall be reduced by 5% for FY 2016-2017. 	
Quarterly Report	<ul style="list-style-type: none"> All entities of the Executive Branch shall prepare a report that lists and details all the taken measures and the corresponding results. The first report shall be submitted 90 days after the approval of this act. 	

3.2.5 Training

PRASA continues to offer varied training programs to its employees to improve work management and productivity. Training topics range from technical-oriented seminars to conflict resolution and team building sessions. During FY2019, PRASA offered over 50,223 training hours to its employees; this represents an average of approximately 11 hours per trained employee for FY2019.

Overall, about 71% (3,254) of the total employees participated in training activities offered by PRASA during FY2019. PRASA continues to invest in personnel training to increase work ownership and productivity levels. Also, PRASA is reducing training contracts and preparing its own employees to handle those duties whenever possible. Furthermore, PRASA is working to establish a digital platform, using the free open source “Moodle” to incorporate trainings via internet. PRASA’s training staff was targeting to incorporate about 11 courses to the digital platform by January 2019 and striving to have around 30 by Summer 2019, however, this was delayed for FY2020. Lastly, PRASA continues to support training and certification of its treatment plant operators, in compliance with requirements established by Regulatory Agencies. **Table 3-5** presents a summary of the number of operators by the type of license held.

Table 3-5. Operator Licensing FY2018

Facility	In Training	Type I	Type II	Type III	Type IV	Total
Water	50	20	44	84	254	452
Wastewater	12	3	8	24	92	139
Total	62	23	52	108	346	591

3.3 Conclusions

The current organization continues to operate and manage the System, despite the difficult challenges it faced in FY2018 and FY2019. PRASA staff levels are under the Executive Management Team's established target level. However, the staffing mix is not yet optimal as many critical technical and operations positions are currently vacant. PRASA must align employees with required skill sets, either through recruitment or further workforce development, to fill technical and operator needs while maintaining optimal staffing levels. PRASA is implementing a digital training platform to help reduce training costs and allow for more efficient and timely training, which could further support workforce development. Also, PRASA should consider the impact of the employee retirement programs and workforce challenges on the island which will continue to affect not only its existing staff, but also their ability to recruit capable and experienced staff. PRASA continues to assess administrative and operational performance and implement organizational and policy changes focusing on customer service, System performance, and budget controls.

4 CONDITION OF SYSTEM

4.1 Introduction

In FY2019, Arcadis assessed the condition and operation of PRASA's assets through an inspection program of selected facilities in the System to meet the following objectives: 1) to assess the current physical state of the facilities inspected; 2) to determine if the facilities are being operated and maintained in a manner to achieve their operating goals; and 3) to evaluate if PRASA's CIP is aligned with the System's identified needs. Given the significant reduction in capital and renewal and replacement investment over the past four years, Arcadis performed asset condition assessments of a selection of WTP and WWTP facilities that were highly impacted during the 2017 Hurricanes as per FY2018 Asset Condition Assessment Report (ACA Report), as well as a different sample of auxiliary facilities. Arcadis inspected facilities to assess the structural integrity and physical condition of structures and equipment; adequacy of operation and maintenance practices; as well as renewal and repair needs among other evaluation criteria. Arcadis also evaluated the compliance performance results for all PRASA WTPs and WWTPs for the period of January 1, 2018 through December 31, 2018. The facility inspections were performed between February 2019 and August of 2019. The next cycle of facility inspections will resume in FY2020 and will include PRASA's dams.

This section presents a summary of Arcadis's inspection results, findings and recommendations regarding PRASA's System based on the condition of the assets inspected during FY2019 and detailed in the FY2019 ACA Report.

4.2 Facility Inspections

A summary of the facilities inspected during 2019 is presented in **Table 4-1**. In total, 173 facility inspections were performed out of a total of 3,816 facilities that comprise the System, excluding active RWIs (141). Inspected facilities include: a number of WTPs and WWTPs, and a selection of wells, WPSs, WSTs and WWPSs. Dams were not included in this round of inspections because they were visited on February 2018 and included in the previous asset condition assessment report prepared by Arcadis. Approximately 31% and 39% of the WTP and WWTPs respectively, were inspected. Also, a small portion (about 3% in total) of the wells, water and wastewater pump stations and water storage tanks were inspected considering the lower risk impact these assets have on the System. It should be noted that no inspections were performed on the following assets: small dams and weirs, buried infrastructure, meters, ocean outfalls, buildings, land, and other ancillary facilities. Nevertheless, based on data provided by PRASA, a discussion of the buried infrastructure has been included in a later sub-section.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 4-1. Percent of Assets Inspected by Asset Category

Asset Category	Total PRASA Facilities ¹	Inspections Performed	
		Quantity	Percent
Regulated Dams	8	0	0
Water Treatment Plants	113	35	31
Wastewater Treatment Plants	51	20	39
Wells	276	16	6
Water Pump Stations	977	32	3
Water Storage Tanks	1,552	40	3
Wastewater Pump Stations	839	30	4
Total	3,816	173	5

¹Data obtained from PRASA Geographical Information System (GIS), updated July 2018.

4.2.1 Inspections Methodology

Inspections were performed throughout PRASA's five Operational Regions: North, South, East, West, and Metro. **Table 4-2** shows the number of facilities inspected within each Region. It should be noted that the total number of inspections performed in the Metro Region is lower than those performed in the other Regions because it has fewer, but larger WTPs and WWTPs. Nevertheless, it was inspected in a manner consistent with the other Regions.

Table 4-2. Summary of Inspections by Region

Asset Category	East	Metro	North	South	West	Total
Water Treatment Plants	7	6	7	8	7	35
Wastewater Treatment Plants	5	3	6	3	3	20
Wells	0	0	6	4	6	16
Water Pump Stations	8	6	6	6	6	32
Water Storage Tanks	8	8	8	8	8	40
Wastewater Pump Stations	6	6	6	6	6	30
Total	34	29	39	35	36	173

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Following the same approach adopted by Arcadis in previous condition assessments, an attempt was made to obtain a random sampling of the wells, pump stations, and storage tanks (ancillary facilities) by inspecting a number of facilities within several specific Operational Areas across the island, rather than inspecting a uniform number of minor facilities within each Operational Area. As the specific assets to be inspected were not pre-determined, this approach provided some assurance that not only the best assets were inspected in each Operational Area. The Operational Areas visited were: Manatí and Arecibo (North Region), Ponce and Yauco (South Region), Caguas and Fajardo (East Region), Aguadilla and San Germán (West Region), and Guaynabo and San Juan (Metro Region). Since the Metro or East Regions did not have wells available, we visited additional wells at the North and West Regions.

Each facility was inspected using an inspection form developed by Arcadis, that included scoring criteria and criteria weighting customized for each specific asset category. Site visits were conducted in each facility. The purpose of the site visits was to determine the current state of repair and operation of the asset as influenced by age, historical maintenance and operating environment.

The evaluation criteria were chosen from the following list:

- Regulatory Compliance – degree to which the performance of the asset is in compliance with its permit limits and regulatory requirements.
- Operations / Process Control – degree to which asset condition and features allow it to be operated and controlled to meet its performance objectives.
- Equipment / Maintenance – assessment of the adequacy of the maintenance practices and the condition of the facility.
- Staffing / Training – assessment of the adequacy of facility staffing coverage and training.

Within each of the evaluation criteria, the asset inspected was assigned a numerical score between 0 and 3. An overall facility rating was then determined based on the calculation of a weighted average of the ratings for each criterion. For WTP and WWTP, a weighted average was used per equipment listing in the inspection form to account for the importance of critical equipment, then the average of each equipment rating was considered for the overall facility rating. The general interpretation of the numerical ratings is described below:

<u>Rating</u>	<u>Range</u>
• Good (Most of the criteria are adequately addressed)	2.5 – 3.0
• Adequate (Many of the criteria are adequately addressed)	1.5 – 2.4
• Poor (Many of the criteria are not adequately addressed)	0.5 – 1.4
• Unacceptable (Most of the criteria are not adequately addressed)	0.0 – 0.4

An overview of the results of the inspections for each asset category is discussed in the following section.

4.2.2 Inspection Results

According to the facilities inspections performed between February 2019 and August of 2019, an overall condition rating for each asset category was determined. The condition of each of the facilities varied

from good to those requiring certain capital upgrades and/or operational/process control improvements. The inspection rankings and results per facility type are summarized in the following subsections.

4.2.2.1 Water Treatment Plants

PRASA operates 113 WTPs where it treats raw water to produce potable water for its customers. The island wide design production capacity of WTPs is approximately 621 MGD. The WTPs range in size from several thousand gallons per day up to 100 million gallons per day (MGD), For FY2019, PRASA reported a total water production of 542 MGD of which approximately 487 MGD came from water treatment plants.

A total of 35 WTPs (31% of total WTPs) were inspected as part of this assessment. Each assessment consisted of a site visit inspection and an interview with the operator, plant supervisor or designated personnel, and revision of available plant reports. Therefore, the information obtained was at least in part based on the understanding of the person that was being interviewed. **Table 4-3** presents the comparison of the average rating results of the facilities inspected by each category evaluated. The overall average rating of each evaluation criteria for 2008 through 2019 inspections is also provided. On average, the WTPs were rated as adequate with a score of 2.0. No WTPs were rated as Unacceptable or Poor in overall rating. Even though all WTPs were classified as Adequate, 16 of the 35 WTPs received a low-end rating that if not attended could deteriorate to a Poor rating.

Table 4-3. WTPs – Comparison of Average Inspections Results for 2008-2019

Criteria	2008	2009	2010	2012	2014	2015	2017	2019	Change 2019 vs. 2017
Regulatory Compliance	2.2	2.3	2.1	2.5	2.3	2.0	2.5	2.6	0.1
Operations/Process Control	2.2	2.5	2.6	2.7	2.2	2.2	1.9	1.6	-0.3
Equipment/Maintenance	2.1	2.3	2.3	2.3	2.4	2.1	1.8	1.7	-0.1
Staffing/Training	2.2	2.6	2.4	2.9	2.7	2.1	2.1	1.9	-0.2
Overall	2.2	2.4	2.3	2.6	2.3	2.1	2.1	2.0	-0.1

Although no facilities were rated as Poor or Unacceptable in terms of compliance, the overall rating of WTPs in this evaluation category increased slightly since the previous inspection. However, several compliance parameters had interim limits or only monitoring, which consequently did not adversely affect the compliance rating. One facility was rated as Poor, Ponce Nueva WTP (South Region) which has reported exceedances in all Safe Drinking Water Act (SDWA) parameters and dissolved oxygen, copper, and biological oxygen demand (BOD) for National Pollutant Discharge Elimination System (NPDES) parameters. The rest were rated as Good or Adequate. However, three facilities (9%) that were rated as Adequate should be closely monitored, since they received a score between 1.7 and 1.8 because of reported exceedances during the period of evaluation in SDWA parameters such as combined filter effluent (CFE) turbidity, Total trihalomethanes (TTHM) and Haloacetic acids (HAA); and, exceedances in dissolved oxygen, BOD, turbidity, residual chlorine, copper, among parameters under the NPDES permit. These facilities were Guaynabo-Los Filtros WTP, Sergio Cuevas WTP and Coto Laurel WTP.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Operations/Process Control in the majority of WTPs inspected were adequate. However, seven facilities (20%) were rated as Poor and five (14%) were rated as Unacceptable. In general, the operations and process control rating decreased by 0.3 when compared to the FY2017 inspections. The common factors in these facilities are that lack of essential process control procedures and support documents. These facilities lacked or had outdated versions of O&M manuals, equipment manuals, emergency response plans (ERP), emergency numbers missing, among others. Process control strategies were not clearly communicated between plant staff making it difficult to obtain a good process control. In addition, jar tests were not being performed regularly or at all; of the 35 WTPs inspected, approximately 13 facilities (37%) were not performing jar tests. Also, almost all facilities lack potable water flow meter and a significant number lack chemical feed pumps calibration plans, proper security. Furthermore, at least 12 facilities (34%) had safety concerns due to existing conditions of the facility, one of its components or within the property limits.

Regarding the equipment/maintenance, out of the 35 facilities inspected, seven (20%) were rated as Poor and although rated as Adequate, 31 (89%) had a rating under 2.0 in terms of equipment and maintenance practices and should be closely monitored. The facilities rated as Poor in this category include: Hatillo-Camuy WTP, Negros Corozal WTP, Santa Isabel (Utua) WTP, El Yunque WTP, Humacao WTP, Cayey Urbano WTP and Enrique Ortega-La Plata.

Pertaining to Staffing/Training, out of the facilities inspected, eight (23%) received a poor rating and, 23 (66%) received an adequate rating in this category mostly due to need of staffing. It has certainly been evident that qualified operators have migrated to the mainland as shown by the WTP's lack of licensed operators to cover the facilities operating hours effectively including vacations and absenteeism. Besides licensed operators, the findings shown multiple vacancies in STS operators, maintenance staff and operational service worker (TSOs for its Spanish acronym) and a few on lab personnel.

In comparison to the 2017 inspection results, the equipment/maintenance, operations/process control and staff/training criteria decreased significantly, and the regulatory compliance increased. This decline in ratings is likely a result of the lack of investment in capital improvements and R&R programs due to the fiscal situation and budget limitations. The greatest concern currently is the physical condition of the facilities, which continues to deteriorate year over year evidenced by the inspection scores.

PRASA is striving to invest in the training of its staff, focusing on achieving greater job understanding, productivity, and ownership. However, the ongoing fiscal situation has adversely affected PRASA's efforts with respect to staff development and the provision of adequate staff in certain facilities.

The facilities with the lowest overall score of the 35 WTPs inspected are summarized in **Table 4-4**. As shown below, all 16 (46%) facilities received a score in the lower end of the Adequate scoring range (below 2.0). Lastly, PRASA should address the shortcomings identified during inspections to improve the physical condition of these facilities and achieve/maintain continuous and consistent compliance.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 4-4. FY2019 WTPs – Lowest Rated Facilities and Observations

WTP	2019 Score	Observations
Barrio Nuevo (Metro Region)	1.6	<p>During the evaluation period the facility compliance was rated as good. However, it had minor exceedance in turbidity for the SDWA parameters and several exceedances of Residual Cl and TDS in the NPDES parameters. According to the operator the water intake pumps have issues staying on. Without a good monitoring, the chlorine application continues application in the system causing excess of dosification. The facility operation and process control were rated as unacceptable. At the moment of the inspection, equipment manuals were not available, Emergency Response Plan (ERP) was not available, compliance testing records weren't received and maintained at the plant and compliance lab results weren't conveyed to the operators. Operators could not convey if WTP complies with CT after disinfection, lab equipment not adequate and chemicals/supplies no maintained on-site. Facility wasn't equipped with an emergency generator unit (damaged since hurricane). Also, no potable water meter and safety was not adequate for the operators in the sludge drying bed area. The facility equipment and maintenance were rated as barely adequate and the equipment condition portion was rated as poor. The intake pumps do not have a working generator. No inlet water turbidimeter, should have one for continuous monitoring. Sedimentation tube settlers need cleaning and may need replacement. Some of the structures are showing signs of concrete deterioration; this should be address. In addition, some pipelines and some pump motors have corrosion and should be painted and protected against corrosion. Moreover, at the moment of the inspection, it was noticed that there was not enough flow to operate filters adequately. Also, thickener needs maintenance; the dewatering system (SDBs) is out of service, as it needs structural repairs; and the EGU is out of service. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and no as-built drawings. Staffing and training are adequate for this facility and its operation hours. However, two operators in process of obtaining the proper license to operate the WTP (meet PRDOH requirements) and WTP compliance monitor remote operating not adequate.</p>
Aibonito-La Plata (East Region)	1.7	<p>During the evaluated period, the facility compliance was rated as good. There were no exceedances reported for drinking water parameters, however, for NPDES requirements there were minor lead, copper, turbidity, and BOD exceedances. Also, raw water has high pH and Iron/manganese, which to counter effect, operators apply hydrochloric acid and sodium permanganate, respectively. The facility operations and process control were rated as unacceptable. The O&M and equipment manuals were not available/used. Also, no jar test performed and need proper lab equipment. The facility lacks a working emergency power generator. There is no potable water meter, no additional security available, automatic entrance gate is not working, illumination is not adequate, and safety is inadequate as there are tripping/falling hazards. Finally, facility lacks proper communication tools. The facility equipment and maintenance were rated just about adequate. The plant lacks a functional emergency generator unit for WTP or raw water intake. Flocculation basin with excess solids. Sedimentation spyder system compressors out of service, deficient sludge removal. Multiple valve actuators are out of service and some corrosion on blowers. Distribution flow meter (CFE) not calibrated and pH monitoring unreliable. Thickener needs maintenance, EQ tank and centrifuge are out of service. Roof for the sludge drying beds not translucent and missing gates. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and lacks prioritization procedure for repairs. Facility personnel needs maintenance data and confined spaces training. Staffing needs at least two additional licensed operator to operate facility effectively.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
<p>Enrique Ortega-La Plata (Metro Region)</p>	<p>1.7</p>	<p>During the evaluation period, the facility compliance was rated as adequate. There was significant non-compliance for THM and minor exceedances of HAA reported for SDWA requirements. There was also significant non-compliance for residual chlorine and lead and minor exceedances of turbidity and BOD for NPDES requirements. The WTP also deals with manganese and TOCs challenges which they address during operation and process control. The facility operations and process control were rated in the lower end of adequate. The operators perform the necessary sampling following the SOP's for adjustments to process. However, O&M manuals not updated, not all equipment manuals were available and no calibration plan for chemical feed pumps. Also, chlorine reagents were expired, no potable water meter at facility, no additional security available and illumination needs improvements. Finally, facility appearance and housekeeping inadequate as debris were laying around and several units in poor condition. The facility equipment and maintenance were rated as poor. Several equipment was out of service starting from the dam intake gates and raw water pumps; EGU at intake does not include pumps. Furthermore, coagulation and flocculation units are in poor condition and need improvements. Also, sedimentation concrete structure and controls deteriorated, spyder system out of service and tube settlers need replacement. Regarding filters, (9) were out of service and several observations made such as: media intermixed, uneven, mudballs; need media replacement; and no filter study has been performed in years. Each of those processes are essential in the treatment process, specifically, sedimentation and filters which are the core of the treatment process. Moreover, the STS system is in poor condition and needs improvements from holding tank (EQ), thickeners and dewatering units. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays; maintenance shop housekeeping, tools and spare parts inventory are not adequate; no as-built drawings; and overall appearance inadequate. The training for this facility is adequate. Staffing has several needs to cover the facility operating hours effectively, including at least two licensed operators, two non-license operators, one STS operator, one heavy equipment operator, three TSOs and a laboratory technician, among others.</p>
<p>Santa Isabel Utuado (North Region)</p>	<p>1.7</p>	<p>During the evaluation period, the compliance was rated as good. There were no exceedances reported for drinking water parameters, however, there were minor residual chlorine exceedances of the NPDES requirements. The facility operations and process control were rated as unacceptable. There are no adjustments based on results of water quality changes are made. No plan for calibration of chemical pumps and no jar test are performed. Some of the piping is not colored adequately and there is no additional security. The EGU at the intermediate tank and the WTP are out of service. Also, some equipment debris laying around and access road needs improvement. The facility equipment and maintenance were rated as poor. No coagulant addition nor any type of mixing at sedimentation basin. At the time of the inspection, the tube settlers were observed in bad condition; need replacement. Also, effluent launders showings signs of corrosion and one of vacuum pumps and one blower of the membrane filtration system were out of service. STS & dewatering systems are out of service; waste is currently discharged directly into the outfall 001. The EGU is out of service. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and no as-built drawings. The training for this facility is adequate. Staffing needs at least two additional licensed operators and one TSO for effectively attending the facility's operating hours.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
Negros Corozal (North Region)	1.7	<p>During the evaluation period, the facility compliance was rated as good. There were no exceedances reported for SDWA requirements, however there were several exceedances of NPDES requirements for dissolve oxygen, residual chlorine, and Copper. The facility operations and process control were rated as unacceptable. At the time of the inspection, the ERP was not available or used, the sampling data was not being used for process control and there were no adjustments made based on water quality changes. Also, jar tests are not being performed and stream current monitor is out of service. The emergency generator has been out of service since Hurricane María. The facility has no additional security, house/ground keeping, and maintenance are needed and the phone was out. Overall equipment and maintenance rating were poor. Critical operation components such as pumps at the water intake, intermediate tank, backwash, and distribution tank have only (1) pump in working order, no redundancy available. Facility, intake and intermediate generators are out of service since Hurricane María. Stream current monitor is installed but not yet programmed. Two out of the four flocculation slow mixers are out of service. No filter media study/replacement has been performed in years. STS and dewatering systems are out of service; sludge is being discharge directly into outfall 001. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and no as-built drawings. Facility personnel needs confined spaces training and update expired operator licenses. Staffing needs at least one licensed operators and one operational maintenance for the plant to operate at optimum level.</p>
Coto Laurel (South Region)	1.7	<p>During the evaluated period, the facility compliance was rated in the lower range of adequate. With regards to the SDWA parameters, the WTP experienced significant exceedances in TTHM and HAA. Also, BOD in NPDES parameters. According to the supervisor, TTHM and HAA exceedances were problems with organics loads coming from Toa Vaca lake. It was decided to eliminate Pre-Cl dosification, increase primary polymer application and add permanganate before in-line mixers. As to the NPDES parameters, the facility had minor exceedances in copper and BOD. BOD exceedances were caused by the increasing of primary polymer applied to comply with the TTHM and HAA but since there were exceedances in BOD, it was decided to change secondary polymer from (floc 2123 to LT22). According to the supervisor, after this change, the facility is complying with the parameters. The operation and process control of the WTP is rated as adequate. The operators perform the necessary sampling, following SOP'S for adjustments to process. However, at the moment of the visit, equipment manuals and compliance testing records were not available in the facility. Also, power failures have caused problems to the EGU, general safety was not adequate (illumination and crane conditions in the disinfection room) and the bathroom facility was found not adequate. In addition, facility needs additional security such as cameras or guards, needs general groundskeeping and facility fence needs repairs. The facility equipment and maintenance were rated in the lower range of adequate. Influent streaming current sensor not operating properly, Cerrillos Reservoir's In-line mixer needs maintenance and TOC analyzer is needed for the influent monitoring. Also, some structures such as the treatment modules have some cracks and filtrations, several pipelines need maintenance (paint) and the aeration system need maintenance. In addition, tube settlers at sedimentation units need to be replaced and structural repairs are required for the crane at disinfection building. Furthermore, WTP does not have distribution monitoring and sludge drying beds roof needs to be replaced. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays, no as-built drawings, and overall appearance inadequate. Facility needs at least two licensed operators and one of the non-licensed operators must complete category 3 training and certification to cover the facility operating hours effectively.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
Cayey Urbana (East Region)	1.8	<p>During the evaluated period, the facility compliance was rated as good. However, it had significant exceedance in turbidity for the SDWA parameters and for the NPDES parameter, it had significant non-compliance in residual chlorine and a minor exceedance in BOD. The facility operations and process control were rated as poor. The O&M manual not updated and equipment manuals were not available/used. also, emergency numbers not posted, jar test not performed and proper lab equipment missing. In addition, affection operations is the lack of automation due to defective equipment. There is no potable water meter nor control room; there is safety fall hazards due to several leaks; no additional security available; and need house/groundskeeping. The facility equipment and maintenance were rated as poor. La Central dam raw water intake is out of service (4 pumps), no EGU for raw water intake available and raw water pipe with significant corrosion. Another maintenance issue is the need to correct leaks through the facility. Also, some of the concrete structures like flocculation and sedimentation are showing signs of concrete deterioration and leak present at pre-Cl injection point. Sedimentation basin needs maintenance as well, as the filters actuators. In addition, facility lacks STS and dewatering system, thus currently discharging directly to point 001 and EGU diesel storage tank needs maintenance due to high corrosion. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and computerized maintenance management system not available. Training is adequate for this facility and its operation hours. However, staffing needs at least two additional licensed operator to operate facility effectively. Also, WTP compliance monitor remote was not operating adequately.</p>
EL Yunque (East Region)	1.8	<p>During the evaluated period, the facility compliance was rated as good. There were no exceedances reported for drinking water parameters, however, there were minor BOD exceedances of the NPDES requirements. The facility operations and process control were rated as poor. The WTP was severely impacted by Hurricane María. A major operational issue is that the facility lacks an emergency power generator. Also, facility lacks a potable water meter and adequate outdoor illumination. The perimeter fence condition is poor, scattered debris through the facility grounds, needs groundskeeping and some safety issues with corroded ladders and broken handrail. Finally, facility appearance not adequate. The facility equipment and maintenance were rated as poor. Half of the aeration system is out of service and there are safety issues with the handrails destroyed by the 2017 hurricanes. One rapid mixer and one slow mixer are out of service. The sedimentation basin equipment is defective and in poor condition and one of the filters is out. Also, filter media should be replaced, (1) IFE turbidimeter is out and (1) backwash pump is out of service. Disinfection scale system is antiquated and causes safety hazard to operators. Distribution flow meters are out, as well as (2) of the distribution pumps. The sludge treatment system is deficient as well as the old dewatering system. Currently using geotubes. Furthermore, the facility lacks a good standing emergency power generator and the discharge 001 flow meter is out of service. Lastly, there is no computerized maintenance management system available; facility has corrective maintenance and procurement process challenges due to extended delays; maintenance shop housekeeping, tools maintenance and spare parts inventory are inadequate; and facility appearance not adequate. The training for this facility is adequate. Staffing needs at least two additional licensed operators and two utility maintenance staff to cover the facility operating hours effectively.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
Ponce Nueva (South Region)	1.8	<p>During the evaluation period, the facility compliance was rated as poor. There was significant non-compliance in CFE Turbidity, TOC, TTHM, HAA for SDWA requirements. Also, minor exceedances in dissolved oxygen, copper, and BOD for NPDES parameters. Also, polymer is applied to handle the high organics from the Toa Vaca raw water source. The facility operations and process control were rated as good. The operators perform the necessary sampling following the SOP's for adjustments to process. However, O&M manuals not updated, power failures cause generator problems, there is no potable water meter in the facility; bathrooms facility are not adequate and there is no additional security. Also, staff performs washing of treatment units to control algae. The facility equipment and maintenance were rated in the lower end of adequate. Influent monitoring should have turbidimeter for continuous monitoring and TOC analyzer was out. Aeration system structure showing signs of weathering, needs maintenance. Superpulsator system and auto sludge removal is out of service (tanks need to be cleaned manually). Also, (1) filter out, (1) backwash pump out and (2) distribution flow meters out. Holding tank is under capacity and no redundancy on pumps, which creates problems for handling the sludge. Also, thickeners need maintenance and vacuum pumps/system for vacuum assisted SDBs not working. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays, no as-built drawings and overall appearance is not adequate. Facility training for staff was adequate. Staffing needs at least one licensed operators, three STS operators and two TSO to cover the facility operating hours effectively.</p>
Aguadilla (West Region)	1.8	<p>During the evaluation period, the facility was rated as adequate. There was significant non-compliance in THM and HAA and minor exceedance in TOC for SDWA parameters. No violations for NPDES parameters. The facility operations and process control were rated in the lower range of adequate. The operators perform the necessary sampling following the SOP's for adjustments to process. However, O&M manual and emergency response plan were not updated. Facility does not meet CT consistently, only half the time. Also, there is no potable water meter; no control room; some of the piping not colored adequately, needs maintenance; fence and gate are not in good conditions; illumination is not adequate; facility needs groundskeeping; and structures need better maintenance to have an adequate appearance. The facility equipment and maintenance were rated as barely adequate and the equipment condition component was rated as poor. Two raw water intake pump and (1) intake screening system; out of service. Also, (2) vacuum blowers for superpulsators were out of service and tube settlers need replacement. Furthermore, filters need improvements and (1) backwash pump from 1-6 filters was out: also, corrosion on other pumps and piping. Moreover, (1) distribution tank level sensor, (2) distribution flow meters and (1) holding tank sludge pump were out of service. Thickener tanks and dewatering system (SDBs) had been out of service for some time. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays/funding and incomplete as-built drawings. Training for staff was adequate. Staffing needs at least two licensed operators and one TSO to cover the facility operating hours effectively.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
Barranquitas Urbano (East Region)	1.9	<p>During the evaluated period, the facility compliance was rated as good. There were no exceedances reported for drinking water parameters, however, for NPDES requirements there were minor zinc exceedances and significant non-compliance in residual Cl. The facility operation and process control were rated as poor. Although the operators make the appropriate adjustments based on process control results and source water quality changes there were several deficiencies. The O&M and equipment manuals were not available/used, and emergency numbers not posted. Also, no jar test performed and need proper lab equipment. A major operational issue is the lack of automation due to defective equipment. No potable water meter available, general safety inadequate and no additional security available. Lastly, facility needs house/groundskeeping and the lack of staff causes operational challenges. The facility equipment and maintenance were rated as barely adequate and the equipment condition portion was rated as poor. Major equipment and maintenance issues include multiple valve actuators which are defective; stream current monitor is out of service; and screening at raw water intake and remote monitoring equipment are deficient. Also, excess sediments observed at flocculation and sedimentation basins. Backwash and distribution pumps lack of redundancy because of pumps being out, disinfection weight scales and dechlorination system heavily corroded and the automatic lamp cleaning system for the ultraviolet (UV) disinfection lamps is out of service. In addition, facility lacks STS and dewatering system, thus currently discharging directly to point 001. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and no as-built drawings. Training is adequate for this facility and its operation hours. However, staffing needs at least (2) additional licensed operator and (1) maintenance staff to operate facility effectively. Also, WTP compliance monitor remote operating not adequate. During the evaluated period the facility compliance was rated as good. There were no exceedances reported for drinking water parameters, however, for NPDES requirements there were minor zinc exceedances and significant non-compliance in residual Cl. The facility operation and process control were rated as poor. Although the operators make the appropriate adjustments based on process control results and source water quality changes there were several deficiencies. The O&M and equipment manuals were not available/used and emergency numbers not posted. Also, no jar test performed and need proper lab equipment. A major operational issue is the lack of automation due to defective equipment. No potable water meter available, general safety inadequate and no additional security available. Lastly, facility needs house/groundskeeping and the lack of staff causes operational challenges. The facility equipment and maintenance were rated as barely adequate and the equipment condition portion was rated as poor. Major equipment and maintenance issues include multiple valve actuators which are defective; stream current monitor is out of service; and screening at raw water intake and remote monitoring equipment are deficient. Also, excess sediments observed at flocculation and sedimentation basins. Backwash and distribution pumps lack of redundancy because of pumps being out, disinfection weight scales and dechlorination system heavily corroded and the automatic lamp cleaning system for the UV disinfection lamps is out of service. In addition, facility lacks STS and dewatering system, thus currently discharging directly to point 001. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and no as-built drawings. Training is adequate for this facility and its operation hours. However, staffing needs at least two additional licensed operator and one maintenance staff to operate facility effectively. Also, WTP compliance monitor remote operating not adequate.</p>
Guzmán Arriba (Metro Region)	1.9	<p>During the evaluation period, the facility compliance was rated as good. There were no exceedances in SDWA and a minor exceedance in copper in NPDES parameters. The facility operation and process control were rated as poor. Although the operators make the appropriate adjustments based on process control results and source water quality changes there were several deficiencies. The O&M and equipment manuals were not available/used onsite and no jar test are currently being performed. Also, the facility is not equipped with an emergency generator unit since Hurricane María, there is no potable water meter and the general safety is not adequate due to lack of illumination in few areas. The facility equipment and maintenance were rated in the lower range of adequate and the equipment condition portion was rated as barely adequate. WTP is processing and receiving more water than the design capacity. There is some equipment out of service such as: (1) screening system at intake, (2) emergency generator units, influent flow meter and the intermediate tank remote monitoring and control system. Distribution tanks and thickeners need concrete structure maintenance and protection and (1) of the weight scales is out of service; they are corroded as well. Lastly, facility has corrective maintenance challenges due to extended delays and no as-built drawings. The training and staffing are adequate for the facility operating hours. However, WTP compliance monitor remote operating not adequate.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
Guaynabo-Los Filtros (Metro Region)	1.9	<p>During the evaluation period, the facility compliance was rated as adequate. There was significant non-compliance for TTHM and minor exceedances of turbidity and HAA reported for SDWA requirements. There were also several minor exceedances of dissolved oxygen, copper, turbidity, and biochemical oxygen demand and significant non-compliance in residual chlorine reported for NPDES requirements. The facility operations and process control were rated as adequate. The operators perform the necessary sampling following the SOP's for adjustments to process. However, the O&M manuals were not available, the equipment manuals were incomplete, and the emergency numbers were not posted. Furthermore, the facility does not have a potable water meter and some of the raw water intake pipes require labeling or adequate coloring. The general safety within the facility was also considered inadequate, even though they have a security guard. The facility equipment and maintenance were rated as adequate. However, several components of critical operation equipment were out of service including: (2) out of (8) slow mixers within the flocculation units; the equipment for sludge removal in the sedimentation basin; (3) out of (18) of the filter's IFE turbidimeters; the flow meter for monitoring from the distribution tank; (2) of the vacuum pumps for the SDBs; (1) of the recycling pumps is out of service; and one of the two EGUs has been out of service since Hurricane María. Notwithstanding, the working generator is capable of supplying power for the functional operation of the entire facility. Also, (3) out of (24) of the sludge drying bed valves were not opening correctly. Lastly, facility has corrective maintenance challenges due to lack of staff and extended delays, and no as-built drawings available. Facility personnel needs maintenance data training. Staffing needs at least two licensed operator and additional maintenance and/or utility personnel to cover the facility operating hours effectively.</p>
Las Delicias (North Region)	1.9	<p>During the evaluated period, the facility compliance was rated as good. However, it had minor violations for total coliforms in the SDWA parameters and for turbidity in the NPDES parameters. The facility operations and process control were rated as poor. The operators perform most of the necessary sampling following SOP's for adjustment to process. However, equipment manuals are not being used; O&M manuals and emergency response plan are outdated. Also, not performing jar tests and lab equipment not adequate. In addition, there is no potable water meter, the control room is out (operating manually) and no additional security available. There are safety issues due to access road condition and erosion near thickener. Finally, fence, illumination, and access road (inside WTP and dirt/pebble road towards WTP) need improvements. The facility equipment and maintenance were rated in the lower end of adequate and the equipment condition portion was barely adequate. One intake pump was out of service, providing no redundancy; and intake screening & EGU need maintenance/replacement. Also, influent flow meter and turbidimeter are out of service. Moreover, (1) of the pre-sedimentation mixers and the tank rake are out, no containment for polymer drums and the treatment modules slow mixers are out. Tube settlers seemed affected by sun (toasted) and should be evaluated. One of the sedimentation launders (perforated pipe) is out, as well as the intermediate turbidimeter and pH monitoring. In addition, (1) of the air scouring blowers is out, the gravity distribution flow meter is out and (1) of the distribution pumps is out. Thickener needs improvements, torque alarm and sludge removal system. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays, lacks prioritization procedure for repairs and no as-built drawings available. Facility personnel needs maintenance data, confined spaces & hazwoper training. Staffing needs at least one licensed operator to cover the facility operating hours effectively and WTP compliance monitor remote operating not adequate.</p>
Guajataca (West Region)	1.9	<p>During the evaluated period, the facility compliance was rated as good. However, for the SDWA parameters, it had significant Non-Compliance of THM. Also, the operator mentioned issues with manganese since the 2017 hurricanes, for which they had to adjust to maintain within limits. The facility operations and process control were rated as poor. The operators perform the necessary sampling following the SOP's for adjustments to process. However, there is no calibration plan and the emergency generator has been out of service since the 2017 hurricanes. Also, there was no potable water meter and access roads, perimeter fence and illumination need improvements. Lastly, groundskeeping is needed and there was debris scattered within the facility. The facility equipment and maintenance were rated in the lower range of adequate. However, the raw water line was damaged during the 2017 hurricanes and there is a temporary force line to supply the WTP when levels are low. No EGU for intake force line. The thickener needs improvements; the geotubes should have roof and area should be landscaped. The WTP</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WTP	2019 Score	Observations
Lajas (West Region)	1.9	<p>emergency generator has been out of service since the 2017 hurricanes. Lastly, facility has corrective maintenance and procurement process challenges due to extended delays and no as-built drawings. Staffing and training were adequate for the facility's operating hours.</p> <p>During the evaluation period, the facility compliance was rated as good. There were minor exceedances in THM and dissolved oxygen for SDWA and NPDES parameters, respectively. The facility operations and process control were rated as poor. Primarily because the emergency generator unit was out of service and the WTP currently does not have emergency power to run plant. Notwithstanding, the operators perform the necessary sampling following SOP's for adjustment to process. Staff performs jar tests and comply with most requirements within criteria except that there was no potable water meter available, equipment manuals were incomplete, and part of the fence is missing/needs repairs. The facility equipment and maintenance were rated in the lower range of adequate. There is no secondary containment on one of the secondary polymers; it should be provided. Also, the tube settlers on the sedimentation basins are deteriorated and should be replaced. The exhaust fan on the old disinfection building is out of service. Moreover, the emergency generator unit was out of service, the distribution flow meter was also out and similarly (1) distribution pump was out of service (although under repair). Lastly, facility has corrective maintenance challenges due to extended delays/funding and no as-built drawings. Staffing and training are adequate to comply with facility operational shifts.</p>

As mentioned, compliance results show that facilities are, in general, performing better with respect to compliance with limits of SDWA and effluent discharge parameters. However, results might be misleading since several NPDES parameters had interim limits or only monitoring and it is unknown whether the facility can meet the actual (permanent) limits when the interim/monitoring expires. It is safe to say that interim limits are likely to continue until PRASA can perform improvements, whether capital or non-capital, to improve the facilities equipment in order to enable them to meet compliance requirements.

Future regulations may require additional capital improvements to achieve higher levels of treatment at certain facilities depending on the characteristics of the source water and the distribution system, such as USEPA's residual chlorine, phosphorous (P) and nitrogen (N) recent criteria. At the issuance process for an updated NPDES permit, PRASA continues requesting interim limits, as determined by the Compliance Department, until the capital project for said facility is executed and completed. The project completion term would be subject to the Prioritization System. PRASA is vigilant of potential future regulations that may impact the System and the compliance of regulatory agencies requirements. One such case is the potential changes to the lead (Pb) and copper (Cu) limits.

The effects of these and other future regulations will not be known until PRASA performs data collection and studies to determine what, if any, additional capital improvements will be needed to comply with these future regulations (see Sections 6.5 and 6.6 for additional discussion on renegotiations with Regulatory Agencies, future regulations and other regulatory requirements). Notwithstanding the impact of future regulations, capital improvements are needed to modernize PRASA's infrastructure, prevent further deterioration, protect public health, safeguard environmental quality, allow continued economic development and help bring the System into compliance with all regulatory requirements.

4.2.2.2 Wastewater Treatment Plants

PRASA currently operates 51 WWTPs. The facilities range in size from several thousand gallons per day up to 80 MGD. The Island-wide design treatment capacity is approximately 402.8 MGD and the treated wastewater for FY2019 was approximately 209 MGD. In level of treatment, PRASA has seven plants designed to provide tertiary or advanced treatment, 38 plants are designed to provide secondary

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

treatment, and the remaining six facilities (which account for 230 MGD of treatment capacity) provide primary treatment.

A total of 20 WWTPs (39% of total WWTPs) currently in operation were inspected in 2019. Each assessment consisted of a site visit inspection and an interview with the operator, plant supervisor or designated personnel. Thus, as with the WTPs, information was at least in part based on the understanding of the individual who was being interviewed. Also, for the equipment/maintenance criterion the inspections forms show scores distributed by type of processes, for ease of identification of deficiencies, as belonging to: Pretreatment; Primary Treatment; Secondary Treatment; Tertiary Treatment; Sludge Treatment and handling; Disinfection and discharge; and Miscellaneous (NPW, Back-up Power, Septage). **Table 4-5** presents the comparison of the average rating results of the facilities inspected by each category evaluated. The overall average rating of each evaluation criteria for 2008 through 2019 is also presented. Overall, WWTP facilities were rated as barely adequate with a score of 1.5. Of the facilities inspected, nine (45%) WWTP were rated as Poor in overall rating. Furthermore, 10 of the 11 WWTPs rated as Adequate in overall rating where in the lower end, close to being rated as Poor.

Table 4-5. WWTPs – Comparison of Average Inspection Results for 2008-2019

Criteria	2008	2009	2010	2012	2014	2015	2017	2019	Change 2019 vs. 2017
Regulatory Compliance	1.3 ¹	1.5 ¹	1.5 ²	1.4	1.5	1.8	2.3	1.3	-1.0
Operations/Process Control	2.4	2.4	2.3	2.4	2.3	2.0	1.9	1.8	-0.1
Equipment/Maintenance	2.2	2.2	2.4	2.2	2.3	2.0	1.8	1.6	-0.2
Staffing/Training	1.8	2.0	1.8	2.3	3.0	2.0	2.4	1.8	-0.6
Overall	1.9	2.0	2.0	2.0	2.0	1.9	2.0	1.5	-0.5

¹ Two WWTPs (Playa Santa and La Parguera) that discharge to underground injection were not evaluated under this criterion because they do not have an approved NPDES Permit.

² One WWTP (Playa Santa) that discharges to underground injection was not evaluated under this criterion because it does not have an approved NPDES Permit.

The WWTPs received an overall combined score of 1.3 in Regulatory Compliance, which falls in the Poor range. It is evident that the conditions of the equipment and having treatment units out of service has negatively impacted the compliance criterion. Despite some of the NPDES parameters having interim limits, the results show that there were still many exceedances. Of the 20 facilities that were inspected, five (25%) were rated as Unacceptable and four (20%) received a Poor rating under the regulatory compliance criterion. The rest were rated as adequate, except for Puerto Nuevo WWTP, which was rated as Good. The facilities that were rated as Unacceptable/Poor in this criterion include: Caguas WWTP, Aibonito WWTP, Dorado WWTP, Arecibo WWTP, San Germán WWTP, Ciales WWTP, Ciales WWTP, Utuado WWTP, Guayama WWTP and Isabela WWTP. In addition, six (30%) of the WWTPs that were rated as Adequate should be closely monitored, since they received a regulatory compliance score between 1.5 and 1.9 as a result of reported exceedances in fecal coliforms, total suspended solids (TSS), total nitrogen, phosphorous (P), dissolved oxygen (DO), ammonia (NH₃), BOD and residual chlorine. Although PRASA intends to address requirements stipulated under the USEPA Consent Decree in order to achieve compliance objectives including new, more restrictive permit limits it is obvious that major improvements need to be implemented to achieve positive results. Therefore, PRASA must plan ahead

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

and make the necessary improvements to meet current limits while considering that when interim limits are lifted, they have the necessary tools and conditions to meet the permanent limits.

Operations/Process Control in the majority of WWTPs inspected were Adequate, with a 1.8 overall rating. However, one (5%) received a rating of Unacceptable and four (20%) received a Poor rating under this criterion. These facilities were: Yabucoa WWTP (Unacceptable), Aibonito WWTP, Aguas Buenas WWTP, Barceloneta WWTP and Utuado WWTP. Process control continues to be a challenge in some of the facilities, even though the plant operators indicated that standard operating procedures and control strategies are followed. Some of the typical issues found during the inspections include: lack or outdated versions of O&M manuals, equipment manuals and emergency response plans; no calibration plan for chemical feed pumps; lab equipment or chemicals not adequate; not performing jar test; no control room; no additional security; lack of non-potable water (NPW) system; piping not colored/labelled appropriately; equipment debris and poor groundskeeping; fence, access road and illumination need improvements; presence of floating solids in effluent; and condition and overall appearance not adequate, among others. Also, Barceloneta WWTP and Puerto Nuevo WWTP have EGUs damaged, thus are without enough capacity to operate entire facility. Additionally, Humacao WWTP, Yabucoa WWTP and Utuado WWTP lack a proper EGU and are without one or using a provisional one. Finally, Dorado WWTP, located near residential/commercial areas, is without proper odor control measures.

The WWTPs generally range from Poor to Adequate condition with equipment/maintenance as the category of primary concern. The greatest current concern is the physical condition of the facilities, which continues to deteriorate due to slowdown and suspension of the CIP and significant reduction in R&R. Average rating for this criterion was 1.6, which is barely adequate. Of the 20 facilities that were inspected, seven facilities (35%) received a Poor rating under this criterion and the rest of the facilities were rated as Adequate. These facilities include: Aguas Buenas WWTP, Caguas WWTP, Aibonito WWTP, Dorado WWTP, Arecibo WWTP, Barceloneta WWTP and Maunabo WWTP. Moreover, despite the majority of the facilities being rated in the Adequate range (65%), at the time of inspection, most are on the lower end of the scoring range (score below 2.0) and, if unattended, could fall to Poor or Unacceptable rating in the future.

Pertaining to Staffing/Training, out of the facilities inspected, two (10%) facilities (Carolina WWTP & Guayama WWTP) were rated as Poor, one was rated as Good (Maunabo WWTP) and 17 (85%) facilities received an Adequate rating in this category. It has certainly been evident that qualified operators have migrated to the mainland as shown by the WWTP's lack of licensed operators to cover the facilities operating hours effectively including vacations and absenteeism. Besides licensed operators, the findings shown multiple vacancies in sludge dewatering operators, maintenance/housekeeping staff and TSOs. Although there were some non-licensed operators, the majority of operators are licensed as required by USEPA. PRASA mitigates the needs by having existing staff work overtime or by reducing shifts which, in turn, increases PRASA's overtime costs.

In comparison with the 2017 inspections results, the regulatory compliance and staffing significantly decreased, while the equipment/maintenance and operations/process control criteria scores decreased only slightly. The recent decrease in the regulatory compliance and equipment/maintenance criterions can be attributed in part to projects not being executed or being postponed in the last couple of years due to PRASA's and Puerto Rico's financial situation compounded by the impact of the 2017 Hurricanes. Likewise, PRASA staffing suffered significant losses of qualified personnel (particularly WWTP and STS

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

operators), as well as other support staff after the 2017 Hurricanes and PRASA has not been able to fill those vacancies. Notwithstanding, PRASA is striving to invest in the training of its current and future staff, focusing on achieving greater job understanding, productivity, and ownership.

In summary of overall rating, of the 20 facilities inspected, nine (45%) received an overall Poor rating and 11 (55%) received an Adequate rating. Furthermore, 10 (91%) of the 11 WWTPs rated as Adequate in overall rating where in the lower end, close to being rated as Poor. The facilities with the lowest overall score of the 20 WWTPs inspected are summarized in **Table 4-6**. As shown below, all eight (35%) facilities received a score in the lower end of the adequate scoring range (below 2). PRASA should address the shortcomings identified during inspections to improve the physical condition of these facilities and achieve/maintain continuous and consistent compliance. These improvements may be related to new process equipment, process automation and or process control optimization.

Table 4-6. FY2019 WWTPs – Lowest Rated Facilities and Observations

WWTP	2019 Score	Observations
Aibonito (East Region)	0.9	The facility compliance was rated as unacceptable. There were significant exceedances of fecal coliform and several in TSS, BOD and an event in NH3. According to the operators, these exceedances could be because there were process equipment units out of service. Currently, the plant has no redundancy and is operating around half of its capacity. The facility operation and process control were rated as poor. During the inspections, the O&M manual was not available in the facility because it's under revision; equipment manuals were damage by the 2017 Hurricane and have not been restored; ERP was not updated; and lab equipment was not maintained adequately. In addition, facility lacks a calibration plan for the chemical pumps and no jar test are performed. Also, there is no control room, general safety and restrooms were not adequate, additional security is needed and telephone service should be restored. Lastly, the facility needs housekeeping, equipment debris around and general appearance is deficient. The facility equipment and maintenance were rated as poor. There were several units out of service: the mechanical screen, (1) primary clarifier, (1) secondary clarifier, (1) Bio filter, all the sand filters units and one of the compressors. Also, the flow meter is out of service and there is heavy corrosion visible in several of the equipment. Facility has corrective maintenance and procurement process challenges due to extended delays. Lastly, facility's appearance is not adequate and according to the manager the facility needs a new Bobcat to work in sludge drying beds. Training of the facility is adequate. However, the facility needs another supervisor, an "at large" licensed operator and two wastewater workers (TA, by its Spanish acronym) staff.
Dorado (North Region)	1.0	During the evaluation period, the facility compliance was rated as unacceptable. It had several parameters that do not comply with the limits. Several violations to fecal coliforms and DO parameters, as well as some exceedances in TSS, BOD and total nitrogen. It is suspected that having the RBC treatment train, nutrient removal tank and UV system out of service contributed to most of the exceedances. The operations and process control of the WTP was rated in the lower end of adequate. The operators perform the necessary sampling to adjust the process. O&M Manuals and ERP not updated. SDS not visible. Facility has no odor controls. Sufficient control parameters are measured and used for process controls. Lab chemicals are not stored properly, and lab location is not adequate. No jar test performed, no equipment. Unstable grounds unsafe. Damaged to fences and some debris laying around affecting the facility appearance. Facility has adequate emergency power but no redundancy. The overall condition of the equipment/maintenance of the facility was rated as poor. Most of the major equipment has some type of issue. There is just one part of the pretreatment system working (one mechanical screen), conveyor is out of service as well as the degritters. Anaerobic Tank for removal of nutrients is out of service, affecting nitrogen parameters. Lift station local controls are deteriorated, and one pump is missing, although the affluent can be handled by one pump. RBC system is currently out of service. One floating aerator in each of the biological reactor units of the A-A treatment train are out of service. Disc Filters are out of service. Also, the mixer (aerator) of sludge holding tank is out of service. Only one Belt Filter Press which provides no redundancy when damage. Septage pumps out of service,

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
		currently not receiving. No odor control system and foul odors are affecting nearby residents/commerce. No procedure to prioritize repairs and there are corrective maintenance and procurement process challenges. No As-built drawings available. Overall appearance not adequate. Training is adequate for this facility. Need at least two licensed operators and one "at large" to cover the facility operating hours effectively. Also, it needs an additional sludge dewatering operator.
Caguas (East Region)	1.1	During the evaluation period, the facility compliance was rated as unacceptable. There were continuous non-compliances of BOD and Residual Chlorine, also phosphorous. BOD violations could be because there several sludge removal equipment out of service such as primary clarifier tanks, secondary clarifier tank and dewatering system. Residual Cl violations could be lack of adjustment of dechlorination or monitoring. The operations and process control of the WTP was rated as adequate. The operators perform the necessary sampling to make adjustment to the process. Laboratory equipment and calibration was rated as good. However, O&M Manual is not updated. Emergency response plan is not updated. Not performing Jar tests. There is no control room and illumination is not adequate. Plant has 24/7 security and odor control, although some units are out. Lastly, there is a significant amount of debris, equipment, and the sort, laying around thus affecting the facility appearance. The overall condition of the equipment/maintenance of the facility was rated as poor mainly due to the poor equipment condition. Most of the major equipment of primary and secondary treatment has some type of issues. Two of the three mechanical screens are out of service, as well as the extractors. Three influent pumps out. There are no primary clarifier tanks working. The tank's domes for odor control were damaged during the hurricanes and have not been restored. The BNR has several components non-operational, including (3) blowers for the aerobic stages. Two of the four secondary clarifier scrappers are not working. One filter out. From the dewatering treatment, only the centrifuge is working; the sludge holding tank, pumps, belt filter press are out along with other components. Some equipment, particularly pumps do not have redundancy. Some of the odor control towers need repairs. Some equipment is controlled manually since the control panels are not working correctly. Septage not in use and two of the four NPW pumps out of service. Training is adequate for this facility. Need at least two licensed operators, one TA and another operator to cover the sludge dewatering operations to efficiently comply with the shifts.
Arecibo (North Region)	1.2	During the evaluation period, the facility compliance was rated as unacceptable. It had major exceedances of fecal coliforms and several TSS violations. These exceedances could be because pretreatment system is out of service or could be indicative of a need for secondary treatment. The fecal coliform parameter violations have been observed in previous inspections. The facility operations and process control were rated as adequate. The operators perform the necessary sampling following SOP's for adjustment to process. However, equipment manuals are not available or being used and the ERP is outdated. There is no calibration plan for chemical feed pumps and there was some trace of solids at effluent. In addition. The facility does not have a control room and its operation with several major equipment in bad conditions. WWTP has adequate emergency power for entire plant. The facility equipment and maintenance were rated as poor. Several equipment was in bad conditions. One mechanical screen and two of the three influent pumps are out of service. Grit from screens has to be removed by hand (extra work). No grit removal as entire degritter system is out of service and screen spacing is too big to hold rags, etc. Primary Clarifier underground structure as well as the influent building structure have exposed rebars and damaged concrete and spalling. One of the thickener tanks is out of service and the other one working as a holding tank, not serving their intended design purpose. Also, one of the BFPs is out and both have high corrosion, (1) sludge pump and grinder are out. Most building structures in bad shape and pipelines in every unit with high corrosion. Septic tank is not used (damaged), when septage is receive it is connected to thickeners. Lastly, there are corrective maintenance and procurement process challenges, there is no procedure for prioritizing repairs and As-built drawings were damaged by hurricanes. Training is adequate for this facility. Need at least another supervisor and one TA to cover the facility operating hours effectively. Also, it needs additional security guards to cover the 2pm-10pm and the 10pm-6am shifts.
Guayama (South Region)	1.3	During the evaluation period, the facility compliance was rated as poor. The WWTP had several exceedances on TSS, dissolved oxygen, BOD and fecal coliform. According to the manager and operators, these exceedances could be due to problems in the primary sludge

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
		<p>pipelines. Pumps were not operated adequately. Mechanical bar screens are out of service since hurricane; Problems with bio filters mechanisms; RAS pumps were operating with problems due to accumulation of sludge in secondary tanks. These tanks are operating as a holding tank, not as a secondary clarifier. Degritter tank and grit washers were not operating adequately due to the amount of solids. The facility operation and process control were rated as adequate. The operators perform the necessary sampling, following SOP's, for adjustment to process. The emergency generator provides power to the entire plant. However, missing some equipment manuals and O&M and ERP manuals need update. Facility lacks control room and does not have water flow meter. Some of the piping is not colored adequately. Fence, gates, and illumination are not in good conditions since hurricane. Ladies bathroom needs a shower for operators. Lastly, overall appearance not adequate. The facility equipment and maintenance were rated as barely adequate. However, the equipment condition component was rated as poor. Several equipment were not operating or in bad condition due to high corrosion: both mechanical bar screens; (3) lift pumps and (1) sump pump; (1) bio filter; (1) secondary clarifier, in addition to the other functioning as holding tank; (1) NPW pump; (1) septage screening system; and (1) anaerobic digester are out of service. In addition, the 2017 Hurricanes damaged the wall/roof protection to disinfection equipment. WWTP needs significant repairs. The staff needs confined spaces training and facility needs TA staff and a supervisor to effectively comply with the facility operation hours.</p>
Yabucoa (East Region)	1.4	<p>The facility compliance was rated as adequate. There were some exceedances of TSS and fecal coliforms and a nitrates violation. According to the manager these exceedances could be due to the state of the equipment, specifically screening & pretreatment system. The operation and process control of the facility was rated as unacceptable. The facility is missing the equipment manuals and the O&M manual and ERP manual are outdated. The package plant weirs had trace of solids at the discharge. According to the operator, blowers were not operating when he entered the shift, damaging the plant process and effluent water quality. Facility is without an emergency generator, currently using temporary one. Analysis are done off-site, taken to the Humacao WWTP. Facility lacks potable water meter and control room. Facility has a deteriorated appearance and needs severe housekeeping and removal old useless equipment. The facility equipment and maintenance were rated as barely adequate. However, the equipment condition component was rated as poor. Facility needs to improve its pretreatment, as there is no screening, comminutors and degritters are out of service. Influent building structure needs rehabilitation due to cracks and deteriorated appearance. Other structures are affected as well and need maintenance. One of the lift pumps is out of service and dry pit ventilation needs improvement. One of the geotubes and the emergency generator unit (EGU) are damaged. Facility has provisional EGU. Old plant should be demolished and removed, as well as the abandoned equipment like the BFP. Overall appearance of facility is poor. Training is adequate for the operation of this facility and its operating hours. Need at least one "at large" licensed operator and one TA for effectively attending the facility's operating hours.</p>
Utuaedo (North Region)	1.4	<p>During the evaluation period, the facility compliance was rated as unacceptable. There were significant exceedances of fecal coliforms, plus several on TSS and an ammonia event. According to the operators and supervisor, fecal coliforms violations could be because the comminutors were out of service and the decanters in SBR were operating with problems. The facility operation and control process were rated as poor. The operators perform the necessary sampling following the SOPs, for adjustment in process. However, the facility is not equipped with an adequate EGU (out of service since hurricane). O&M and ERP manuals are outdated. In addition, facility should have restroom for both men and women, currently only one (unisex). Also, access road, fence and gate are not in good conditions since hurricane and facility needs landscaping. Current influent flow is below half the capacity. The facility equipment and maintenance were rated as adequate. Most of the equipment is in good conditions except for: (1) lift station pump, (2) decanters in SBR and (1) filter unit out of service. Most importantly, the facility lacks a working EGU to continue operations when power is out. According to the operators, UV system supposed to have two pumps for cleaning the system. These pumps are not currently installed, and it is urgent for the elimination of solids in the lamps of the system. Lastly, there are corrective maintenance challenges (delays). Training of the facility is adequate. However, the facility needs at least another licensed operator and a TA staff.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
Ciales (North Region)	1.4	<p>During the evaluation period, the facility compliance was rated as poor. There were significant exceedances in parameters of TSS and BOD. These exceedances could have resulted because there was only one train of biological nutrient reactor operating; digester tanks, and both dewatering systems were out of service. The operations and process control of the WTP was rated as adequate. The operators perform the necessary sampling, following SOP's for adjustments. No control room, O&M manual and ERP updates were lost in the hurricane, currently older (outdated) versions available. The WWTP has adequate emergency power. However, facility doesn't have NPW system, water meter and backflow preventer since hurricane. Also, it has a broken fence caused by a fallen tree and problems with illumination. No jar test performed, and facility lacks the equipment to perform it. No additional security available and access roads need improvement. The overall condition of the equipment/maintenance of the facility was rated as barely adequate, however the equipment condition component was poor. WWTP is operating below half of design capacity. There is (1) drum screen out of service; (1) BNR train out of service, including (2) floating mixers and (1) IMLR; Broken diffusers at aeration tanks and digester; (1) contact chamber operating with problems; (1) secondary clarifier out of service; NPW system out of service; and both pre-treatment (off-site) electrical grinders (comminutors) out of service. The entire dewatering system is out of service, the BFP and the SDBs, thus having to haul solids to other WWTPs. Training is adequate for facility. However, additional staffing (operators and TA) is required to comply with the facility operation hours.</p>
San Germán (South Region)	1.4	<p>During the evaluation period, the facility compliance was rated as unacceptable. There were significant exceedances in parameters such as TSS, NH3, phosphorous and residual Cl. Also, in total nitrogen prior to the interim limit and an event in DO. The exceedances of residual Cl were unknown since in this plant, chlorine is not applied at any point of the process. According to the manager, an investigation was conducted, but the problem was not found. Dechlorination system is planned to be added during the process to comply with the objectives. In addition, there is not an adequate equipment to measure the residual cl since the limit of permit is too low (0.011 mg/L) for the actual equipment. The facility operations and process control were rated as good. The operators perform the necessary sampling, following SOP's for adjustment in process. Currently, plant operates at a quarter of the design capacity, which creates problems for equipment maintenance and operations. Operations manual and emergency response plan are not updated. The WWTP has an adequate emergency power for entire plant. There is no control room and some old containers (polymer) should be removed. The facility equipment and maintenance were rated as adequate. However, the degritter system is not working, grit washers have high corrosion, ventilation system for lift pump station is not working (confined area). Two of the variable frequency drives (VFD) at the lift station are out of service. One BFP is out of service, but the WWTP has spare sludge drying beds. One secondary clarifier is out of service due to transmission. In addition, new mixing system for anaerobic/anoxic stages in the secondary treatment is not working correctly and four of the oxidation ditch tank rotors have damaged blades. Lastly, one of the blowers providing air for mixing at the sludge holding tank is out of service. Training is good for the operation of this facility and its operating hours. Need at least one licensed operator and a dewatering operator for effectively attending the facility's operating hours.</p>
Isabela (West Region)	1.5	<p>During the evaluation period, the facility compliance was rated as unacceptable. There were significant exceedances of BOD, TSS, fecal coliforms and Residual Cl. These exceedances could be because both comminutors were out of service, there were several events of heavy rains and the manual screen was too small for the influent pit causing water and excess of solids to pass over the screen. Also, there may be poor aeration in the treatment. (Note: The WWTP was not operating during inspection visit). The facility operations and process control were rated as good. The operators perform the necessary sampling following the SOPs for adjustment in process. The emergency generator provides power to the entire plant. Standardized files were very organized. No control room, some illumination was missing and facility needs some landscaping. The facility equipment and maintenance were rated in the lower end of adequate. However, the equipment criteria were barely adequate. The influent pit needs modifications for a higher flow capacity and better screening system. Both comminutors are out of service. During the inspection, it was observed that biological reactors (BR) and aerated digester tank were full of floating solids. Also, several of the floating aerators of the BR were out of service as well as the VFD control. There were two aerated</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
		<p>digesters out of service and one mixing system. There was (1) secondary clarifier with high corrosion under repairs and the septic tanks area was overflowed. The sludge drying beds don't have a roof and corrosion on EGU was visible. Training is good for the operation of this facility and its operating hours. Need at least one licensed operator for effectively attending the facility's operating hours.</p>
Aguas Buenas (East Region)	1.6	<p>During the evaluation period, the facility compliance was rated as adequate. However, it had several parameters with interim limits or monitoring only. Several exceedances in residual chlorine and total suspended solids and one violation on phosphorous. The operations and process control of the WTP was rated as poor. The operator performs the necessary sampling to adjust the process. O&M manuals and ERP not updated. Equipment manuals incomplete. No jar tests being performed. Lab location not adequate, it needs relocation and chemicals storage needs door. No potable water meter, control room nor additional security. Access road needs improvement, too tight. Facility needs general maintenance and repairs to fence and illumination. The overall condition of the equipment/maintenance of the WTP was rated as poor. Half of the facility is out of service (Package Plant A). Pretreatment area with structural cracks and deterioration. Degritter unit out of service and comminutor with no redundancy. One pump out of service and corrosion visible. Ventilation not adequate. No redundancy on dosing pumps for coagulation at clarifier, dewatering and dechlorination. Also, dechlorination chemical storage not clean. Fuel storage for EGU with corrosion. Effluent area of discharge needs maintenance. Corrosion on NPW system. Delays in procurement process and as-built drawings are not legible and breaking apart. Overall appearance not adequate. Training is adequate for this facility. Need at least two licensed operators to cover the facility operating hours effectively.</p>
Maunabo (South Region)	1.7	<p>During the evaluation period, the facility compliance was rated as barely adequate. There were several exceedances of BOD, residual Cl, TSS, phosphorous and total nitrogen. According to the manager, during this period the Residual Cl permit limit was modified to one more stringent and the facility was not notified on time; also, several equipment was out of service or were operating with problems. The facility operation and process control were rated as good. The operators perform the necessary sampling to adjust the process. However, no control room and no security available in the facility. Additionally, the fence was damaged during the hurricanes and needs repairs, exacerbating security issue. ERP is not updated. Plant operates around half of design capacity, which could create process control/operational issues. Emergency generator has the capacity for entire plant. The facility equipment and maintenance were rated as poor. There were significant equipment out of service such as (1) influent pump, the entire grit removal system, (1) RBC unit, (1) BNR mixer, (1) secondary clarifier, Disk filters, UV system and (1) pump for sludge removal at Thickener. Furthermore, facility has only one dewatering unit, no redundancy; if damaged, trucks must collect the sludge incurring in added costs. Lastly, operating with low flow can create process control and operation issues. The staffing and training are adequate for the operation of this facility and its operating hours.</p>
Barceloneta (North Region)	1.7	<p>During the evaluation period, the facility compliance was rated as adequate. There were some exceedances of parameters in TSS and BOD. These exceedances could be because degritter equipment, primary clarifiers and dewatering system are out of service since Hurricane María. A provisional centrifuge was added to the system but does not have the capacity for the total solids produced at the facility. The operations and process control of the WTP was rated as poor. The operators perform the necessary sampling, following SOP's for adjustments. However, EGU is not adequate for the facility, as one unit is out of service and facility needs all three units to operate entire plant. Also, the transfer switch automatic function does not work, currently manual, and the EGU equipment in general looks deteriorated. O&M and ERP manuals are outdated. There is no potable water meter nor control room at facility and some of the piping is not colored adequately. Lastly, the illumination needs improvements. The facility equipment and maintenance were rated as poor. Mechanical screens chains are deteriorated and (1) unit is out of service, two lift pumps are out, there is no grit removal equipment (grit washers, grit pumps, conveyance system) and both primary clarifiers are out of service (currently being bypassed). Also, (1) secondary clarifier is deteriorated; four out of the five blowers for aeration system for holding tank and biological reactors are out of service; one of the digester blowers is also out; one of the gravity belts is out; and there is not an adequate dewatering system for the facility, as the provisional centrifuge is inadequate. Furthermore, backup power (EGUs) are in bad conditions and</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
		currently do not have enough capacity to run entire plant; (1) unit out of service, need all three. Lastly, overall appearance is inadequate. Training is adequate for the WWTP. Need at least two licensed operators (currently two in training) and three TAs to cover the facility operating hours effectively. Also, it needs an additional sludge dewatering operator.
Bayamón (Metro Region)	1.7	During the evaluation period, the facility compliance was rated as adequate. However, several parameters exceedances in fecal coliform, TSS and residual Cl. The supervisor indicated that the dewatering system, clarifier tanks and screening system were out of service or working in bad conditions during this period and attributed these non-compliances to solid overload at the thickener tank operation. The facility operation and process control were rated as adequate. The operators perform the necessary sampling, following SOP's for adjustment to process. The emergency generator has capacity to operate entire plant. However, WWTP lab needs jar test and cleaning equipment upgrade. Also, there is no potable water meter nor control room and there is equipment debris that needs removal. Finally, access roads, fence (including gate) and illumination need improvement. Overall, the facility equipment and maintenance were rated as adequate. However, the equipment component was barely adequate. The influent wet pit needs to be repaired, one mechanical screen and two degritter units are out of service, and one lift pump is out as well. Also, the following deficiencies were observed: primary clarifiers concrete structure has cracks and two out of the six units are out; the traveling bridges in primary clarifiers with heavy corrosion, as well as the weirs and pipelines; two sludge pumps and a grinder out of service; several blowers out of service; and a thickener unit is out of service and hasn't worked for years. Similarly, the control panel room from the dewatering system is in bad condition and electrical equipment located in a room that floods. Likewise, one of the belt filter press is out of service as well as one of the sludge pumps and one of the effluent vertical pumps. Also, the effluent pump station has structure cracks and its control panel is in bad condition. Lastly, one of the NPW pumps is out and there are corrective maintenance (delays) and procurement process challenges. The training is adequate for this facility but need to complete the programmed hazwoper training. Staffing needs at least a licensed operator and a TA for effectively attending the facility's operating hours.
San Sebastián Nueva (West Region)	1.7	During the evaluation period, the facility compliance was rated in the lower end of adequate. There were several exceedances of TSS and fecal coliform. As informed by supervisor, sludge and scum pumps from clarifier tanks were out of service. After the repairs, due to the amount of scum and sludge accumulated, pipelines were damaged (scum pipe from primary clarifiers and sludge pipeline from secondary clarifiers); sludge pumps from clarifier tank were replaced one year after hurricane. Also, the facility is in a flood zone. The facility operation and process control were rated as adequate. The operators perform the necessary sampling, following SOPs for adjustment to process. Several equipment manuals are missing. O&M and ERP manuals not updated, and emergency numbers not posted. The facility has adequate EGU for the capacity of the plant. There is no NPW system and no control room in the WWTP. Some debris laying around and facility appearance a bit deteriorated. The facility equipment and maintenance were rated in the lower end of adequate. The comminutor in the pre-treatment and the degritter system were out of service. A lift pump was out of service. The primary and secondary clarifier were working as a holding tanks due to problems with pipelines of sludge and scum distribution; green grime floating in tanks. Additional one unit of the secondary clarifiers was out. The exhaust fan in the disinfection building was out, needs replacement. The motor control center (MCC) of WWTP equipment is very old and needs to be replaced. EGU appears deteriorated. Trainings are adequate for the facility operation. However, at least two licensed operators and one supervisor are needed to effectively comply with the facility operation hours.
Toa Alta (North Region)	1.8	During the evaluation period, the facility compliance was rated as barely adequate. Several parameter exceedances in BOD and fecal coliform present during the evaluation period. These could be due to raining events, degritter system being out of service and/or package plant operational problems. The facility operation and process control were rated as adequate. The operators perform the necessary sampling to make adjustment to the process. However, some equipment manuals were not available, and ERP not updated; Plant does not have NPW system nor water meter; As-built drawings not available during the inspection; and there is no control room nor security in the facility. The facility equipment and maintenance was rated in the lower end of adequate. There is only one package plant, so there is no redundancy. The entire degritter system is out of service. Extractor for lift station

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
		<p>missing. One blower was out of service. One geotube was missing. SDBs roof needs maintenance or replacement. Only (1) emergency generator unit, no redundancy if its damaged. No NPW system available. Dechlorination system should have roof. Septage station is not in use, so it should be eliminated. Facility staff operate one shift only. Additional licensed operators and maintenance staff are necessary to effectively comply with the facility operating hours. Sometimes supervisor must operate the plant due to lack of personnel. The training is adequate for the operation of the facility.</p>
Carolina (Metro Region)	1.8	<p>During the evaluation period, the facility compliance was rated as adequate. However, the facility had some exceedances in fecal coliforms, total suspended solids and BOD. This could be due to some of the sludge removal and sludge treatment equipment being out of service. The facility operations and process control were rated as adequate. The operators perform the necessary sampling, following SOP's, for adjustments in process. However, effluent had a bad appearance and some floating sediments were present. In addition, the O&M manual is outdated, compliance lab results are not being passed down to operators, facility lacks chemical feed pump calibration plan and there is no potable water meter. Also, there is no control room, some piping is not colored adequately, illumination is inadequate and there are some equipment debris laying around facility. Currently, plant operates at around a little over half of the design capacity and WWTP has adequate emergency power for the entire plant. The facility equipment and maintenance were rated as barely adequate. Several of the process equipment has been damaged since the 2017 Hurricanes. One of the pista grit units is out of service, meaning some of the influent flow is not going thru the grit removal process as it is being bypass through the old degritter channels straight to the distribution chamber. The primary clarifiers (Traveling bridge type) are in poor conditions, high level of corrosion, damaged control panels and some of the traveling bridge and scrappers are misaligned; some of the telescopic valves are clogged. Sludge pumps should consider grinders. Sludge holding tank mixer system is damaged, sludge sensor not calibrated and (1) sludge pump is out. Sludge holding tank system control room with inadequate ventilation. Also, one belt filter press is damaged and one of the alarms in the disinfection room has malfunctioned. Currently under planning to replace gas chlorine disinfection system to liquid chlorine disinfection system. Lastly, there are corrective maintenance (delays) and procurement process challenges and equipment debris should be disposed of. Staff needs confined space training. Need at least one licensed operator and another sludge dewatering operator for effectively attending the facility's operating hours and colleagues' vacations.</p>
Humacao (East Region)	1.9	<p>The facility compliance was rated as adequate. However, there were some exceedances of BOD, TSS and an event with fecal coliforms. These exceedances could be due to several equipment being out of service. The facility operation and process control were rated as adequate. Operators make necessary adjustment following SOPs. However, during the inspection period, O&M manual and emergency response plan were not updated; No control room at facility; Substantial amount of solids were observed in effluent discharge due to tank cleaning; some equipment/materials debris laying around; and facility currently has a provisional (rental) EGU since after the 2017 Hurricanes. The facility equipment and maintenance were rated in the lower end of adequate. However, the equipment condition component was rated as poor. Most of the equipment have high corrosion and there were several important units out of service such as: (1) mechanical screen, (1) influent pump, (1) degritter unit, (1) primary clarifier, (1) sludge pump, (1) Bio filter, (1) Anaerobic digester, (2) blowers; all gas burners and disinfection system working with incomplete equipment. At its current condition, if flow increases the facility will have issues treating it due to all out of service equipment. Also, since thickener system is not in use, if there is no plan to activate, equipment should be eliminated. Some maintenance to control algae production should be performed. Training is adequate for the facility. However, need at least one licensed operator and one TA staff to effectively comply with the facility operating hours.</p>
Ponce (South Region)	1.9	<p>The facility compliance was rated as adequate. However, there were exceedances of fecal coliforms, TSS, DO and one flow event. According to the supervisor, exceedance of flow was due to the raining events in the area of Juana Diaz and Villalba and exceedances of DO were due to a cleaning in the influent wet pit and that this could have affected the process. Fecal coliforms could be due to lack of sufficient treatment (secondary) or digestors. The facility operations and process control were rated as adequate. The operators perform the necessary sampling, following SOP's for adjustment in process plant has good process control procedures and adjustments are performed by operators as a result of sampling. O&M</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP	2019 Score	Observations
		is outdated, lost 2013 version during Hurricane María. Process analyses performed at Guayama WWTP not onsite. There is no control room, access roads need improvement and several structures need painting and concrete treatment. No sludge treatment, from clarifiers to sludge drying beds. WWTP is operating at a little over half the capacity. The equipment and maintenance of facility was rated as adequate. However, most of the intake structures had cracks with visible rebars high corrosion and filtration in the roof. Additionally, one lift pump out of service; aerated system and grit pumps on degritter system with issues; two out of the four sludge pumps were out; and the sludge drying beds show concrete deterioration and have no roof. Digester are out, in plans to eliminate. Training is adequate for the operation of this facility and its operating hours. Need at least three licensed operator and five TA for effectively attending the facility's operating hours.

4.2.2.3 Wells

PRASA has reported that it owns and operates 276 water wells, most of which deliver water directly into a distribution system with little or no treatment, except for disinfection by chlorination. PRASA's wells vary in size from 100 to 1,200 gallons per minute (gpm). A total of 16 wells (equivalent to 6% of total wells) from the Operational Areas of Arecibo, Manatí, Yauco, Ponce, Aguadilla and San Germán were inspected in FY2019. The sample of wells inspected represent 13.6% of the total (118) ancillary facilities inspected. Each assessment consisted of a site visit inspection and an interview with the designated personnel. The results of the assessment of those wells are described below. The facilities were evaluated using the following criteria: facility specific and regional specific criteria. The facility specific evaluation criterion considers operations, process control and equipment aspects, which are related to a specific facility. The regional specific criterion considers maintenance aspects which are carried out either on a regional or operational area basis and, also, the staffing and training aspects. Staffing and training was included to evaluate the adequacy of PRASA's assigned monitoring and operations personnel. The facility specific (operations/process control/equipment) criterion was assigned a weighting factor of 75%, while the regional specific (maintenance/training/staffing) criterion was assigned a weighting factor of 25%.

The inspection results for previous years were compared to the inspection results from the 2018 inspection to analyze condition changes. **Table 4-7** illustrates the comparison of the average rating for 2008 through 2019 of all facilities using the overall rating since the equipment evaluation was merged with the operations/process control criterion. This merged criterion was performed using the same deductions and weighted score than previous asset condition assessment reports thus the impact on the overall score was not altered. Out of the 16 wells inspected, 13 received a rating of Adequate and three were rated as Poor, for the overall rating. The wells rated as Poor include Cabo Rojo 3, Camino del Sur and Comercial. Furthermore, it is important to point out that although only three wells were rated as Poor, six (equivalent to 30% of the wells inspected) of the 13 wells rated in the Adequate range received an overall rating below 2.0 and, if left unattended, their condition could deteriorate, downgrading their rating to Poor or Unacceptable rating in the future. Of particular note is the condition of the Matadero 10 well, which was barely adequate (1.5).

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 4-7. Wells – Comparison of Average Inspections Results for 2008-2019

Criteria	2008	2009	2010	2012	2014	2015	2017	2018	2019	Change 2019 vs. 2018
Overall	2.0	1.9	2.1	2.2	2.2	1.9	1.8	1.7	1.9	0.2

In general, the average results slightly increased when compared to the 2018 results. Although most wells were generally observed to be in Adequate condition, there were a number of factors that resulted in several wells receiving a lower score and rating.

In general, the facility specific deficiencies noted were due in part to deterioration in equipment conditions. According to the inspection performed the most notable deficiencies were:

- 63% of the wells inspected are not remotely monitored;
- 19% of the wells inspected need painting and protection on piping and appurtenances;
- 13% of the wells inspected have leaks;
- 44% of the wells inspected have corroded pipelines and fittings;
- 69% of the wells inspected do not have an EGU; and
- 25% of the wells inspected did not have a satisfactory appearance.

The observed deficiencies in terms of the Regional evaluations for Arecibo, San Germán, Aguadilla and Ponce Operational Areas for potable water systems, which were rated as Poor, were the following:

- Unavailability of O&M/vendor manuals
- Challenges in the parts procurement process
- Lack of plan to implement major improvements
- No official schedule for outstanding work orders
- Lack of written procedures to handle emergencies
- Maintenance parts inventory inadequate
- Unavailability of as-built drawings
- Insufficient staff

The other operational areas evaluated, Yauco was rated as barely Adequate and had similar deficiencies. As for the Manatí Operational Area, which was rated as Adequate, it had only a few of those deficiencies.

The average rating of the evaluated wells was adequate. However, some of the wells presented a poor condition in the facility specific criteria. As much as nineteen percent of the wells visited were rated as poor in the facility criteria and deterioration has been observed through the years since there has not been capital improvements works. Also, the regional evaluation average rating was poor and PRASA should look to mitigate some of the deficiencies cited herein. Nevertheless, for the time being, these wells are expected to continue to serve their intended function of supplemental water supply. One of the main concerns is the lack of backup power at the majority of the well facilities inspected. This lack of backup power compromises the quality of service to PRASA's clients, making the potable water supply an intermittent one during events of electrical power problems. Also, corrosion was a repeated observation in

several wells. Notwithstanding, most of the deficiencies noted can be addressed through PRASA's R&R program and may not require major capital improvements. Note, however, that financing of PRASA's R&R program has also been negatively affected given PRASA's fiscal situation. In terms of operational deficiencies, the lack of monitoring of 63% of the wells evaluated in this year's assessment is of concern, since the quality of the product (safe potable water), may be compromised. Furthermore, future regulatory requirements may require either the implementation of significant capital improvements to include and achieve additional treatment capabilities at well facilities, or the closure of certain wells. Currently, PRASA continues conducting the comprehensive study at all active groundwater wells island-wide to assess source water protection and identify potential groundwater under the direct influence (GWUDI) of surface water the GWUDI program. Results of the GWUDI evaluations currently being conducted by PRASA should prove beneficial to identify additional needs in these facilities. For additional information regarding the GWUDI program please refer to the Compliance Department summary in Section 5 of this report.

4.2.2.4 Water Pump Stations

PRASA has reported that it owns and operates 977 WPSs. WPSs consist of two major categories: 1) above ground pumps and 2) below ground pumps in vaults with heavy covers that cannot be readily removed by field inspectors, such as underground booster stations (these are not inspected). PRASA's WPSs vary in pumping capability from less than 100 gpm to over 9,000 gpm. A total of 32 above ground WPSs (3.3% of total WPSs) were inspected. Each assessment consisted of a site visit inspection and an interview with the designated personnel. The results of the assessments of those stations are described below. The facilities were evaluated using facility specific and regional specific criteria, in order to have a better understanding about the facility's conditions and obtain an overview of the maintenance and staffing practices of the region/operational area. One criterion considers operations, process control, and equipment aspects which are related to a specific facility. The other criterion considers maintenance aspects, which are carried out either on a regional or operational area basis and, also, the staffing and training aspects. Staffing and training was included to evaluate the adequacy of PRASA's assigned monitoring and operations personnel. The facility specific (operations/process control/equipment) criterion was assigned a weighting factor of 75%, while the regional specific (maintenance/training/staffing) criterion was assigned a weighting factor of 25%.

The average WPSs overall rating resulted in the lower end of adequate with a rating of 1.7. As previously stated, the facility specific criterion accounts for 75% of the weighted factor, as it is the key criterion for assessing the condition of the WPSs. Two facilities, Cerro Marquez (North Region, Arecibo) and La Finca-Cruz (South Region, Yauco) were rated Unacceptable under the Facility category. In addition, 11 facilities were rated as Poor under this category, these included: Cupey (Metro Region, San Juan), Bo. Ríos II (Metro Region, Guaynabo); Dos Millones and Saldaña, both from the Fajardo Operational Area (East Region); Quebrada Arenas (North Region, Manatí); Ciénega 2 and Medio Millón, both from the Arecibo Operational Area (North Region); Consejo 1 (South Region, Yauco), Marías 2 (West Region, Aguadilla); and Molinas 2 and Santana 2, both from the San German Operational Area (West Region). Furthermore, it is important to point out that besides the 13 WPS rated as Unacceptable or Poor in overall rating, nine facilities received an overall rating below 2 and, if left unattended, their condition could deteriorate downgrading their rating to Poor or Unacceptable in the future. Moreover, in contrast with previous assessments, the overall Regional Evaluation of Operational Areas was rated as barely adequate.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The inspection results for previous years were compared to the inspection results from 2019 inspection to analyze performance changes since the previous inspections. **Table 4-8** illustrates the comparison of the average rating of all facilities by each category evaluated. The overall average rating of each evaluation criteria for 2008 through 2019 is also presented.

Table 4-8. WPSs – Comparison of Average Inspections Results for 2008-2019

Criteria	2008	2009	2010	2012	2014	2015	2017	2018	2019	Change 2019 vs. 2018
Overall	2.2	2.2	2.3	2.4	2.2	2.2	2.3	1.7	1.7	0.0

As shown in **Table 4-8**, there was no change in the overall rating (lower end of Adequate) compared to the 2018 results, which reflect the impact of the 2017 Hurricanes.

Although about 60% of the inspected WPSs were generally observed to be in adequate or good condition, there were several factors that resulted in 40% of the WPSs being rated lower. According to the inspections performed, some of the most notable deficiencies include the following:

- 22% of the WPSs inspected lack remote monitoring;
- 35% of WPSs inspected had at least one pump out of service;
- 69% of the WPSs inspected were observed to have leakage with severity ranging from minor to severe;
- 69% of the WPSs inspected were observed to have corrosion ranging from minor to severe;
- 25% of the WPSs inspected did not have a flow meter;
- 16% of the WPSs inspected did not have a satisfactory appearance; and
- 60% of the WPSs inspected did not have an EGU.

The observed deficiencies in terms of the Regional evaluations for Arecibo, San Germán, Aguadilla and Ponce Operational Areas for potable water systems, which were rated as poor were the following:

- Unavailability of O&M/ vendor manuals
- Challenges in the parts procurement process
- Lack of plan to implement major improvements
- Lack of procedure to prioritize repair
- No official schedule for outstanding work orders
- Lack of written procedures to handle emergencies
- Maintenance parts inventory inadequate
- Unavailability of as-built drawings
- Insufficient staff

The other operational areas evaluated, Yauco was rated as barely adequate and had similar deficiencies. As for the Manatí Operational Area, which was rated as adequate, it had only a few of those deficiencies.

The WPSs are generally in adequate condition (1.7), although a higher amount was found in poor conditions, it reflects the significant degradation from FY2017 to FY2018, after the impact of the 2017 Hurricane. Note that 13 facilities (40% of the evaluated facilities) were rated as Unacceptable or Poor. Nevertheless, they are expected to continue to serve their intended function of delivering drinking water throughout the distribution systems. The deficiencies noted are related to lack of features to optimize O&M practices, and condition of equipment of facilities. Other noted deficiencies, such as leaks and overgrown vegetation can be addressed through routine maintenance or PRASA's R&R program and do not require major capital improvements. The most significant deficiencies observed were, the lack of an operating EGU and different severity of leaks in the facilities, followed by pumps out of service, then the lack of flow meters, and lastly the lack of remote monitoring of the facilities and equipment corrosion.

4.2.2.5 Wastewater Pump Stations

PRASA has reported that it owns and operates 839 WWPSs, these vary in pumping capability from less than 100 gpm to over 10,000 gpm depending on the population density and its proximity to the receiving WWTP. A total of 30 WWPSs (3.6% of total WWPSs) were inspected in FY2019. Each assessment consisted of a site visit inspection and an interview with the designated personnel. In general, the inspected facilities predominantly use wet pit type submersible pumps, although several dry pit type stations were also inspected. The results of the assessments of those stations are described below.

The facilities were evaluated using facility specific criteria and regional specific criteria, in order to have a better understanding about the facility's conditions, and obtain an overview of the maintenance, training and staffing practices of the regional/operational area. One criterion considers operations, process control and equipment aspects, which are related to a specific facility. The other criterion considers maintenance aspects, which are carried out either on a regional or operational area basis and, also, the staffing and training aspects. Staffing and training were included to evaluate the adequacy of PRASA's assigned monitoring and operations personnel. The facility specific (operations/process control/equipment) criterion was assigned a weighting factor of 75%, while the regional specific (maintenance/training/staffing) criterion was assigned a weighting factor of 25%.

Out of the 30 WWPSs inspected, 21 received an overall rating of Adequate, four received an overall rating of Good and five were rated as Poor. The facilities rated as Poor included: Villas de Castro (East Region, Caguas); Allen Grup and Barriada Obrera, both from the Fajardo Operational Area (East Region); and Montaña and San Antonio-Vieja, both from the Aguadilla Operational Area (West Region). As previously stated, the facility specific criterion accounts for 75% of the weighted factor, as it is the key criterion for assessing the condition of the WWPSs. Therefore, highlighting this criterion, the WWPSs rating distribution for this evaluation period is as follows: none Unacceptable, three Poor, 17 Adequate, and ten Good. In addition, this inspection cycle had more Operational Areas in the Regional Evaluation category rated in the Poor range.

In addition to the facilities rated as Poor in the Facility criterion, although rated as Adequate in that criterion, five WWPSs (equivalent to 17% of WWPS inspected) received a rating below 2.0 and, if left unattended, their condition could deteriorate downgrading their rating to Poor or Unacceptable in the future. These facilities were: UM-49 WWPS and Villa Andalucía WWPS, both from the San Juan Operational Area (Metro Region), Altos de la Fuente WWPS (East Region, Caguas), Campo Alegre WWPS (north Region, Manatí), and Jacanas WWPS (South Region, Yauco).

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The inspection results for previous years were compared to the inspection results from 2019 to analyze the performance. **Table 4-9** presents the comparison of the average rating of all facilities by each category evaluated. The overall average rating of each evaluation criteria for 2008 through 2019 is also presented.

Table 4-9. WWPSs – Comparison of Average Inspections Results for 2008-2019

Criteria	2008	2009	2010	2012	2014	2015	2017	2018	2019	Change 2019 vs. 2018
Overall	1.7	2.0	2.0	2.1	2.3	2.4	1.8	1.8	1.9	0.1

The overall condition of WWPSs slightly increased, still in the lower end of Adequate, compared to the 2018 results. There has not been a significant improvement, which can mostly be attributed to the lack of investment in improvement works the last few years due to the ongoing fiscal situation and the effects of the hurricanes that impacted the island in 2017.

In general, some of the most significant deficiencies encountered during the inspections revealed the following:

- 97% of the WWPSs inspected were not remotely monitored;
- 13% of the WWPSs inspected had recorded overflows during the evaluation period;
- 33% of the WWPSs inspected had exhaust fans out of service, missing or operating in manual mode;
- 27% of the WWPSs inspected had pumps out of service or did not have elapsed time meters;
- 27% of the WWPSs inspected did not have audible alarm;
- 23% of the WWPSs inspected did not have an EGU or it was out of service
- 20% of the WWPSs inspected had issues with site illumination; and
- 13% of the WWPSs inspected did not have a satisfactory appearance

The observed deficiencies in terms of the Regional evaluations for Arecibo, Fajardo, Caguas, San Germán, Aguadilla and Ponce Operational Areas for wastewater systems, which were rated as Poor, were the following:

- Unavailability of O&M/vendor manuals
- Challenges in the parts procurement processes; very slow
- Challenges in the parts procurement process; very slow
- Lack of plan to implement major improvements
- Lack of procedure to prioritize repairs
- Lack of sufficient maintenance tools
- Maintenance parts inventory inadequate
- Unavailability of as-built drawings
- Insufficient staff

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The other operational areas evaluated, Yauco was rated as barely Adequate (1.5) and had similar deficiencies. As for the Guaynabo and San Juan Operational Areas, which were rated as Good, the only issues reported were: O&M/vendor manuals and as built drawings availability, and lack of a good maintenance parts inventory.

Overall, the WWPSs are in Good to Poor condition. Although the about the same overall average rating compared to FY2018, it is still in the lower end of Adequate. In past years, there has been a trend on increase deterioration due to the lack of capital improvement invested, as a result of the fiscal situation, and compounded with the damages caused by the 2017 Hurricanes. While only 13% of the visited facilities had recorded overflows during this evaluation period, it is still of concern. Even though most of the visited facilities had an EGU, overflows were still reported. Therefore, this problem can be attributed to the fact that 97% of the facilities visited are not remotely monitored, 27% of the facilities do not have an exterior alarm, and 27% had pumps out of service, among other potential issues. Having remote monitoring will help PRASA prevent overflows in the System and adding a comminutor (grinder type) to those facilities which receive vast amounts of solids would help maintain the entryway clear of debris. PRASA's Operational Regions continue their effort with IMP to install telemetry at all facilities to enable monitoring from the ROCs but they are addressing the WSTs and WPSs first, thus the WWPS are lagging.

4.2.2.6 Water Storage Tanks

PRASA has reported that it owns and operates 1,552 water storage tanks (WSTs) that vary in storage capacity (size) from 100 to 10,000,000 gallons. A total of 40 water storage tanks (2.6% of total tanks) were inspected in FY2019. Each assessment consisted of a site visit inspection and an interview with the designated personnel. The results of the assessments of those stations are described below. **Table 6-1** summarizes the two evaluation categories and corresponding weighting factors used in the evaluation of water storage tanks, same as the previous inspections. The facilities were evaluated using facility specific criteria and regional specific criteria, in order to have a better understanding about the facility's conditions, and obtain an overview of the maintenance, training and staffing practices of the region/operational area. One criterion considers operations, process control and equipment aspects which are related (limited to) a specific facility. The other criterion considers maintenance aspects, which are carried out either on a regional or operational area basis and, also, the staffing and training aspects. Staffing and training were included to evaluate the adequacy of PRASA's assigned monitoring and operations personnel. The facility specific (operations/process control/equipment) criterion was assigned a weighting factor of 75%, while the regional specific (maintenance/training/staffing) criterion was assigned a weighting factor of 25%.

Out of the 40 WSTs inspected, 30 received an overall rating of Adequate, four received an overall rating of Good and six were rated as Poor. The facilities rated as Poor included: Quebrada Arenas (North Region, Manatí); El Junco (North Region, Arecibo); Julio Morales 2 and Rincón 1 Millón, both from the Fajardo Operational Area (East Region); Altos de la Fuente (East Region, Caguas); and Cupey (Metro Region, San Juan). Furthermore, it is important to point out that although the average overall rating was in the adequate range (1.90), ten WSTs (equivalent to 25% of tanks inspected) received an overall rating below 2.0. Moreover, in contrast with previous assessments, the overall Regional Evaluation of Operational Areas was rated as barely adequate. As previously stated, the facility specific criterion accounts for 75% of the weighted factor, as it is the key criterion for assessing the condition of the wells.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Therefore, highlighting this criterion, the WSTs rating distribution for this evaluation period is as follows: no Unacceptable, six Poor, 25 Adequate, and nine Good.

The inspection results for previous years were compared to the inspection results from 2019 inspection to analyze performance changes since the previous inspections. The overall rating was in the adequate range, with an overall rating of 2.3. **Table 4-10** illustrates the comparison of the average rating of all facilities by each category evaluated. The overall average rating of each evaluation criteria for 2008 through 2019 is also presented.

Table 4-10. WSTs – Comparison of Average Inspections Results for 2008-2019

Criteria	2008	2009	2010	2012	2014	2015	2017	2018	2019	Change 2019 vs. 2018
Overall	1.9	1.6	1.6	1.9	2.4	2.3	2.4	1.9	1.9	0.0

On average, the overall rating remains the same, in the lower end of Adequate, compared to the 2018 results, which reflect the impact of the 2017 Hurricanes. However, in contrast to FY2018 where no WSTs were rated as Unacceptable or Poor, six WSTs (15% of inspected tanks) were rated as Poor in FY2019. In addition, four of the ten WSTs rated as adequate in overall rating but below a 2.0, were borderline adequate in the facility criterion and, if left unattended, their condition could deteriorate downgrading their rating to Poor or Unacceptable in the future. These facilities are: Fair View WST (Metro Region, San Juan), Dos Millones WST (East Region, Fajardo), Vista Verde WST (West Region, Aguadilla) and La Finca-Cruz WST (South Region, Yauco).

In general, some of the most significant deficiencies encountered during the inspections revealed the following:

- 60% of the WSTs inspected did not have a local level indicator;
- 60% of the WSTs inspected have deteriorated concrete walls, with cracks ranging from minor to moderate degree.
- 55% of the WSTs inspected did not have a high/low level alarm;
- 40% of the WSTs inspected are not remotely monitored;
- 28% of the WSTs inspected had minor to moderate degree leakage.
- 25% of the WSTs inspected had an unsatisfactory appearance and lacked proper insect protection on vents or float valve
- 20% of the WSTs inspected had roof surface defects and lack emergency numbers;
- 18% of the WSTs inspected did not have adequately secured access hatches; and
- 5% of the WSTs inspected were not visited daily

Even though not all tanks are visited daily, PRASA stated that all tanks are in compliance with the Tank Monitoring Program established in the 2006 PRDOH Settlement Agreement, as amended.

The observed deficiencies in terms of the Regional evaluations are the same as described in the WPS and Well sections for potable water systems.

The WSTs are generally in Adequate condition and are expected to continue to serve their intended function of providing potable water storage throughout the distribution systems. The most significant deficiencies observed were lack of local level indicator, minor to moderate cracks, lack of high/low level alarm, lack of remote monitoring, minor to moderate leaks, minor to moderate roof surface defects, and lack of adequately fitted/ locked access hatches. These deficiencies may not require significant capital upgrades, but rather a modification to O&M practices (e.g. removal of overgrown vegetation and periodic tank internal inspections) or can be addressed through PRASA's R&R program (e.g. repairs to tank hatches, vents, level alarms, and security fences). Deficiencies that could require capital upgrades, such as tank refurbishing, deteriorated concrete, and significant leakage through walls were observed in 28% of the visited tanks.

In addition, remote monitoring is recommended as an optimization measure and as a preventative measure against water losses in the distribution system; consequently, PRASA had started with this initiative, providing remote monitoring to those tanks that have been identified as critical in the distribution system. Although PRASA's Operational Regions are at different stages of WST visualization level achieved, some at more advanced than others, all have established goals to reach high levels of WST visualization and will continue implementation until reaching 100%.

4.3 Buried Infrastructure

Although buried infrastructure (i.e. water meters, water mains and distribution pipes, buried valves, sewer trunks and collection pipes, and manholes) was not inspected, the following sections provide some discussion regarding indirect indicators of the condition of buried infrastructure. Since FY2005 PRASA has invested in and continues to develop and update its Geographical Information System (GIS) database to allow for a better control, record and management of its buried assets. Also, PRASA slowly continues with its buried infrastructure R&R program, mainly managed and implemented by the Operational Regions and as their assigned budget allows. R&R of distribution (water) and collection (wastewater) pipes, which targets pipe breaks and leak-prone areas, are identified by PRASA's Operational Areas and prioritized according to severity of the problem. Meter replacements are programmed and managed through PRASA's Non-Revenue Water (NRW) Reduction Program.

4.3.1 Water Meters

PRASA owns over 1.4 million water meters ranging from 1/2 to 12 inches in diameter. PRASA has continued its meter replacement initiative under the Revenue Optimization Program. As reported by PRASA, about 731,000 small meters (1-inch in diameter or less) and over 5,400 large meters (greater than 1-inch in diameter) were replaced between FY2009-FY2019. However, due to PRASA's current fiscal situation the implementation of the initiatives included in the Revenue Optimization Program have been slowed down and meter replacements are on hold. About 7,144 small meters and 117 large meters were replaced during FY2019. These replacements were mainly due to maintenance, theft or special client requests.

PRASA is currently focusing its efforts in the planning and implementation of the 2019 PRASA Fiscal Plan which includes the implementation of a key initiative: a P3 Project to modernize PRASA's metering system, enhance customer service activities and customer satisfaction, improve billings and collections,

and reduce NRW. Through this initiative, PRASA will reactivate its meter replacement initiative utilizing advanced metering technology.

4.3.2 Water Distribution System

Based on the latest published PRASA Accountability Report (1st trimester of FY2016), PRASA owns over 14,753 miles of water pipelines, which include both transmission and distribution pipes with sizes ranging from two inches to 72 inches in diameter. As in previous years Arcadis did not inspect the water transmission and distribution system. However, it is reasonable to assume that a portion of the water distribution system will require structural repairs, as well as rehabilitation to reduce leakage.

4.3.3 Non-Revenue Water

NRW is water that has been produced but is not billed to customers. However, not all NRW is due to water losses. As shown in the water balance summary presented in **Figure 4-1**, NRW has three main components: unbilled authorized consumption, commercial (apparent) losses and physical (real) losses. Combined, commercial and physical losses make up the System's water losses. Unbilled authorized consumption is in turn composed of unbilled metered and unbilled unmetered consumption which includes water used by PRASA (measured and estimated) for operational and internal purposes and water used for firefighting. Examples include potable water service provided to PRASA's facilities, water used for washing and cleaning PRASA's tanks and sanitary pipelines, tanker trucks for communities with deficient water service, firefighter's usage, etc.

Table 4-11 provides a summary of key water distribution system metrics since FY2012, including current estimated levels of water production, water losses, and NRW, as reported by PRASA. PRASA's NRW levels have been consistently declining except for FY2018 where there was a slight increase.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

System Input Volume (Dispatched Water)	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Commercial Losses (Apparent Losses)	Unauthorized Consumption (theft)	
			Customer Metering Inaccuracies	
			Data Handling (Billing) Errors	
		Physical Losses (Real Losses)	Main Line Leakage	
			Storage Tank Overflows	
			Service Connection Leakage	

Source: American Water Works Association and International Water Association

Figure 4-1. Water Balance Summary

Table 4-11. Water Losses and Non-Revenue Water

Fiscal Year	Total Water Production (MGD) ¹	Water Losses	Non-Revenue Water
		(MGD)	(MGD)
FY2012	647	381	399
FY2013	617	354	363
FY2014	598	343	351
FY2015	557	299	307
FY2016	508	291	298
FY2017	507	293	299
FY2018	507	308	314
FY2019	542	342	349
Difference FY2018-2019	35	34	35
Cumulative Difference FY2012-2019	-105	-39	-50

¹Includes a metering-error adjustment identified by PRASA in its water balance audits.

As shown in **Table 4-11**, from FY2012 to FY2019, PRASA reports to have reduced the amount (volume) of water produced (105 MGD reduction), amount of water losses (39 MGD reduction), and NRW (50 MGD

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

reduction). In FY2019, water production increased due to the slow recovery process, slower repair response of pipe leaks and breaks, damaged metering equipment, and filtration plants overcompensating these deficiencies with increased production. PRASA estimates the FY2019 total water production at approximately 542 MGD and NRW at approximately 349 MGD. Of the total volume of NRW, unbilled authorized consumption was about 7 MGD while water losses, which total an estimated 342 MGD, consist of approximately 39.4 MGD in apparent (commercial) losses and 302.7 MGD in real (physical) losses. PRASA projects that water audits and NRW estimated values will be refined as metering efforts (both at the production point and customer service points) get underway.

Following the industry's recommended NRW data analysis and reporting, PRASA is reporting NRW in terms of volume reduced in its annual water audits, and no longer as a percentage of the water production. The American Water Works Association (AWWA) recommends not to use NRW as a percentage of water production as a performance indicator of NRW efforts because this method may show confusing and misleading results. NRW as a percentage of water production does not necessarily represent NRW performance efforts. For example, when comparing FY2016 and FY2015 results included in **Table 4-11**, the volume of water produced, volume of water losses and volume of NRW were all reduced. However, when calculated as percentage of volume of water produced, no reductions in water losses nor in NRW are obtained.

Since FY2012, PRASA began measuring the Infrastructure Leakage Index (ILI) which is an indicator that is used to measure the level of physical losses in the water distribution system. More specifically, the ILI is defined as the current annual real losses divided by the unavoidable annual real losses. The unavoidable annual real losses represent the lowest technically achievable annual real losses for a well-maintained, well-managed system and is the likely lower bound on water losses. As a performance indicator, the ILI represents a measure of the combined performance of three infrastructure management methods for real losses: the speed and quality of repairs, active leakage control, and asset management. Factors that affect the ILI include the pipe age and material, customer density, and system pressure. The ILI was introduced in 2000⁸ and is also defined and calculated in AWWA's M36 Water Audits and Loss Controls manual. An ILI between 1 and 3 is considered excellent. U.S. utilities with combined operations currently measuring the ILI for their systems reported values ranging from 1.12 to 4.17, with a median of 2.20⁹. Globally, systems in developed countries report lower values of 5; while in developing countries, values range from 10 up to about 50. In FY2012, PRASA reported an ILI of about 18. However, since then, PRASA's ILI has reduced by about 43% until the reported value of 10.19 in FY2018 as a result of the 2017 Hurricanes. In FY2019, while still under the recovery effects of the 2017 Hurricanes, PRASA reported an ILI of 12.16, an increase of 19% from FY2018.

PRASA has been calculating these AWWA indicators (ILI and volume of commercial and physical losses per connections per day) as part of the annual water audit process. However, PRASA indicated that to do so, a high amount of estimation takes place, which may affect the validity of the results. Therefore, PRASA's NRW team is redefining the NRW goals and metrics and developing new initiatives to obtain more reliable results based on real data measurements (i.e. flow, tank water levels, systems' pressures).

⁸ Source: Alegre, H. Hirner, W., Bapista, J., and Parena, R. (2000). "Performance indicators for water supply services" IWA Manual of Best Practices.

⁹ Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA attributes the reductions in NRW to the following main contributing factors and measures:

- Greater understanding and improvement of management practices regarding NRW and water losses.
- Improvements in data management and quality (better production measurement).
- Reduction in events and duration of water storage tank overflows.
- Reduction in the time to repair leaks.
- Leak detection with specialized equipment.
- Pressure management in the distribution system.

Notwithstanding the recent improvement in NRW, PRASA's level of NRW is still higher than the average utility benchmarks results. U.S. and Canada average results of apparent (commercial) losses per service connection per day and average results of real (physical) losses per service connection per day for utilities with combined (water and wastewater) operations range from 3.04 to 13.16 gallons (median of 7.00) and from 24.80 to 78.00 gallons (median of 41.83)¹⁰, respectively.

PRASA recognizes that reducing its NRW and water losses volume and, in turn, its water production, will have positive effects on not only its operations, but also on its financial results (lower O&M expenses and higher revenues, for example), and on its sustainability practices. Therefore, reducing NRW is one of the top priorities and is one of the main objectives of the 2019 PRASA Fiscal Plan.

Additionally, PRASA's NRW office is focused on refining the validity and credibility of the data of the annual water audits and reducing NRW by among other measures, continuing the Revenue Optimization Program, installing flow meters at PRASA facilities to measure a more significant percentage of the authorized unbilled consumption, and reducing the unmetered production by installing additional flow meters at WTPs to adequately measure daily production to distribution flows. PRASA's goal is to reach a metered reading of 80% of the production supplied by FY2020. Measuring the most amount of water production increases the credibility of the results and decreases the probable over estimation of the NRW results. Nonetheless, as previously mentioned, PRASA is currently redefining the NRW goals and metrics, with this one particular goal under review. In addition, PRASA's Operational Regions plan to install meters to measure the water discarded as part of the water system's programmed drainages implemented as part of the measures to meet compliance with DBP levels in the water system.

4.3.3.1 Leak Monitoring and Control

As shown in **Table 4-12**, leaks reported in FY2018 and FY2019, were 45,873 and 57,997, respectively. **Table 4-12** also shows the average annual leaks occurrence per 100 miles of water piping for recent fiscal years. The total annual reported leaks for FY2019 increase approximately 7% compare to FY2014 and 26% compared to FY2018. The previous increasing trend observed over FY2015 and FY2016 shifted for FY2017 and FY2018. However, Arcadis has not made an independent evaluation to identify the root causes of this recent decrease. For FY2018 part could be attributed to the 2017 hurricanes that impacted the island, a period when PRASA refocused efforts to recovery activities and other more critical matters. As such, in FY2019, after the normalization of PRASA's operations the annual reported leaks went back up.

¹⁰ Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Despite the recent decrease trend prior to the increase in FY2019, PRASA's reported rate of leak occurrence continues to be extremely high compared to other utilities in the U.S. and Canada (average annual combined leaks and breaks per 100 miles are between 11.8 and 36.4)¹¹. Although this high rate is not surprising, given the existing infrastructure's age, size, complexity, and significant changes in elevations of the System, it still influences PRASA's NRW. Aging infrastructure is another contributing factor to the high rate of leaks in addition to the decrease of funding available for pipeline R&R.

Table 4-12 Reported Leaks from FY2014 to FY2019

Fiscal Year	Total Annual Reported Leaks	Annual Leaks per 100 miles Using 14,753 miles of Water Pipeline
2014	54,154	386 ¹
2015	63,503	430
2016	62,079	421
2017	54,810	372
2018	45,873	311
2019	57,997	393

Source: PRASA Systems, Applications, and Products in Data Processing (SAP) (Commercial) Database

¹Water pipeline total length used for previous fiscal years (FY2011-FY2014) was 14,031 miles.

The average weekly reported and repaired leaks per fiscal year, as well as the percentage of repaired leaks with respect to the number of leaks reported in each fiscal year are shown in **Figure 4-2**. For FY2019, PRASA reports an average of leaks per week of approximately 1,115. Comparing the weekly reported leaks in each fiscal year, it can be observed that from FY2014 to FY2015, the weekly reported leaks increased approximately 17%. However, from FY2015 to FY2016, the weekly reported leaks decreased about 4%. The same trend is observed with the weekly repaired leaks. From FY2014 to FY2015 a steady increase was being achieved in weekly repaired leaks. However, from FY2015 to FY2018, the weekly reported leaks decreased annually by approximately 4%, 10% and 15%. Then it increased again from FY2018 to FY2019 by approximately 26%. The same trend is observed with the weekly repaired leaks. Also, the percent leaks repaired has remained at 99% from FY2017 to FY2019.

¹¹ Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

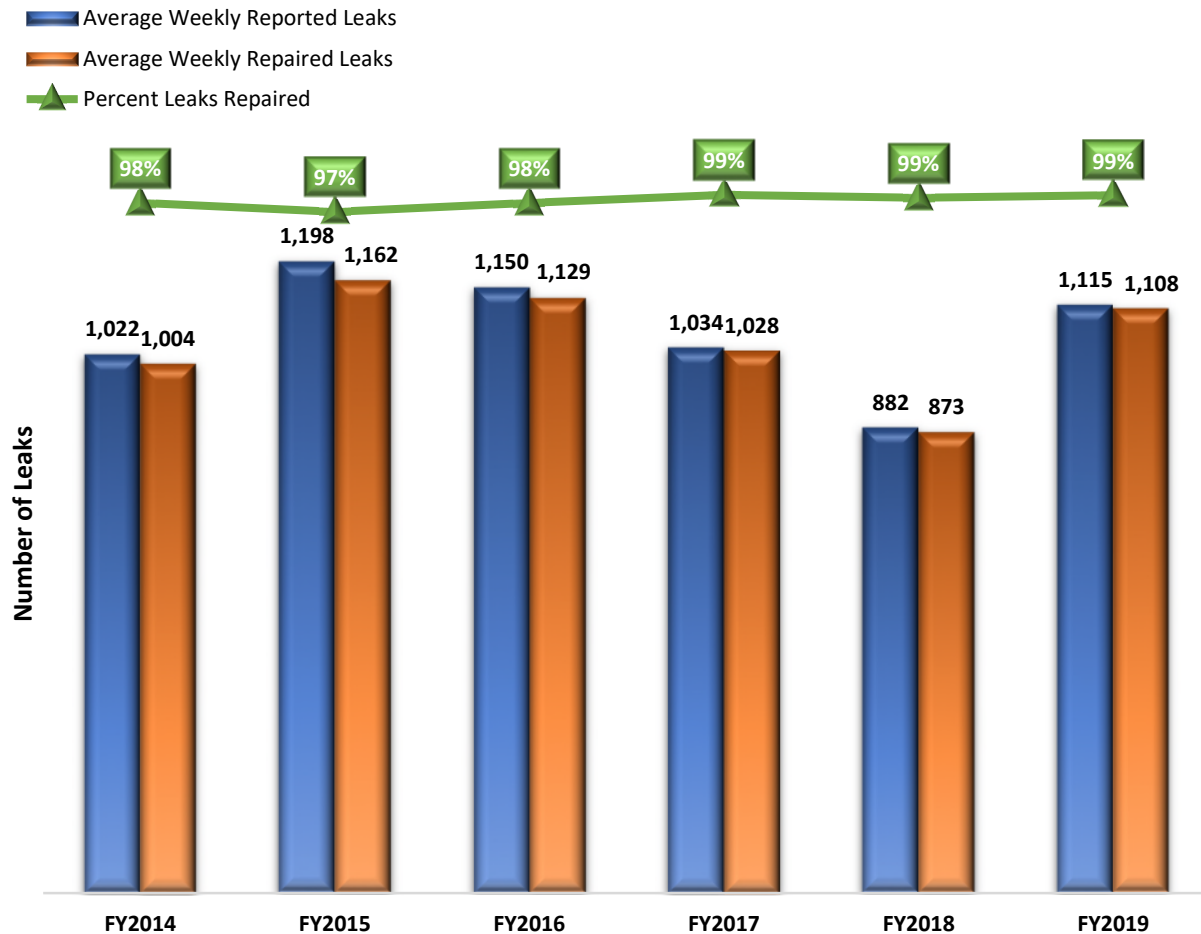


Figure 4-2. Island-Wide Weekly Average Leaks Reported and Repaired

Figure 4-3 shows the active leaks with duration greater than seven days before being repaired for recent fiscal years. In FY2015, there was a slight upturn in correlation with the increase in reported leaks as PRASA reported to have ended the fiscal year with a total of 3,049 pending leaks with duration greater than seven days and 62 weekly average pending leaks with duration greater than seven days. However, in FY2016 the number of leaks with duration greater than seven days was reduced to a total of 2,698 pending leaks with duration greater than seven days and 54 weekly average pending leaks with duration greater than seven days. Furthermore, in FY2017 the number of leaks with duration greater the seven days was significantly reduced to a total of 365 pending leaks with duration greater than seven days and 8.1 weekly average pending leaks with duration greater than seven days. However, the month of June 2017 data was not available. For FY2018, not enough data was obtained to generate a good trend for the year since the only data available was from March 2018 to June 2018. This was mostly due to the impact of the 2017 Hurricanes and the recovery efforts, damage to the communications infrastructure and the fact that the responsible personnel were temporarily relocated to attend the more urgent recovery and restoration of the System. For FY2019, while still in recovery of the 2017 Hurricanes, the number of leaks with duration greater than seven days significantly increase to a total of 13,291 pending leaks with

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

duration greater than seven days and 288.9 weekly average pending leaks with duration greater than seven days.

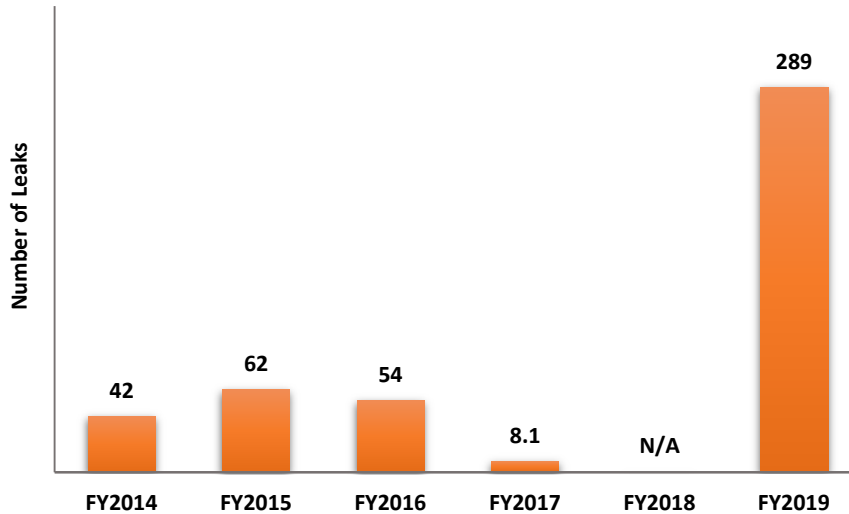


Figure 4-3. Island-Wide Weekly Average Pending Leaks with Duration >7 Days

Table 4-13 provides a summary of the average repaired leaks per working day and average backlog. Based on the weekly average pending leaks and weekly average pending leaks with duration greater than seven days, it can be observed that in FY2019 PRASA averaged a backlog of approximately 3.9 days of pending leaks and a backlog of approximately 1.3 days of pending leaks with duration greater than seven days. This increase from the previous declining trend is a result of the 2017 Hurricanes and its aftermath with the slow recovery process. The average backlog days for pending leaks has decreased since FY2014 by reducing 17% in FY2015 and has continued its improvement every year up to FY2018 when Puerto Rico was hit by the 2017 Hurricanes and not enough data was obtained to generate a good trend for the year. The 2017 Hurricanes affected the improvement trend from previous years that last reflected, in FY2017, a significant decrease of 80% in average backlog days pending leaks >7 days compared to FY2016. Furthermore, PRASA's effectiveness in repairing pending leaks in a timely manner has continued to improve year after year since FY2011 up to the 2017 Hurricanes that have negatively impacted the trend for FY2018 (no data) and FY2019.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 4-13. Annual Average Backlog of Pending Leaks

Fiscal Year	Average Weekly Pending Leaks	Average Weekly Pending Leaks >7 Days	Average Repaired Leaks per Working Day ¹	Average Backlog Days for Pending Leaks	Average Backlog Days for Pending Leaks >7 Days
2014	460	72	205	2.3	0.4
2015	434	62	232	1.9	0.3
2016	354	54	234	1.5	0.2
2017	263	8.1	210	1.3	0.04
2018	N/A	N/A	N/A	N/A	N/A
2019	864	289	222	3.9	1.3

¹ Assumes five working days per week. Source: PRASA SAP (Commercial) Database.

Regarding water storage tank overflows issues, PRASA has been implementing continuous monitoring of water storage tanks across its operational regions as a measure to help control and minimize overflow (water losses) occurrences, as the fiscal situation and repair prioritization allows. It is still PRASA's goal to reach 100% monitoring in water storage tanks. Finally, as a measure to help optimize the System's operation and reduce potential leaks through valves, PRASA has included its pressure regulator/sustaining valves in the IMP and has indicated that it is providing training to its employees to carry out the necessary maintenance activities. Additionally, the Water Recovery Office (WRO) has initiatives like pressure management (reduce pressures, pressure gage at tanks, validation & replacement, valves) and Leak Detection Program, which will consequently help with overflows.

PRASA intends on implementing WRO initiatives to reduce leaks and tank overflows in parallel with the repair/replacement of damage buried infrastructure as the fiscal situation and availability of funding allows. PRASA also indicates that although the meter replacement initiative has slowed down, minor replacements have been performed, either due to maintenance, theft or special client requests. However, as part of the P3 initiative included in the 2019 PRASA Fiscal Plan, meter replacement/maintenance and leaks/overflows metrics are expected to be addressed.

4.3.4 Wastewater Collection System

Based on the latest published PRASA Accountability Report (1st trimester of FY2016), PRASA owns approximately 5,994 miles of wastewater pipelines. Although the wastewater collection system was not inspected, it is reasonable to assume that a significant portion of the wastewater collection system will require some structural repairs, as well as rehabilitation (replacement) to reduce inflow and infiltration and overflow occurrences and to address the impacts of the 2017 Hurricanes.

4.3.4.1 Overflow Monitoring and Control

As shown in **Table 4-14**, PRASA indicates that overflows reported in FY2019 were 27,253. Data is not available regarding frequency of overflows in (a) combined sewer systems compared to separate systems or (b) dry weather overflows compared to wet weather overflows. Dry weather overflows are often caused

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

by (a) insufficient cleaning and maintenance of the collection system, resulting in a buildup of roots or grease, restricting, or blocking flow or (b) pump station failures due to old or insufficiently maintained equipment, poor design, or lack of reliable backup power supply. Wet weather overflows are an indicator of leaking sewers, storm water connections to sanitary sewer systems, or under-sized pipes or pump stations.

Table 4-14 also shows the average annual overflows occurrence per 100 miles of sewer. In FY2019, an average of 455 overflows per 100 miles of sewer were reported. There was an increase of total annual reported overflows of about 6% from FY2014 to FY2015 and about 6% from FY2015 to FY2016, which could be due to an increase in the actual number of overflows occurrences, an increase in the number of people reporting overflows (as a result of PRASA's communication initiatives and increased social media presence), the additional pipeline miles included in the analysis or a combination of the three. However, in FY2017 and FY2018, there was a decrease in reported overflows of 5% and 16% when compared to FY2016 and FY2017, respectively. In FY2019, there was an increase of 16% in reported overflows, which could be due to the 2017 Hurricanes impact to the buried infrastructure and WWPSs. Again, as with the increase in FY2015 and FY2016, Arcadis has not made an independent evaluation to identify the root causes of this increase. Notwithstanding, PRASA's reported rate of overflow occurrence continues to be extremely high compared to other utilities in the U.S. and Canada with combined operations (average annual overflows (non-capacity & capacity) per 100 miles are between 0.2 and 4.3 overflows¹²). However, this high rate is not surprising given the size and complexity of the System. Other contributing factors to this high rate of overflows include aging infrastructure, damages from 2017 Hurricanes, and inadequate customer use (i.e., illegal connections and discharges).

Table 4-14. Reported Overflows from FY2014 to FY2019

Fiscal Year	Reported Overflows	Annual Overflows per 100 miles Using 5,994 miles of Wastewater Pipeline
2014	26,937	506 ¹
2015	28,569	477
2016	29,991	500
2017	28,510	476
2018	23,819	397
2019	27,253	455

Source: PRASA SAP (Commercial) Database

¹Wastewater pipeline total length used for previous fiscal year (FY2014) was 5,325 miles.

PRASA's average weekly reported and repaired overflows per fiscal year for recent fiscal years are shown in **Figure 4-4**. For FY2019, PRASA reports an average of approximately 524 per week. In FY2015 and FY2016, the average weekly reported overflows experienced an increase of 6% and 5% compared to FY2014 and FY2015 results, respectively. Conversely, in FY2017 a decrease of 3% was observed when compared to FY2016 and continuing the decrease trend, a 15% drop from FY2018 to FY2017. However, FY2018's significant reported drop may be an outlier because of the lower reporting in the aftermath of the 2017 Hurricanes. Lastly, in FY2019 an average weekly reported overflows increase of 14% was

¹² Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

observed when compared to FY2018. Also shown in **Figure 4-4** is the percentage of repaired overflows with respect to the number of overflows reported in each fiscal year.

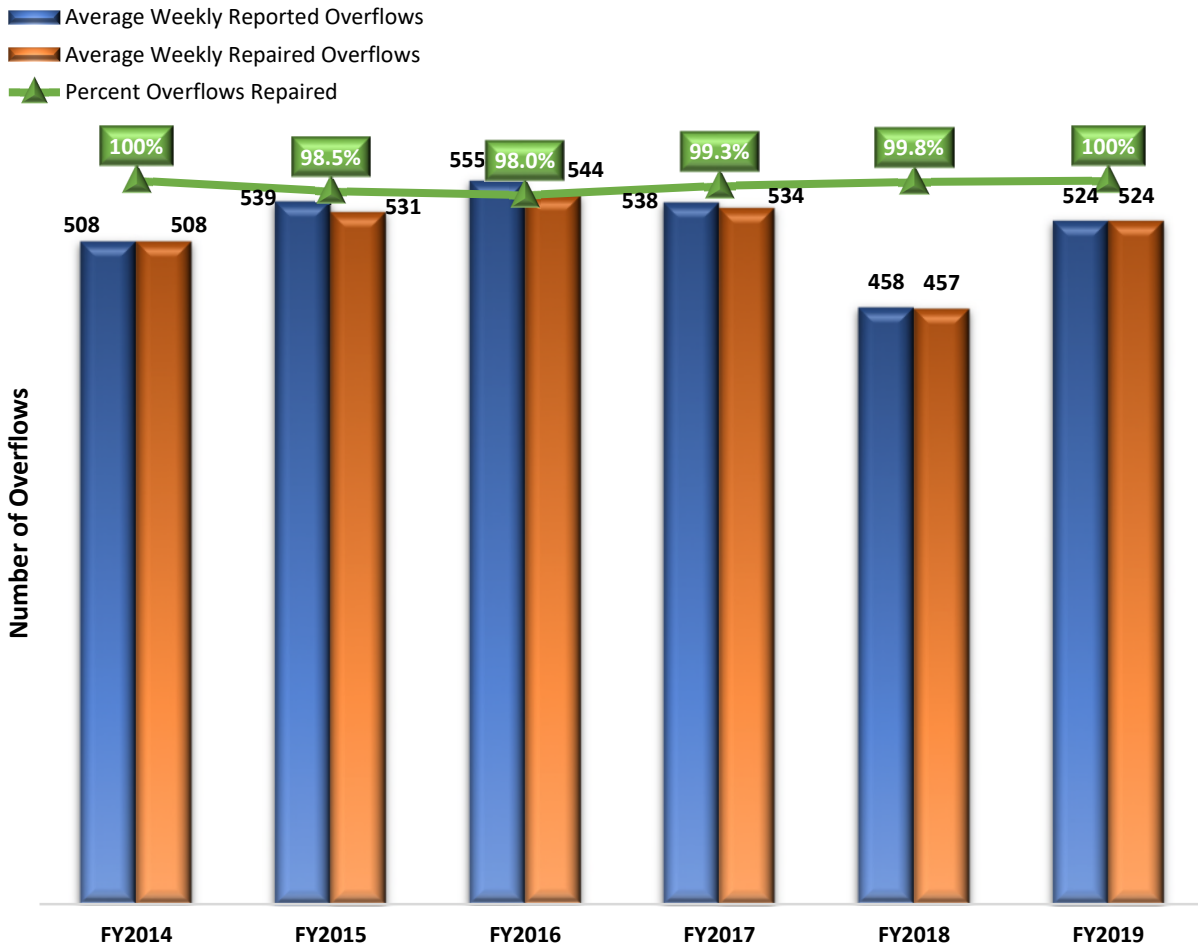


Figure 4-4. Island-Wide Weekly Average Overflows Reported and Repaired

Figure 4-5 shows the pending overflows with duration greater than seven days for recent fiscal years. As shown in the figure, the number of pending overflows with duration greater than seven days slightly decreased in FY2015. In FY2016, there was an increase in the weekly average pending overflows with duration greater than seven days of about 30%. Conversely, in FY2017, there was a decrease of 62% in the weekly average pending overflows with duration greater than seven days. For FY2018, not enough data was obtained to generate a good trend for the year since the only data available was from March 2018 to June 2018. This was mostly due to the impact of the 2017 Hurricanes and the recovery efforts, damage to the communications infrastructure and the fact the responsible personnel were temporarily relocated to attend the more urgent recovery and restoration of the System. However, in FY2019 there was a significant increase in pending overflows compared to the last reported fiscal year. This could be due to slow recovery process and non-repaired impact to the buried infrastructure and WWPSs as a result of the 2017 Hurricanes. However, Arcadis has not made an independent evaluation to identify the root causes of this increase.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

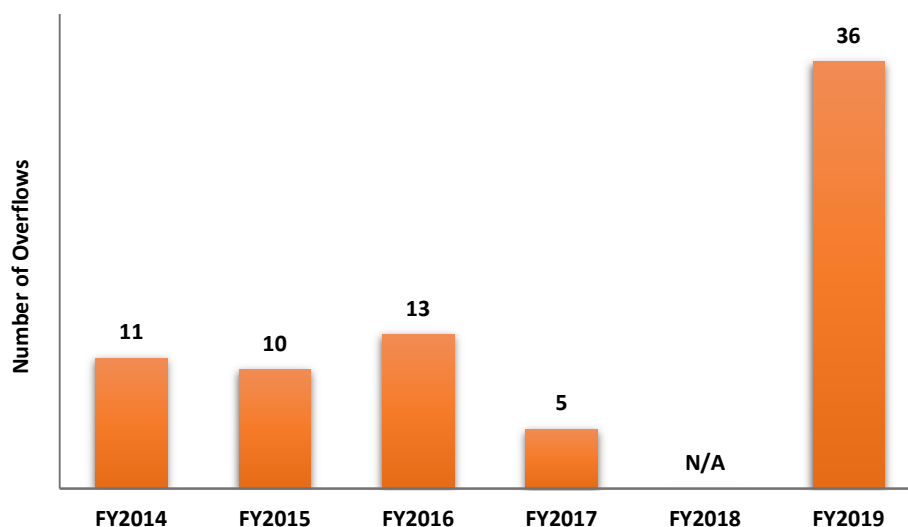


Figure 4-5. Island-Wide Weekly Average Pending Overflows with Duration >7 Days

Table 4-15 provides a summary of the average repaired overflows per working day and average backlog. As shown, in FY2015, FY2016 and FY2017, PRASA reported a decrease trend with 108, 104 and 75 average weekly pending overflows, respectively. In FY2017, PRASA also improved its average backlog achieving approximately 0.7 days of pending overflows as well as the backlog of pending overflows with duration greater than seven days to 0.05. These results represent a reduction of about 22% and 58%, respectively, compared to FY2016 results. PRASA's effectiveness in repairing pending overflows in a timely manner has continued to improve year after year since FY2014, particularly those with duration greater than seven days, except for FY2016. For FY2018, not enough data was obtained to generate a good trend for the year since the only data available was from March 2018 to June 2018. Furthermore, FY2019 reflects the effects of the 2017 Hurricanes as all criteria increased significantly from the last reported available data, in FY2017.

Table 4-15. Annual Average Backlog of Pending Overflows

Fiscal Year	Average Weekly Pending Overflows	Average Weekly Pending Overflows >7 Days	Average Repaired Overflows per Working Day ¹	Average Backlog Days for Pending Overflows	Average Backlog Days for Pending Overflows >7 Days
2014	169	18	104	1.6	0.17
2015	108	10	106	1.0	0.09
2016	104	13	113	0.9	0.12
2017	75	5	109	0.7	0.05
2018	N/A	N/A	N/A	N/A	N/A
2019	156	36	105	1.5	0.35

¹ Assumes five working days per week. Source: PRASA SAP (Commercial) Database

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

As with leaks, PRASA expects to improve its sewer overflows response time and metrics tracking using the new mobile technology currently being implemented across its operational regions. Also, PRASA continues with the Fats, Oils and Grease (FOG) program, which should continue to have a positive impact on overflows. PRASA contracted a third-party consultant to perform site visit inspections at different commercial establishments to educate people on the program with the intend that owners limit the discharge of fats, oils and grease into PRASA's wastewater network. In addition, as part of the FOG program, in the Metro Region, PRASA is focusing on recurring overflows areas to identify those commercial/industries that may be impacting the network and coordinate site visits. Other regions are also implementing that strategy. PRASA intends on implementing sanitary sewer evaluations and repair plans to reduce levels of infiltration and inflow (I/I) that must be treated in their WWTPs when funds become available.

4.4 Conclusions

Table 4-16 presents a summary of the overall rating results for the 173 facility inspections completed by Arcadis between February and August of 2019. The data indicates that 79% of the facilities inspected in FY2019 are in the Adequate to Good range. Although, most of the treatment facilities were rated as Adequate (46 of 55, 84%), there is a concern pertaining to the physical condition (the equipment/maintenance criterion) as 35 (64%) of the facilities visited where rated below 2.0. Facility ratings decreased in equipment/maintenance, operations/process control and staff/training criteria compared to the 2017 inspections. This decline in ratings is likely a result of the lack of the capital improvements and R&R investments due to the fiscal situation and budget limitations.

Table 4-16. 2019 vs 2018 Asset Condition Inspections Results Summary

Asset Category	Unacceptable		Poor		Adequate		Good		Total	
	2019	2017 / 2018	2019	2017 / 2018	2019	2017 / 2018	2019	2017 / 2018	2019	2017 / 2018
Water Treatment Plants ¹	0	0	0	0	35	69	0	1	35	70
Wastewater Treatment Plants ¹	0	0	9	1	11	21	0	1	20	23
Wells	0	0	3	6	13	13	0	1	16	20
Water Pump Stations	1	0	12	11	15	18	4	2	32	31
Water Storage Tanks	0	0	6	2	30	27	4	1	40	30
Wastewater Pump Stations	0	0	5	5	21	13	4	2	30	20

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Asset Category	Unacceptable		Poor		Adequate		Good		Total	
	2019	2017 / 2018	2019	2017 / 2018	2019	2017 / 2018	2019	2017 / 2018	2019	2017 / 2018
Total	1	0	35	25	125	161	12	8	173	194
Percent of Total	1%	0%	20%	13%	72%	83%	7%	4%	-	-

¹For the WTP and WWTP comparison, the FY2017 Condition assessment was used, since the FY2018 for those facilities was related to damage by the 2017 Hurricanes. All ancillary facilities were compared to the FY2018 condition assessment.

Process standardization and providing more tools and training to operators for process controls and actions could result in improved plant operations and performance. Moreover, PRASA should consider operational improvements including new process equipment and process automation to reduce operators' dependence on less efficient manual operations. Physical condition deterioration of WTP and WWTP facilities was observed. Process control also continues to be a challenge in some of the facilities, even though plant operators indicated that standard operating procedures and control strategies are followed. While there was no significant change in the compliance score of WTPs, the overall compliance score for WWTPs decreased significantly since the previous inspection. In addition to considering more stringent, permanent compliance limits (in lieu of interim limits currently in place), PRASA should consider the stricter residual chlorine, fecal coliforms parameters for WWTPs with ocean outfalls and stringent phosphorus and nitrogen limits. Bringing facilities into consistent and sustained compliance with discharge parameters, addressing the shortcomings identified during inspections and additional operational improvements including new process equipment, process automation and process control optimization are some of the measures that PRASA could undertake to continue to improve the condition and operation of treatment facilities.

The overall rating of ancillary facilities did not materially change. Most of the deficiencies noted in ancillary facilities can be addressed through PRASA's R&R program and may not require major capital improvements. PRASA continues to work on its leak detection and monitoring practices and continues to address leak occurrences, although occurrences have not decreased in the last five years. Where able, PRASA is remotely monitoring tank levels to avoid overflows and improve the water balance in the distribution system. PRASA continues conducting periodic water audits which are used to implement the necessary controls and develop action items to address NRW.

Although the number of sanitary overflows is also high compared to the U.S., PRASA has maintained its response time and attention/repair effectiveness to minimize the duration of these overflow events and their environmental impact. Prompt identification and actions enabled by remote monitoring should help PRASA mitigate overflows in the System, and adding pre-treatment (screens, comminutors) and preventive maintenance to facilities would help lessen overflows.

Given the size and complexity of the System, it is reasonable to state that the System will continue to require significant capital investments and continuous maintenance and repairs, in addition to the repair required after the 2017 Hurricanes. Also, as the System continues to age and as new compliance regulations are implemented, an increase in the O&M budget may be necessary to address maintenance and repairs and compliance matters related to the wastewater collection system.

5 O&M PRACTICES AND STRATEGIC PLAN

5.1 Introduction

Arcadis assessed the adequacy of PRASA's O&M practices based on compliance with regulatory requirements, interviews with PRASA personnel, and facility observations by field inspectors obtained through the asset condition assessment efforts described in detail in Section 4. There were several WTP and WWTP facilities that reported exceedances in compliance treatment parameters during the evaluation period and/or lacked the appropriate operational tools (i.e., O&M manuals, equipment manuals, process controls, and laboratory equipment). A key finding detrimental to O&M practices were the lack of a working EGU at several facilities which was due because of the extensive use during the 2017 Hurricanes that damaged them, no jar testing performed and deficient house/grounds keeping. Despite some operations and process control issues, the water treatment facilities are generally delivering potable water adequately, but in contrast, the wastewater treatment facilities are struggling to treat wastewater adequately. The latter struggles also include the facilities equipment and maintenance conditions, lack of staff and compliance deficiencies. In addition, it is important to highlight that regulatory compliance results might be misleading, since there are several parameters with interim limits, or some are only being monitored per consent decree and agreements with Regulatory Agencies. Notwithstanding, there is still room for further improvement with respect to prioritization, scheduling, and execution of corrective and routine maintenance activities, and optimization and strengthening of the System (through permanent rehabilitation projects).

Despite of all the challenges faced by PRASA in FY2018 and slow recovery in FY2019, most of the facilities have been brought to operational status and, at least in the short term, continue to serve their intended purpose of providing potable water supply and treating used water. However, the 2017 Hurricanes affected the conditions of most of PRASA's facilities, and it becomes more imperative that projects necessary to address the damages and improve conditions are implemented to guarantee the production of safe drinking water and treatment of wastewater in compliance with applicable regulations. PRASA continues to address operational challenges resulting from intermittent power supply and budget constraints. Conversely, PRASA expects that the CIP is reactivated during FY2020 and anticipates the implementation of projects will address some of the major issues.

A summary of the O&M budgets, O&M highlights provided by PRASA's support departments and Regional personnel, and a detailed summary of PRASA's Strategic Plan, programs and Operational Initiatives are included in this section.

5.2 O&M Costs

Over the past five fiscal years, PRASA's O&M expenses have fluctuated from \$695M in FY2013 to \$867M (includes non-cash adjustments and prior to expected reimbursement from the 2017 Hurricanes) in FY2018. PRASA continues its effort to become more efficient by exercising greater management controls to reduce its O&M costs and by implementing various operational programs and initiatives.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA's FY2019 O&M expenses preliminary projection for the water and wastewater system (combined) prior to expected reimbursement from the 2017 Hurricanes is approximately \$782M, of which \$694M are directly related to the O&M of the System. The other \$87M are related to commercial activities and provision of customer services, including but not limited to staffing and operation of customer service offices island-wide; meter reading; connection and disconnection services; invoice preparation, printing and distribution; and customer service call centers, amongst others. PRASA estimates that during FY2019 approximately 73% of its System's O&M budget (\$507M) was allocated to the water system and the remaining 27% (\$188M) to the wastewater system. Estimated costs per million gallons (MG), per customer account and per 100 miles of pipe for combined utilities operations are summarized in Tables 5-1 and Table 5-2 below. A comparison to benchmark values is also provided.

Table 5-1. PRASA FY2019 O&M Water System Budget Benchmarks

Performance Indicator	FY2019 PRASA	2018 AWWA Benchmark Median ¹
Cost per Account ²	\$411.00	\$470.00
Cost per MG Processed ³	\$2,561.00	\$2,425.00
Cost per 100 miles of pipe ⁴	\$3,404,467.00	\$2,904,472.00
Preliminary O&M System FY2019 Costs	\$507M	-

¹Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

²Based on number of accounts at the end of FY2019 of 1,231,633 (water accounts) and 763,194 (wastewater accounts).

³Based on FY2019 total production and distribution of approximately 542 million gallons per day (MGD) of potable water.

⁴Based on 14,883 miles of water pipeline.

⁵Values are rounded.

Table 5-2. PRASA FY2019 O&M Wastewater System Budget Benchmarks

Performance Indicator	FY2019 PRASA	2018 AWWA Benchmark Median ¹
Cost per Account ²	\$246.00	\$353.00
Cost per MG Treated ³	\$2,460.00	\$2,318.00
Cost per 100 miles of pipe ⁴	\$3,130,358.00	\$2,698,845.00
Preliminary O&M System FY2019 Costs	\$188M	-

¹Source: 2018 AWWA Utility Benchmarking: Performance Management for Water and Wastewater.

²Based on number of accounts at the end of FY2019 of 1,231,633 (water accounts) and 763,194 (wastewater accounts).

³Based on FY2019 total treatment of approximately 209 MGD of wastewater.

⁴Based on 5,994 miles of wastewater pipeline.

⁵Values are rounded.

5.3 Support Departments and Regional O&M Highlights

Arcadis conducted meetings with key PRASA department directors and other personnel to obtain an update on the status of the different departments, operations, and initiatives. A summary of the information provided by PRASA is detailed in the following sub-sections below.

5.3.1 Department Updates

5.3.1.1 Human Resources

PRASA's human resources (HR) Department is currently focusing on two main tasks: 1) achieving PRASA's headcount goal of 4,800 employees by FY2021 (with no vacant positions) as presented in the 2019 PRASA Fiscal Plan and 2) understanding and implementing the requirements included in the series of acts (Act 211-2015, Act 3-2017 and Act 26-2017) that have been passed in recent years.

In FY2017, PRASA completed identifying the roster of employees that classify for the Voluntary Pre-Retirement Program as defined by Act 211-2015. About 327 employees previously qualified for this program, resigned by June 30, 2019. For further detail refer to Section 3.2.3 Staffing Profile of this Report.

Lastly, the HR Department ongoing initiatives include:

- Updating and developing KPIs that adjust to HR Department changes.
- Utilization of System Applications and Products in Data Processing (SAP) to manage Health Plan Insurance information.
- Contractor currently working on employees' classification studies to evaluate salary scales.

5.3.1.2 Customer Services

PRASA's Customer Service Department continues to focus on measuring and implementing metrics to further improve the following: invoicing, collections, billing adjustments, customer service complaints, service interruptions, service quality, meter actual reading, and waiting time in commercial offices as well as in the call center.

The Customer Service Department has been impacted by the fiscal situation as well as by limitations in personnel. Currently, there is a staff shortage that affects the ability to handle complaints in a timely manner, delays on meter replacements, longer waiting time in commercial offices, among other issues associated to the limited personnel in the department.

PRASA operates 12 commercial offices with an average rate of 1,200 people per day visiting the offices for invoice payments and service requests. On June 30, 2019, the Bayamon Commercial Office reopened. Although the reopening might have reduced impact (waiting time) on other offices, since opening it is only receiving approximately 125 customers visits/day which is significantly lower volume than before its closing due to the 2017 Hurricanes impacts.

Actual meter readings versus estimation was included as new KPI on August 2017 to drive a reduction in meter reads estimation, increase invoice accuracy, and reduce adjustments. Meter replacements have been significantly reduced compared to previous years. Current inventory of 5/8-inch meters typically used for residential and commercial customers is estimated at about 4,000 and is being used strictly for new service connections or critical replacements. On February 2019, it was approved to acquired 50,000 water meters progressively to last until the end of FY2020. Inventory will continue to be replenished as necessary until the P3 Project Agreement is executed and the Contractor, who will assume all

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

responsibilities for meter replacements, is fully transitioned. The department's ongoing initiatives are summarized below:

- Revision of Customer Service Protocols for alignment with the most recent version of Regulation 8901 are currently on hold. It is now expected to be completed by the end of FY2020.
- Upgrade of cashiers and other equipment at the commercial offices (subject to schedule of implementation of the P3 Project).
- Upgrade of meter reading portable terminals (TPL, for its Spanish acronym) to improve the investigation of service claims (subject to schedule of implementation of the P3 Project). Currently a significant number of TPLs are not working, thus data recording is done manually. Approximately, over 125 employees need TPL upgrade to perform task adequately.
- Expansion of breadth of services provided by the call centers' private contractors. To achieve this, PRASA is revising the automatic operator format to be able to program investigation appointments by phone. Services were established in 12 locations: Mayaguez, Aguadilla, Arecibo, Caguas, Río Piedras, Metro, Cayey, Guayama, Fajardo, Manatí, Naranjito, and Ponce. There are currently two private companies managing the call centers and these private contracts are renewed every three years; Services were extended until the end of FY2020 and may be transitioned to the P3 Project Contractor.
- In response to requests by several Mayors, Customer Service Mobile Units were implemented to provide mobile customer services in specific communities across the island. There are currently two units which are on standby due to budget cuts; however, PRASA expects to continue service until it is eventually transition to the P3 Project Contractor.
- Encouraging PRASA customers to enroll in electronic billing (paperless) to reduce printing costs, offering \$1 discount on electronic bills.

PRASA's fiscal situation has caused a slow down on the implementation of the above-listed initiatives. With respect to other government initiatives, such as the Central Government's Integrated Services Offices, PRASA has not provided staff for such offices and the decision to participate is currently on hold.

5.3.1.3 Purchasing and Logistics

PRASA's Purchasing and Logistics Department continues to operate mainly from the central administration building, although certain purchasing and logistics personnel are permanently assigned to the regions. As established during FY2018 orders below \$3,000 do not have to be approved by the director of the department, but rather by the different regional managers resulting in a more expedite approval workflow process.

The backlog of orders that was created in the aftermath of the 2017 Hurricanes has been substantially reduced. Although there are some pending orders, specific to EGUs and some others, the backlog is minimal.

Rehabilitation works were performed in both distribution centers, Trujillo Alto (serving Metro, East and part of the South Regions) and Aguadilla (serving the North, West and part of the South Regions) and are fully operational. These are interconnected and communicate with each other mostly via SAP. PRASA

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

continues to report greater inventory controls. Moreover, as part of their effort of maintaining control of PRASA's purchased materials, staff performs daily counts using SAP at all their facilities.

The Puerto Nuevo WWTP storage yard (which houses large diameter materials and equipment) and transshipment station (used to store decommissioned materials and equipment) are operational and completed their rehabilitation and improvement works.

The Materials Requirement Planning (MRP) is fully operational at both Aguadilla and Trujillo Alto Storage Warehouses and Distribution Centers. This system automatically sends POs once the inventory has reached certain amount of inventory.

- MRP is expected to be implemented during FY2020 at the Puerto Nuevo WWTP storage yard and transshipment station.
- Also, PRASA is modifying the system to limit repetitive POs and to buy those materials in bulk, thus streamlining the process and saving time and money.

Procedure 400 for purchasing process is still under revision. The elimination of Lotus Notes has created some delays.

- PRASA is expecting the revision of the Emergency 331 component of the process because of its importance attached to health, water and wastewater service provision and security needs. At the time of the interview, it had an Administrative Order under revision by PRASA's President. When given the go-ahead, it will be implemented.

Regarding purchases, the department adheres to the following:

- Express Purchase (known in PRASA as "*Rapidita*") < \$10,000 – Only needs approval by the different regional managers.
- Open Market process between \$3,000 - \$100,000
- Public Bid > \$100,000 – Requires Purchase Manager, Regional Manager and President approvals.
- The Government of Puerto Rico had approved a waiver during the 2017 Hurricanes emergency, in which PRASA was exonerated from the Central Government PO approval process. PRASA is only required to notify the Central Government but did not need to request approval from them. This waiver no longer applies. However, the Governor has delegated the responsibility to approve POs over \$100,000 to PRASA's President instead of Central Government and/or OMB.

The department's ongoing and future initiatives are summarized below:

- Bar Code initiative has been implemented and is functional in both the Aguadilla and Trujillo Alto Storage Warehouses and Distribution Centers.
- Updates to the SAP system which include changes in the purchase release and improvements in the visibility of the purchase status.
- The "*liberador sustituto*" initiative implemented during FY2018 continues. This initiative consists in assigning two substitute employees to each key person within the PO process algorithm and both substitute and key person can have visibility and power of approval at the same time. This initiative has been useful and provides advantages to expedite the approval process.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- The mobile system Fiori (SAP) initiative is functional.
 - For purchasing it has been operational since FY2018 and for logistics during FY2019.
 - Mobile system allows to access SAP and approve POs; create POs; look at stock in warehouses; perform warehouse management, etc. These mobile units are provided by PRASA and can also receive phone calls. However, they do not make calls.
- The Insurance Department is also improving their amendment (PO Review) approval process, which has a positive effect to the Purchase and Logistics Department.
- The inventory labeling initiative continues implementation by product.
- Being implemented in FY2020 is an initiative to track in SAP the whereabouts of chlorine gas cylinders (150lbs & 1-ton) from original shipment from provider to each WTP, to storage and back for refill.
- Another new initiative is to include in SAP, the validation process for insurance requirements for service and chemicals POs, so that everyone can view the status. Also, include that amendments to POs return to Insurance Department for validation.
- New initiative to create record for suppliers on database to have annual insurances already on record and help expedite the process.

No significant impact regarding the fiscal situation was reported.

5.3.1.4 Systems and Information Technology

PRASA Systems and Information Technology (IT) Department continues developing the information technology management areas and the implementation of the Global Technological Innovation for PRASA's Renovation Program (INTEGRA for its Spanish acronym). INTEGRA is no longer used to refer as the umbrella of multiple initiatives. The initiatives under this umbrella continue ongoing.

During FY2019 the following initiatives and programs were implemented:

- Lotus Notes
 - Elimination is dependent on the acquisition of SAP HANA. This is ongoing. PRASA expects to have this effort completed by the end of FY2020.
 - This project has to be submitted to the FOMB for approval due to the fact it exceeds \$10M.
- SAP improvements
 - Integration of SAP with QPLUS, which is a software that utilizes android platform. This initiative is specific for Preventive Maintenance Department. Also, it seeks to replace the handheld computers (tablets) used in the field to generate orders.
 - Provision of 100 android devices for the Customer Service Department while waiting for the implementation of the P3 project. This will mitigate issues of lack/defective devices. Contract has already been approved and is currently in the purchasing department.
 - Warehouse Bar code initiative was completed and implemented.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- After the firewalls were completed in May 2018, the *Arin* Application was expected to be implemented during FY2019, but it has been delayed. Neptuno consultant is currently working on this initiative. Design of the software is completed; pending to purchase routers. It is expected to be completed by December 2019.
- Banking Transactions Security – An upgraded encryption application, TLS 1.1, was implemented for such purposes. The implementation of TLS 1.2 was completed.
- The SAIA App implementation was completed during FY2018; however, the Contract is still awaiting sign off by the PR Fire Department and PRASA. This app enhances the hydrants inspection process.
- VHF radios and P-25 radios acquisition
 - VHF radios were not purchased, instead P-25 radios were acquired for communication during emergencies. P-25 radios work on a specific band for public safety and are located in strategic areas such as Offices of Emergency Management, PRASA's Main Building, and Municipalities with dams.
 - PRASA purchased (14) P-25 radios for the following facilities: PRASA's Main Building, West Regional Operations Office (Sultana del Oeste), South Regional Operations Office (El Tuque), North Regional Operations Office (Arecibo Operations), East Regional Operations Office (Angora), La Plata Dam, Sergio Cuevas WTP, Carraízo Dam, Operations Carolina, Loíza Dam, Operations Trujillo Alto, Operations Toa Alta, Operations Dorado and Operations Bayamón.
- Inventory initiative, consultant Accenture Puerto Rico LLC (Accenture) is managing this initiative. Currently on user test status. Expected to go live on October 2019.

PRASA's IT future initiatives include the following:

- SAP HANA initiative. Equipment was received in June 2019 and it is expected to go live on October 2019.
- SAP Single Sign-On initiative. It will facilitate and reduce the use of multiple passwords which result on less help desk tickets and increased employee productivity.
- Digitalization to eliminate manual procedures (Open Text)
- PS and SAP Grants – will facilitate Grants management and disbursement (for Infrastructure Department). Licenses are already available, pending configuration of the App.
- New Website initiative. Language was changed to increase security and make it easier to perform updates. This will also allow access to specific parts of the Website without having to modify the entire structure.
- Dynatrace Software (Artificial Intelligence) initiative. This will help to identify errors, diagnose, and fix performance issues and find the root cause analysis of the issues
- Developing KPIs. Currently on phase 1 (user test).

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Payment Gateways – It consists in the consolidation of all payment methods under one (Pay Admin App), which will facilitate the system updating process. During FY2019 this initiative still in working progress in phase 2 and is expected to be completed by April 2020.
- Portal Life Ray – This will segregate applets within the website which will ease the safe addition of content to the website. Initiative was completed and is waiting for communications coordination to go live. It is expected to launch in Jan 2020.
- Developing for P3 project
 - SAP HANA
 - Low power wide area network. Developed in Europe, new technology in Puerto Rico. PRASA is currently evaluating this technology; pilot testing is ongoing.

No significant impact regarding the fiscal situation was reported. Positions that were vacant in FY2018 were mostly filled.

5.3.1.5 Communications

PRASA's Communication Department has been focusing efforts on moving forward in this social media era and improving the utilization of PRASA's website as well as the different social media platforms such as Instagram, Twitter, and Facebook. During FY2019, there was a substantial increase of followers for the social media applications mentioned. Due to the quick availability of information and images received through social media, it allows PRASA to respond faster to the clients and in a more efficient manner. In addition, this have had a positive impact on customers' perspective towards the service offered. PRASA is continuing to use social media as an educational platform by continuously sharing tidbits on treatment processes, how their infrastructure works, among others. Social media platforms are also being used to share information on repair status (including pictures of crews working), service interruption, etc. to keep the public informed of on-going and resolution of operational situations. Press conferences and other events are also shared on social media.

The Communications Department, in coordination with the IT Department, continues updating and improving PRASA's website, which includes consent decree information, press releases, virtual office, information related to seasonal events (e.g. hurricane season, water conservation, etc.), among others. PRASA's website is currently under reconstruction and it is expected to be completed and re-launched on December 2019. All government agencies websites will follow the same template for consistency.

Over the fiscal year the Communication Department faced some challenges where had to handled unexpected events that required highly media presence to educate citizens. Some of the most notable events were the water reduction plans, the manganese level situation, and the water service disconnection fee. PRASA's Communications Department allocated resources got involved with subject matter experts related to each of the events, which resulted on a successful media performance. On the other hand, tours of facilities for groups is no longer allowed. The Open Plants Day is no longer available, due to safety issues after the hurricanes and suspicious requests. PRASA is currently working with the Legal Department to make a confidentiality document with requirements and restrictions to allow public access to the water plants in the future. Also, safety measures are being reevaluated.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Despite PRASA's financial situation and limited personnel throughout the departments, the Communication Department had a successful year in general. Below are some of the most relevant achievements during FY2019:

- Launched the FOG and Petroleum, Oil, Gas and Sand (POGS) Campaign in multiple type of media: social media, radio, PRASA website, radio, flyers, etc. This was a joint effort with the Compliance Department.
- Achieved certification of social media sites: Facebook, twitter, and Instagram. This was an important accomplishment because prior this certification anyone was able to report the site and eventually get shutdown. After the certification, no one can close the sites.
- Substantial increase of followers in the main social media sites: Facebook, twitter, and Instagram.
- A "tweet" was utilized for news media. This accomplishment implies the importance of the social media now a days that this type of notification is even used by other media to develop news.
- Communication Department presence at 90% community service events.
- Multiple events with the Potable Water Truck for: community events, service fairs, 5ks, etc.
- Created the art in house for vehicles lettering and uniforms.
- Puerto Rico Water and Environment Association (PRW&EA)- Fast Track program consisted of workshops in the different regions to provide technical training as well as exposure to new technologies to PRASA personnel.
- Susan G Komen – pink electronic billing and pink illumination in selected water facilities (Carraízo, Op. Camuy, and Op. Yauco).
- In FY2019, a new administrator of the communication department was integrated to the team and a key position for the Educational Program is pending to be filled in FY2020. The Communications Department Future initiatives include the following:
 - Water Conservation Campaign
 - Awareness of Hydrants Management
 - Billing Campaign - Discount of \$1.00 if enroll in electronic billing, otherwise will be charged this amount. PRASA's Governing Board is requesting this campaign and the Communication Department expect to have it completed by Feb 2020.
 - Service Connection Campaign - Inform and educate people about the process of being connected, costs, fees, etc.
 - Customer Service Campaign
 - Breast Cancer Awareness – Provide truck with equipment to perform mammography and consults. Expected to launch by Feb 2020.
 - P3 discussions with PRASA Departments involved to delineate a communication plan once the project is confirmed for implementation.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Announcement of Capital Improvement Projects and Resiliency Projects once FEMA funds become available.

5.3.1.6 Compliance

PRASA's Compliance Department continues to monitor regulatory compliance in PRASA facilities and continues to maintain open channels of communication with Regulatory Agencies. After the 2017 Hurricanes, PRASA's Central Laboratory was completely devastated, and therefore inoperable. At this point 100% of the samples collected were contracted out to external laboratories due to the inability to process them. Over 2 years after these events, PRASA Central Laboratory operations have been slowly bringing back up, although the original laboratory facility could not be restored. This facility is currently on the demolition phase for eventually the construction of a new laboratory in the premises.

For PRASA being able to start processing samples, multiples mobile office trailer units were acquired, and a temporary laboratory complex was installed, obviously with a much smaller capacity of sampling analysis as well as office spaces limitations. Currently, the temporary PRASA Central Laboratory is partially certified and only can handle between 60-70% of the sample analysis, the rest of the samples are contracted out to private laboratories. Regarding the smaller scale laboratories located at strategic points on the island, only PRASA Mayaguez Laboratory is operating as normal. On the other hand, PRASA Camuy Laboratory is no longer in operations. PRASA is evaluating other alternatives such as the location of another laboratory in Aguadilla area.

After the 2017 Hurricanes PRASA requested Force Majeure protection and a hold for a period of time for ongoing and upcoming work and deadlines and stipulated penalties with both Regulatory Agencies. Ongoing negotiations with USEPA and PRDOH are being conducted on a case by case basis. Further detail is included in Section 6.

PRASA is currently in the process of implementing several operational strategies and initiatives in the system to reduce DBPs, which PRASA acknowledges to be the biggest compliance challenge at the time after the implementation of the Stage 2 Disinfectant By-Products Rule (D/DBPR). Complying with Stage 2 D/DBPR is more challenging since averaging results across monitoring locations within a system is no longer applicable. Hence, reporting for the DBPs running annual average (RAA) per location has resulted in more violation instances. PRASA has continued to implement several operational strategies in the System to reduce these incidences. In the past PRASA performed water quality modeling to identify the root cause of these non-compliance events to establish corrective actions and implement control measures. Since FY2017, PRASA has developed an action plan to address exceedances to DBPs and continued to implement in FY2019, which consists of, but is not limited to a combination of the following corrective measures:

- Elimination/reduction of pre-chlorination
- Increasing frequency of process tanks/systems wash
- More frequent drainage of systems
- Change in coagulants
- Hydraulic modeling to reduce retention time in tanks

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Lowering pH
- Training
- Evaluation of new chemicals for pre-disinfection and coagulation (e.g. polymers, chlorine dioxide)

PRASA recognizes that no single corrective action will solve the DBP issues; but rather, corrective measures will need to be combined and the different departments involved must collaborate to achieve compliance. Therefore, PRASA created a task force team by regions that include personnel from different areas such as: managers, area supervisors, compliance, and distribution system. Monthly meetings are performed to discuss operational adjustment, challenges, findings, among others in an effort to learn necessary steps to improve in this area.

As part of their efforts to comply with the requirements stipulated by the Regulatory Agencies regarding the optimization of preventive maintenance protocols and corrosion prevention, new opportunities to improve the preventive and corrective maintenance program are required to ensure the proper O&M of all critical facilities. PRASA began implementation of the Corrosion Control Plan with site visits conducted on September 3rd, 2019. As indicated by the Compliance Department, the implementation of the Sewer System Operation and Maintenance Plan (SSOMP) program for Puerto Nuevo WWTP, which includes mapping pipelines, cleaning and flushing program, assessment of System's condition, among others, is ongoing and the sewer cleaning of the High Priority Areas (lines <30") is expected to be completed by the end of FY2020. The Compliance Department also reported that they continue with the implementation of the FOG Program, performing monthly visits, delivering educational material, locating, and focusing areas prone to overflows, among others.

Also, in compliance with the consent decree requirements, PRASA continues the implementation of the Process Control System (PCS) at treatment facilities in accordance with potable water and wastewater industry standards. The PCS aims to keep current and revised to address, as appropriate, new regulations, treatment process changes, new equipment and/or treatment units installed/eliminated, and addition/elimination of chemicals. PRASA is currently conducting meetings with the consultant and it is expected to have completed Metro and West (STS and WWT) regions by the end of FY20. The rest of the regions are expected to be completed by the end of FY2021. Also, the department continues focusing on the implementation of remedial measures and commitments to improve the separate and combined sanitary sewer system operating efficiency to minimize sewer overflow impacts.

Furthermore, the department continues as the responsible party for PRASA's Health and Safety Program, which includes talks, meetings, and task risk assessments to improve O&M practices and employee safety. A delay on the development and implementation of the Health and Safety Plan occurred due to a significant personnel reduction (approx. 30%) as of December 2018.

Lastly, the Compliance Department is working on the logistics to submit a revised schedule for expected compliance with the 2015 USEPA Consent Decree and 2006 PRDOH Settlement Agreement. Additional details on Consent Decree programs are provided in Section 6.

5.3.1.7 Legal

The Legal Department deals with 1) claims, which include courts and extra-judicial; and 2) litigations, which include damages, contract non-compliance (class action lawsuits, service & contractors Contracts),

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

bid injunctions, bankruptcy and administrative (bills, water theft, injunctions). The department consists of the director, three auxiliary directors (Litigation, Opinions/Counsel, Contracts) and a pool of 9 lawyers; down from 11 in FY2018, as two lawyers resigned under the pre-retirement programs. Also, for damages and pre-judgements litigation related to insurance claims they use contracted external counsel. There are about ten firms under contract, during FY2019, to handle litigations. However, the fiscal situation has forced the legal department to use in-house lawyers to minimize the contracting costs. Invoice objection and water theft litigations are managed through administrative proceedings, with an average rate of about 10 administrative hearings per day. As for PRASA's financial debt negotiations and Fiscal Plan counsel, these are managed exclusively by external law firms.

The department reports that there has been a decrease in litigation cases, mainly due to the CIP continuing to be suspended as well as a decrease in claims in general. During FY2019, the legal department concentrated its efforts on existing litigation, mainly related to damages and prejudice claims, also some Awarded Bid appeals. Customer bankruptcies are usually handled by the Customer Service Department, but Legal aids as needed. There were no criminal active cases. Also, during FY2019 the department provided guidance and legal advice to the Compliance Department regarding the 2015 USEPA Consent Decree and review of its amendments. The Legal Department expects by December 2019 to finalize agreements regarding the 2015 USEPA Consent Decree. The 2006 PRDOH Drinking Water Settlement Agreement continues negotiations through the individual systems vehicles provided under the Agreement.

The legal department continues to provide support to PRASA's land acquisition for sales and expropriation cases, if any. Also, provides support to PRASA for the P3 project process.

The department has vacancies in the following areas: two lawyers' vacancies; two administrative staff for aid in administrative hearings; and one for general administrative duties. Furthermore, the department has had reductions regarding contracts, travel, etc.

Legal Department has a FY2020 initiative that consists in providing a weekly report on extraordinary issues to PRASA's President.

The Puerto Rico Legislative House of Representatives passed a series of bills and amendments as a result of the slow recovery of the island in terms of essential services regulated by the General Administration Services (ASG by its Spanish acronym). These laws have an impact on operational aspects such as: costs, delays, and service procurement. Such laws are included below:

- Law 42 2018 - "*Ley de Preferencia para Contratistas y Proveedores Locales de Construcción*"
 - Given the need to address critical infrastructure identified on the island, this legislation enacted gives preference to local businesses and construction suppliers in order to incentivize the economy and the development of individuals and businesses in Puerto Rico. This law was established with the purpose of reserving at least 20% of the purchase and contracting of construction services for local businesses or suppliers that render said services to government agencies and entities. In the event that PRASA does not benefit from the services of the ASG, it shall conform its procedures and/or regulations to fully comply with the provisions of the Law.
- Orden Ejecutiva ("Boletín Administrativo Núm. OE-2018-033")

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Any construction project financed totally or partially with funds from the Government of Puerto Rico, its agencies, instrumentalities, and public corporations will have as a condition that the contractor pays the employees who work there a minimum salary of fifteen dollars (\$15.00) per hour. This requirement will also apply to subcontractors. Any other aspect of federal legislation and regulations regarding how the minimum wage is paid, hours of work, which employees and occupations are exempt from the minimum wage, and what constitutes hours or hours of work shall apply. A certification confirming that the cement to be used for the project was produced in Puerto Rico, shall be issue as a contract requirement for concession of a construction project.
- The provisions of this Executive Order shall form part of the communications issued by agencies requesting proposals or auction bids for procurement for any matter subject to the provisions of this Executive Order. Contracts between the Government and its contractors must include that the subcontractors shall comply with the requirements of this Executive Order.
- Law 73 2019 - *“Ley de la Administración de Servicios Generales para la Centralización de las Compras del Gobierno de Puerto Rico de 2019”*
 - Establishes that the ASG is the governmental entity authorized to establish and carry out all procedures for the acquisition of goods, works and services of the Government of Puerto Rico, in order to establish a uniform procedure centralized for the acquisition, evaluation, and review of purchases made by government instrumentalities.
 - The provisions of Law 73 will govern the processes of purchases and auctions of goods, works and non-professional services of PRASA. According to the definitions of this law, PRASA is considered an Exempt Entity until the validity of the current Fiscal Plan (PROMESA) expires, and then it will be considered a Government Entity. Once the Fiscal Plan expires, it will be considered a Governmental Entity, therefore shall comply with the law stipulations.
 - Upon completion of the validity of the Fiscal Plan, the provisions contained in Chapter III of the Law regarding auxiliary services will be mandatory for PRASA. This means that, at the end of the validity of the Fiscal Plan, the ASG will have under its jurisdiction the administration and control of all means of transport (land, air and sea) that are owned or used by the Executive Branch, including the acquisition of all either, (fuels, equipment or replacement parts necessary for the operation, repair or maintenance of the means of transport) and to negotiate contracts for repair and maintenance services for the means of transportation.
 - Law 73 establishes that any Exempt Entity such as PRASA must prepare an Annual Procurement Plan, which must include a list of all the non-professional goods, works and services deemed necessary and whose purchase is probably acquired during the fiscal year for which the plan is made The Annual Procurement Plan must be submitted to the ASG on or before March 31 of each year. In addition, PRASA will be required to review the estimates in the Annual Procurement Plan quarterly.
 - The law also establishes the bidding methods that will be performed in the procedures for purchases and auctions of goods, works, non-professional services, and professional

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

services. It also includes general provisions on bidding processes, purchase and auction request processes, billing process, and compliance with general standards and preferred public policies, as applicable.

PRASA's legal team continues communication and discussion with ASG and the Central Government regarding the impacts of these laws on PRASA's procedures and the potential schedule and cost increase that might result. As for new initiatives, the legal department is actively working closely with other PRASA's departments to provide legal guidance.

5.3.1.8 Infrastructure

PRASA's Infrastructure Department continues to oversee and manage PRASA's CIP. However, as previously mentioned, most of PRASA's CIP continues to be suspended until funding is identified. Most of the Department's efforts since the 2017 Hurricanes has been guided to the recovery efforts, the Insurance settlements for damages incurred and negotiations with FEMA for funding of damages not covered by Insurance. The Infrastructure Department has managed the asset damage assessments and estimates for claims negotiations with PRASA's insurance company and FEMA. The department has continued its support during the ongoing claim negotiations and is working closely with FEMA. Currently, the Interim Executive Director for Infrastructure, in coordination with PRASA's Executive Management Team and FEMA, has undertaken the process to reactive the CIP. The Infrastructure Department is also responsible for the management of the Comprehensive Energy Management Program, the Plant Automation Program and Planning Department.

PRASA received the funds associated for Hurricane María claims and continues the process of negotiations for the claims for Hurricane Irma and the Rains events after Hurricane María. Please refer to the Insurance section in this Report for details.

During FY2019, five CIP projects were submitted to FEMA to obligate funds via a Project Worksheet (PW) with the expectation of funds being available for December 2019. These projects were: PRASA's Central Lab, Enrique Ortega WTP Rehabilitation, Dorado WWTP rehabilitation, Buena Vista Water Storage Tank restoration and the Guajataca Reservoir Intake works.

In addition, the Department is running a Bid for the demolition of the Central Lab in Caguas. It will also include a Design/Bid of the new Lab with the CIP.

Of notice is that during FY2019 PRASA published a Bid requesting proponents for a Statement of Qualifications (SOQ) to serve as Program Management Consultant (PMC) of PRASA's CIP. PRASA expects to continue the process by issuing a request for proposal (RFP) during FY2020. Also, PRASA indicated that they have engaged designers for revising design of several projects that were cancelled during the previous CIP so that they are in an advance stage when the CIP is reactivated.

The Department also played a key role in the negotiations with the Regulatory Agencies for the restructuring of outstanding debt with USDA and USEPA, which opens access to USEPA state revolving funds (SRF) from USDA Rural Development (RD) funds that can be used in the CIP implementation.

Regarding the Energy Management Program, the Energy Performance Contracts (EPCs) with Honeywell were cancelled but the Solar Power Purchase Agreement (PPA) contract continues with Windmar Renewable Energy.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The following material changes occurred during FY2020:

- Infrastructure published a bid announcement to receive support from a Consultant with the allocation of funding with FEMA's Program of Public Assistance (20-RFP-DAC). PRASA expects selection during FY2020. In addition, PRASA is analyzing alternatives to develop a funding strategy between funding sources that maximizes the funding for each project.
- Infrastructure published the RFP for PMCs to manage the CIP. PRASA expects that the CIP implementation starts during FY2020.

5.3.1.9 Strategic and Corporate Planning

PRASA's Strategic and Corporate Planning oversees and manages the Project Management Office (PMO), the IT Department, Training and Continuing Education Program and the WRO. Most of the efforts are guided towards the WRO and the NRW reduction efforts, the development of the PMO, and in finalizing the Strategic Plan (2020-2025).

The PMO is currently in the development phase and will be designed to establish Standards and Procedures through all the operational Regions, that can be implemented with any type project. Furthermore, the PMO will work closely with the Consortiums to be able to share best practices in the CIP as well as, Internal Initiation projects. To provide a "Best Practices" approach to help improve operations and maintenance performances, become less reactive and more preventive, incorporate and use lessons learned, and maximize available data (data mining), thus enabling the Operational Regions to make informed and smart decisions.

The WRO focusses in water recovery and operational optimization. The NRW component has been discussed previously in Section 4.3.3 and in more detailed in Section 5.5.2 of the Report. However, it is important to highlight the leak detection plan, for which the WRO has requested funding to implement the program and eventually transition to each Operational Region. Regarding Operational Optimization, the WRO goals are to provide continuous support to PRASA Operations, specifically on reducing costs, optimizing income, becoming more cost efficient, increasing visibility of the Systems, support on determining where to invest and get the most benefits, and standardizing programs through all Regions, among others.

For more details on the Strategic Plan refer to Section 5.4 of the Report.

5.3.2 Regional Updates: Challenges and Initiatives

Meetings with all five regional directors were conducted during the month of October 2019. The purpose of these meetings was to assess the progress of the region based on the established KPIs, the impact of Puerto Rico's fiscal situation, the issues and challenges after the 2017 Hurricanes, the programs and initiatives developed in each operational region during FY2019, achievements, overall operational activities, and future initiatives.

The Regions presented issues and challenges as a result of limited operational budgets, slow recovery from damages caused by the 2017 Hurricanes, and delay on FEMA funds disbursements, among others. Some of the most common issues and/or challenges among all regions are listed below:

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Lack of personnel for O&M functions, mainly due to hiring freezes and low workforce supply caused, in part, by the population emigration to the U.S., and the Voluntary Pre-Retirement Program. There are mechanisms available to fill positions of difficult recruitment and currently efforts are focused to cover these vacancies. One of the greatest challenges that O&M regional experience is the ability to find plant operators and electromechanics, among others.
- Although a considerable number of systems have restored the visualization after the 2017 Hurricanes, there still telemetry systems pending to be installed to achieve full visualization of the water systems. Wastewater systems in general have limited visualization.
- Although new fleet vehicles were purchased in FY2019, PRASA still faces limited availability of fleet vehicles, mainly due to deterioration of vehicles, long repair times and limited budget for purchasing new vehicles.
- Delay in obtaining approvals of POs.
- Aging infrastructure and lack of maintenance.
- Length of time to address and close out work service orders.
- Challenges to maintain and/or reach compliance with the DBPs regulations, mainly due to limited budget, which prevent investment for repairs, additional sampling, exploration of new technologies, among others.

During FY2019 all the regions reported a shortfall in employees which have caused an increase in overtime costs and a direct impact on the operations of the systems that have resulted in delays on repairs as well as making more challenging the ability to maintain and/or reach compliance with regulations. In addition, DBPs compliance has been another common challenge identified throughout the regions. PRASA's efforts to maintain and/or reach compliance with these parameters (THMs, HAA5, TOC) are currently focused in operational adjustments although in some cases it may require a capital project to address the issues. Because capital projects are subject to funds availability they are currently on hold or moving slowly. Also, the Regions are continuing their efforts to control costs and optimization of the systems. However, other programs that were implemented during previous fiscal years are currently on hold or proceeding at a slow pace due to the current lack of personnel and funding. These programs are the following: reduction of sanitary sewer overflows (SSOs) and combined sewer overflows (CSWOs), NRW reduction, Energy Consumption Reduction, among others.

Delay of FEMA reimbursements have left on hold recovery efforts. Currently, the rehabilitation of systems is being affected by the insufficient funds to perform such activities which only exacerbates the physical deterioration of the facilities and may ultimately impact their operation. Also, the vehicles fleet availability has been severely impacted in all regions due to deterioration, age and lack of funds to replace such fleet, thus putting at risk PRASA Operations Department performance. During FY2019 PRASA was able to acquire and distribute a limited number of vehicles for each region, however it was reported by all regions that there is still a significant need regarding fleets.

There are other issues specific to each Region, that are important to be highlighted. For example, in the West Region repairs are taking too long to be resolved, partly because of purchasing, logistics and payment challenges. Once that repairs are completed, replacing asphalt on the work area has become an issue due to the current elevated cost. In addition, STS present a significant equipment and management

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

issues in the region. The North Region continues experiencing issues associated to pipes bursting because of high pressures in the water system. The region is working to reduce water system pressures by switching several wells to standby mode and installing pressure regulators at strategic locations. The North Region still dealing with the saline intrusion in the Islote trunk sewer and the rehabilitation of the Manatí trunk sewer which collapsed in several segments. Lastly, East Region visualization capabilities diminished as low as 10% after the 2017 Hurricanes. Also, this region experiences delays on installation of pressure regulators, line repairs, among other necessary work for optimization of the systems due to limitations in personnel and funding. **Table 5-3** summarizes some of the initiatives and projects being implemented or planned during FY2019 and initiatives to be implemented during FY2020, subject to funding availability.

Table 5-3. New and Future Initiatives and Projects by Operational Region

Region	Initiatives/Projects	Description
West	Optimization Initiatives	<ul style="list-style-type: none"> • Elimination of water pump stations at strategic locations. • Elimination of San Sebastián Nueva and Vieja WTPs. • Increase visualization of wastewater components. • Elimination of Wastewater facilities • Infiltration study
	Water Compliance Actions to meet DBPs	<ul style="list-style-type: none"> • Rehabilitation of Aguadilla (Montaña) WTP and dredging of the water source. • University of Puerto Rico at Mayaguez (RUM) collaboration on additional sampling.
	Asphalt Cost Reduction	Coordination with Municipalities to establish Memorandums of Agreement (MOAs) or Contracts so that Municipalities address asphaltting needs after a repair. Municipalities already included in this program are: San Sebastián, Hormigueros, Aguada and Añasco. This is an ongoing program.
	Projects	<ul style="list-style-type: none"> • Mayaguez Submarine Outfall - repair of pipeline rupture, to address violations to the discharge permit. • Installation of fixed EGUs in pump stations related to Guajataca. • Rehabilitation and expansion of Culebrinas WTP. • Improvements at Aguada and Mayagüez WWTPs.
Metro	Water Compliance Actions to meet DBPs	<p>Ongoing initiative of reduction of chlorine application (1.8-2 mg/l) at discharge, elimination/reduction of pre-Cl, System's drain program, tank clean-up program (yearly), use divers for tanks that cannot be taken out of service and WSTs oscillation in term of water level with the goal of reducing retention time, in order to avoid water aging. Also, as part of this measure a flushing program was established as well as sampling points (100% accomplished).</p> <p>Aeration project at Carraízo Dam is expected to be completed during FY2020. This could bring benefits for reducing polymers, reducing permanganate and reduction of chlorine application.</p>

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Region	Initiatives/Projects	Description
	Optimization Initiatives	<ul style="list-style-type: none"> • Delimitation of service areas • Continue with pressure reduction measures in the distribution system. • Redundancy and Flexibility of the potable water distribution system has continued to be achieved. • Water meters installation at the regions WWTPs is expected to continue in FY2020.
	SOMP – Sewer Operation Maintenance Program	The program provides for sewer line cleaning, identification of defects, identification of any illegal connections, among others which result in the repair of lines to control and prevent future overflows.
	Energy Consumption Reduction Program	Targeted 1% energy reduction was achieved. This initiative includes performing pumps adjustments, reducing time in operation, using smart system, which reduces consumption. Another ongoing initiative regarding reduction in energy consumption is the elimination of the Pumps Stations in the systems of Caimito and Quebrada Arenas, due to pressure problems at the Hollywood Hills PS and WST and PS Holy Hills. This project is targeted to be completed by FY2020.
	Projects	<ul style="list-style-type: none"> • Puerto Nuevo's 48-inch potable water transmission pipeline- new alignment needed, as current alignment hinders flexibility between Sergio Cuevas and Superaqueduct WTPs Service areas. This project is on the list of Resiliency Projects for FEMA funds (\$13 - \$14 M) • Elimination of Hollywood Hills and Holy Hills pump stations. • Transition from CL gas to liquid: Completed at Guaynabo-Los Filtros and Canóvanas Nueva WTPs & pending at Carolina WWTP. • Carraízo Dam Aeration Project • Pump installation at Cantera
East	Water Compliance Actions to meet DBPs	Implementation of measures continues such as tanks oscillation, chorine injection point, evaluation of new chemicals, and implementation of the flushing program.
	Restructuring of Fleet Department and Acquisition of New Vehicle Fleet	An on-site and off-site repair and maintenance contract still ongoing with Mayaguez Fleet company located on the Humacao operational area. Also, the region acquired new vehicles for their fleet, however these do not satisfy all the needs of the fleet in the Region.
	Energy Consumption Reduction Program	<ul style="list-style-type: none"> • This program continues with a target of 0.5%. Initiatives for FY20: • Installation of Solar Panels – At Culebra WTP, El Yunque WTP and Humacao WTP) • Elimination of pump stations – Arcadia (Vieques) • Installation of timers for pump stations
	Projects	<ul style="list-style-type: none"> • Aibonito WWTP (Sand filters and Biofilters) • Caguas WWTP – Blowers BNR, Primary clarifiers, odor control domes, dewatering (screw conveyor), BFP or centrifuge, corrosion protection on walkways of 2ry Clarifiers. • Aguas Buenas WWTP – Module B done; Rehabilitate Module

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Region	Initiatives/Projects	Description
North		<ul style="list-style-type: none"> Comerío WWTP – Clarifiers 1 & 2 improvements Culebras WTP (Cayey) – Replace package unit Farallón WTP – STS Project El Yunque WTP – Hurricane damage repairs Central Lab – Demolition ongoing Buena Vista WPS – VFDs
	Water Compliance Actions to meet DBPs	This initiative includes the following measures: WSTs level oscillation, frequent WST wash program, increase in the drainage frequency at, Jayuya, Manatí, and Corozal distribution tanks, level control at WSTs, water quality testing, elimination of several WSTs, restructuring of service areas based on pressure and capacity, and elimination/reduction of pre-chlorine injection. Continue sectorization plan for optimization and compliance improvements.
	Pipe Rupture and Water Loss Mitigation	Aggressive plan to replace pipelines. There are several measures to reduce pressure in the system. One is to reduce the use of wells by switching several wells to standby mode and installation of pressure regulators, especially in the Manatí Operational Area. This is an ongoing plan and has decreased potable water loss, but it's limited to the available budget.
	Sanitary Overflow Prevention Initiative	Identification of illegal interconnections in the Arecibo Operational Area, infiltration of saline water into Islote Trunk Sewer, CSWOs, and collapsed pipe segments in Manatí Trunk Sewer, piping replacement plan, sectorization, and detailed investigation for the occurrence of overflows.
	Optimization/Energy Consumption Reduction Initiative	Same concept as other regions. Key initiatives include: <ul style="list-style-type: none"> Elimination of Corozal WTP by installing a pump station to pump from the 1MGD tank to Costanera and then to Substation Padilla. This project will reduce energy, costs, and improve water quality. Installation of telemetry systems to integrate more facilities into visualization system.
Projects	<ul style="list-style-type: none"> Relocation of the Dorado WWTP Rehabilitation of the Quebrada weir is in process (75% completion) Elimination of Matadero and Ojo de Agua Wells is in process Elimination of Indiera Alta WTP Elimination or rehabilitation of Corozal WTP Renovation of Toa Alta WTP Elimination of UV system at Morovis Sur Elimination of membrane system at Sanamuertos 	
South	Water Compliance Actions to meet DBPs	<ul style="list-style-type: none"> This initiative includes the elimination of the pre-chlorine and post chlorine injection points; enhanced coagulation with the implementation of Gulbrandsen GPAC 200, GC850, MAC 4000, MAC 2000; increased frequency of sedimentation tanks cleaning from a semi-annual basis to three times per year,; sampling of drainage points at water distribution system with higher

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Region	Initiatives/Projects	Description
		concentrations of non-compliance; and weekly staff training and refreshers regarding compliance equipment, operations, continuous monitoring among others.
	Acquisition of Vehicle Fleet	New vehicles are in process to be acquired for the region's fleet. However, budget is limited, and it only represents approximately 20% of the fleet.
	Pipeline Ruptures and SSOs Control	This initiative includes the validation of leak/overflow claims; relocation of the Guayama WTP raw water pipeline and raw water transfer of 600gpm to Carite, which will decrease the water pressure in the raw water pipeline and at the same time decreases energy consumption due to raw water pumping, since the Carite system is a gravity system.
	Energy Consumption Reduction Initiatives	Same concept as other regions. This initiative includes: <ul style="list-style-type: none"> • Guayama penstock • Facilities lighting replacement to LED • Elimination of pump stations such as: Monte Pelao I, Guánica, among others.
	Optimization of Operations	<ul style="list-style-type: none"> • Regarding the Salinas Aquifer Restoration, PRASA continues to decrease water extraction from the aquifer even though PRASA is not the entity that causes major impact per the results of Level and total dissolved solids (TDS) analyses. This initiative is pending on other agencies to take the necessary steps toward the solutions of this issue. • H-H modelling – El Tuque (Brisas) – eliminate 3 WPS or reduce their capacity. These are: Obras Públicas Municipal, Brisas I and Brisas II. • Jaguas-Pastos System: Consejo 1 & 2 wells were affected by drought, the Region added redundancy to the system to supply water from Jaguas-Pastos WTP to the area supplied by the wells. • Moving from gas chlorine to liquid in several systems such as Río Pietro WTP, Quebradas well, among others.
	Non-Revenue Water Recovery	Measurement of system's drain flow and installation of water meters at PRASA's facilities. Drainage flow metering has been implemented in Yauco only for fire hydrants. Increased visualization of PRASA's South Region System water tanks. In addition, will perform operational adjustments and installation of pressure regulator valves on strategic locations throughout the distribution system.
	Projects	<ul style="list-style-type: none"> • Rehabilitation of the sanitary trunk sewer from Salinas to Guayama, which collapsed after the September 2017 hurricanes. • Elimination of Ponce Vieja WTP • Ponce Nueva WTP Improvements

Region	Initiatives/Projects	Description
		<ul style="list-style-type: none"> • Toa Vaca WTP – evaluating eliminating NPDES permit, raw water pumps • Patillas floating intake rehabilitation project • Guayama WWTP Improvement: Rotary Screens, Secondary Clarifiers, Biofilters and Digesters • Yauco WWTP – evaluating replacement WWPS to chopper pumps • Ponce WWTP: installation of new mechanical screen and evaluation to eliminate digestors • Vertedero well improvement (currently is out of service)

5.4 Strategic Plan

PRASA's Executive Management Team continues to work on its revised Strategic Plan which will highlight its Goals and Vision and will also be aligned with the objectives included in the FY2019 PRASA Fiscal Plan, Build Back Better Plan, and in the Government of Puerto Rico's "Plan para Puerto Rico".

5.4.1 Key Performance Indicators

Table 5-4 presents a summary of PRASA's KPI goals and results for FY2019 as of June 2019. In FY2019, PRASA's KPI results improved substantially from FY2018 but remain low as a result of the delays in the recovery efforts and the fiscal situation hindering the implementation of certain initiatives.

PRASA had a challenging FY2019. Considering that most of PRASA facilities were affected by the 2017 Hurricanes and are still in the recovery process. Operations has also been impacted by attending critical issues for providing service, several KPI's were a challenge to implement or improve. This effect is reflected on the results for the Overtime KPI on Fiscal Health, and several KPIs on Operational Efficiency and Organizational Transformation.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 5-4. FY2019 PRASA Operations Key Performance Indicators

Strategic Plan Initiative	Key Performance Indicator	FY2019 Goals	Results as of June 2019
Fiscal Health	Employees per Connection	3.34 or less Employees per 1,000 connections	2.97
	Overtime	Reduce to 7% or Below	8% ²
	Budget Compliance (Excludes Electricity Costs)	Below 100%	97%
	Collection vs. Billings	Increase to 96% or Above	102%
Operational Efficiency	Compliance - Water System	Increase to 99% or Above	99.7%
	Compliance - Wastewater System	Increase to 97% or Above	95.1% ²
	Billing Adjustments	Reduce to 2% or Below	1.5%
	Complaints in Customer Service (per 1000 Actives Accounts)	Reduce to 16.7 or Below	11.81
	Monthly Average of Customers with Service Interruptions (as a Percentage of Total Customers)	Reduce to 5% or Below	17.8% ²
	Customer Service Attention Time (Commercial Office)	Maintain below 30 min.	26:12 min
	Vehicle Availability	Increase to 92% or Above	65% ²
	Average Processing Time of Purchase Orders ¹	Less than 40 days	-
	Preventive vs. Corrective Maintenance Ratio	Increase to 80%	76% ²
	Average Time for Equipment Repairs	Less than 25 days	51.70 days ²
	Reported Leaks	Reduce to 4,598 monthly	4,562
	Reported Overflows	Reduce to 2,298 monthly	2,198
	Repair Time for Leaks	Reduce to 53.0 hrs	120.87 hrs ²
	Repair Time for Overflows	Reduce to 32.0 hrs	53.81 hrs ²
Average Water Production (MGD) ³	Reduce to 505 MGD	542 MGD	

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Strategic Plan Initiative	Key Performance Indicator	FY2019 Goals	Results as of June 2019
	Percent of NRW	Reduce to 53.2%	64.4% (Estimated)
Infrastructure and Sustainability	Energy Consumption (Annual)	Reduce to 660.34 M kWh	630.91 M kWh
	Project Progress (CIP) ³	Greater or equal to 0.9	-
	Cost Performance (CIP) ³	Greater or equal to 0.9	-
Organizational Transformation	Training (Cumulative Hours per Employee)	More than 26 hrs per year	14.1 hrs ²
	Unplanned Work Effectiveness (Absenteeism)	Reduce to 2.0 days	2.13 days ²
	Planned Work Effectiveness	Reduce to 10%	4%

¹ This KPI was not measured or available due to the impact of the 2017 Hurricanes and delays of reimplementation.

² These KPIs results were still adversely impacted by the 2017 Hurricanes.

³ Due to the suspension of the CIP, the Project and Cost Performance KPIs for FY2019 are not being measured.

5.5 On-Going Programs and Initiatives

The following are programs and initiatives being pursued by PRASA. A brief description and status of each of these initiatives is provided below.

5.5.1 Integrated Maintenance Program (IMP)

The previous 2006 and 2010 Consent Decrees with USEPA and the 2006 PRDOH Agreement required that PRASA implement and continue to develop a comprehensive Integrated Preventive Maintenance Program, which evolved to the IMP during FY2013 to include both corrective and planned (i.e. preventive, predictive and proactive) maintenance activities, to ensure the proper O&M of its treatment plants and other critical facilities, including WWPSs. Through this program, PRASA established a plan to enable programmed and continuous maintenance to treatment plants, pump stations, vehicles, and equipment to provide for more reliable service, improve client satisfaction, and achieve long-term operational cost savings through preservation of assets.

The 2015 USEPA Consent Decree included the requirement for PRASA to continue with the approved IMP, which includes the following key components:

- Recordkeeping
- Maintenance planning and scheduling
- Storeroom and inventory system
- Maintenance personnel training and organization
- Cost and budget for maintenance operations

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

In accordance with the requirements established on the 2015 USEPA Consent Decree, PRASA has indicated that 100 percent of the required facilities (WWTPs, WTPs STS & Pump Stations) have been incorporated into the IMP. SAP PM tool is being utilized to manage job itineraries that eventually are discussed during the Master Planning Schedule (MPS) meetings. PRASA is currently working on the process optimization of the IMP in order to be more efficient and it is expected to be completed by December 2019.

In addition to the minimum requirements established in previous Consent Decrees, the 2015 Consent Decree required PRASA to develop and submit to USEPA no later than March 1, 2017 a Corrosion Control Program as part of the implementation of the IMP. Nevertheless, the emergency caused by the passage of Hurricanes Irma and María over the island compelled PRASA to put the program temporarily on hold. The Corrosion Control Program was resumed on September 2019. Currently, PRASA is in the process of evaluation of the most critical facilities to develop an action plan on a case by case basis. The facilities evaluation phase was divided into 4 phases from which phase 1 has been already completed and phase 2 is at 30% of completion. Some of the facilities that have been evaluated include: PAS Carolina, PAS Bayamón, PAS Puerto Nuevo, among others. PRASA is utilizing external resources to continue moving forward with this program and it is expected to complete its implementation by December 2020. As reported by the IMP Department, another roadblock PRASA is still facing is the difficulty to enforce the program due to limitations on technical staff. In order to continue with the program implementation more efficiently, PRASA needs to recruit additional staff to support the program.

During FY2019, another relevant change for the IMP Department was the appointment of a new Executive Director. Also, PRASA continues contracting external resources to provide repairs and maintenance services to critical equipment to ensure continuity of operations. It is important to mention that the IMP Department has an inventory of critical equipment available to avoid or limit service interruptions. Also, they were able to acquire EGUs for systems redundancy, although there still a need for additional units to cover all the facilities. PRASA expects to put out another bid for additional EGUs in November 2019.

PRASA is currently working with the development and implementation of new metrics for the IMP Department in four main areas such as: service, efficiency, costs, and compliance. During the month of October 2019, IMP Department reported a 83% of compliance with the preventive maintenance plan. Critical factors that continue to affect PRASA's ability to efficiently implement the IMP are the fiscal situation and the limitations to hire new staff. Additionally, the lack of technical personnel adversely affects the KPI's follow up, preventive maintenance and the Corrosion Control Program.

On-going IMP initiatives and projects executed during FY2019 include the following:

- New IMP metrics were established and are ongoing.
- IMP Department began the installation of technologies for the visualization of water tanks. It is expected to complete 65% of the visualization by FY2020.
- Ongoing improvements to SAP PM for IMP processes optimization.
- Integration of IMP routes in SAP for optimization.
- Acquisition, installation, and maintenance of EUGs to ensure systems redundancy.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Revision of IMP procedures to ensure necessary updates are performed.
- Predictive Maintenance is currently being implemented through private contracts in all Regions except the South Region. The South Region bided the work but it was not awarded, however it is expected to be rebid early on 2020. In the meantime, they are using some internal personnel but are very limited. Some of the predictive maintenance techniques include ultrasound technology, vibration, among others, to make sure that the preventive maintenance is working properly and to be able to predict future failures. The end goal of this initiative is to train PRASA personnel to internally continue the implementation of predictive maintenance, however, since there is still a lack of equipment, and additional training is needed for the time being it will continue to be subcontracted.
- IMP is actively working on improving their visualization and automation capabilities.

PRASA's IMP Department future initiatives include the following:

- Installation of flow meters at all water treatment facilities to measure production to be able to account for NRW.
- Implementation of the new handheld (HH) technology that allows for more accurate work documentation and system updates in real time.
- Finalize the optimization of the Integrated Maintenance Program.
- Implementation of the initial phase of the Corrosion Control Plan.

5.5.2 Non-Revenue Water Reduction Program

In May of 2008, PRASA began to implement its comprehensive NRW Reduction Program to reduce water losses (apparent and real), increase revenue, reduce operational costs, and minimize water infrastructure capital investments.

Reducing NRW is a high priority goal for PRASA, as it will have both a revenue enhancing and an expense reduction impact to PRASA's finances. In late 2011, PRASA retained the services of Miya, an NRW consultant, who completed a Report (May 2012) that identifies a series of short, mid, and long-term activities. Furthermore, as part of the NRW Management and Reduction Plan, PRASA established the Water Recovery Office and is now conducting periodic water audits (refer to Section 4), which are used to implement controls and develop action items to address NRW and meet the established goals.

As challenging as it has been, reducing NRW continues to be a top priority objective for PRASA. Hence, in pursuing PRASA's vision to achieve long-term sustainability, PRASA has included the reduction of NRW as one of the three key focus areas of the 2019 PRASA Fiscal Plan. To do so, PRASA has established three main initiatives, as listed below:

- Reducing the system water production by 10% by FY2024 (from 507 MGD).
- Privatizing PRASA's customer services via a P3 to reduce commercial losses and identify unauthorized consumption.
 - Replacement of meters
 - Installation of advanced metering technology

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Enhance customer services activities
- Reducing physical losses through a series of initiatives:
 - Water Leak Detection Program
 - Tank Telemetry and level monitoring – 65% of tanks by FY2020
 - Water pressure management and optimization
 - Data Quality Improvement – Goal of measuring 80% WTP production

Some of the issues the WRO has encountered, which have hindered the implementations of the programs or affected precision are:

- Installation – Locations – there is an opportunity to make adjustments and improvements in data collection to help reduce physical losses.
- Non-operational equipment
- Inaccuracy of Equipment or fail to properly calibrate

To address some of these issues, the Team is inspecting meters and installing new insertion meters, which can be “hot tap”, have expedite calibration, high accuracy (M36 standard) and easy to replace.

The WRO further established an NRW team to include not only the Water Recovery Office staff, but also integrate operations personnel to address the 2019 PRASA Fiscal Plan NRW initiatives efficiently and effectively per Region. PRASA's Water Recovery Office also oversees the GIS Office.

5.5.2.1 Revenue Optimization Program

As part of the NRW Reduction Program, PRASA's strategy has focused mostly on revenue optimization (enhancing) initiatives, which target apparent losses related to its commercial operation. Since 2009, PRASA has implemented a public-private effort that is charged with identifying new opportunities for revenue sources and optimizing collections. These activities, which include small and large meter changes, identifying theft and inactive accounts, disconnections and collections efforts, among others, have resulted in significant additional revenue for PRASA over the past fiscal years. Approximately \$100M per year of PRASA's revenues (or about 10% of total Operating Revenues) are generated from these initiatives. In the future, most of these initiatives will be transferred to and address by the P3 Project Contractor.

5.5.2.2 Accounts and Structures Validation Initiative

PRASA's Water Recovery Office established the Accounts and Structures Validation Initiative (INVEC, by its Spanish acronym) in FY2015. This initiative has identified connections that are not already identified in PRASA's SAP customer database or georeferenced in PRASA's Geodatabase, thereby helping to identify and address illegal connections. Through INVEC, PRASA identified what is internally known as “red structures”. Red structures are occupied housings located at a distance of 100 meters or less from PRASA infrastructure, as reported by GIS, that are not connected to PRASA system. Hence, these structures may be either non-PRASA communities (communities that have their own private water source) or illegal connections (theft, derivations).

An initial number of 300,000 accounts were identified. In its Geodatabase efforts in previous fiscal years, PRASA was able to narrow down this number to 265,505 by eliminating structures that are 600 square-

feet or more and at a distance of 6 meters from a water meter to reduce the potential of keeping gazebos. Then, PRASA searched for structures such as hotels and industries to also disregard those and were able to further narrow the number down to 205,000 accounts. Thirteen percent (13%) of these accounts (26,000 accounts) were identified as communities with low economic resources that are illegally connected to PRASA (with service but without meters), known as the "yellow structures". These yellow structures are to be georeferenced in PRASA's Geodatabase. PRASA intends to continue the search for schools and hospitals to keep reducing this number prior to going to the field for verification. However, this initiative was impacted by the effects of the September 2017 Hurricanes and was put on hold during FY2018 and FY2019. The initiative is expected to be transferred to the P3 Project Contractor.

5.5.2.3 Water Leak Detection

To better understand the magnitude of hidden water leaks (physical losses) in PRASA's water system, in FY2013 PRASA carried out a project to detect leaks in the Arecibo and Caguas water distribution systems. In total, between the two systems a total of 600 miles of pipeline was surveyed. About 288 leaks were detected with an estimated flow of about 4.7 MGD. Through this project, PRASA confirmed that there are a significant number of undetected water leaks in PRASA's water system. Based on these results, PRASA projects that there could be as much as 100 MGD being lost through undetected water leaks throughout the island. Hence, PRASA's Executive Management Team believes that detection and repair of these leaks could significantly reduce the volume of PRASA's NRW. Furthermore, in January 2014, PRASA expanded the leak detection project throughout the island. PRASA established a goal of surveying about 7,000 miles of water pipelines, island-wide, over an 18-month period as part of the project. The water pipeline inspections goal was completed by June 2015 and a total of 3,800 leaks were detected. Moreover, as of December 2015, PRASA established a new goal of surveying about 3,500 miles of small meter water pipelines throughout the island and a total of about 25.5 miles of large meter water pipelines in selected areas. The bid process for this project was performed and a contractor was selected. However, due to the September 2017 Hurricanes impact this initiative was placed on hold. As of the date of this Report, PRASA's management is evaluating the next steps for this project.

For continuing implementation of the Water Leak Detection Program, which is to be performed in parallel with the Pressure Management Program, PRASA hired a Consultant and started with a pilot program in Old San Juan (OSJ). After completing OSJ, the initiative moved its focus to several Metro areas and an ongoing effort of expanding through PRASA's Regions. The program tasks include, but are not limited to:

- "Sondeo Sonido" (Values) & Water Meters
- Data gathering (pre-location)
- Search for leaks (sounding, quantity of loss)
- Pinpointing leaks (OP-14, OP-15)
- Awareness, response, repairs

The team also, monetized the leaks by calculating the loss in gallons per minute (gpm), and assigning the cost of producing per gpm, in terms of volume lost. This way PRASA is able to interpret, prioritize and present urgent issues to the Executive Management Team.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Simultaneously, the Pressure Management Program was implemented, by starting in the Metro Region and then expanding through all the Regions. The WRO runs two consecutive cycles and then it's passed to Operations to continue the implementation. Goals of this program are to reduce pressure, which consequently helps with overflows and NRW reduction. Tasks include:

- Tanks pressure gage validation
 - Replacement & Decommission
- Tanks valves validation with adjustments
 - Replacement & Decommission
- Validation of valves in distribution
 - Replacement & Decommission
- Pumps valves validation
 - Replacement & Decommission

Figure 5-1 shows PRASA's workflow for pressure management and visualization on distribution tanks. "ORA" stands for Water Recovery Office in Spanish.

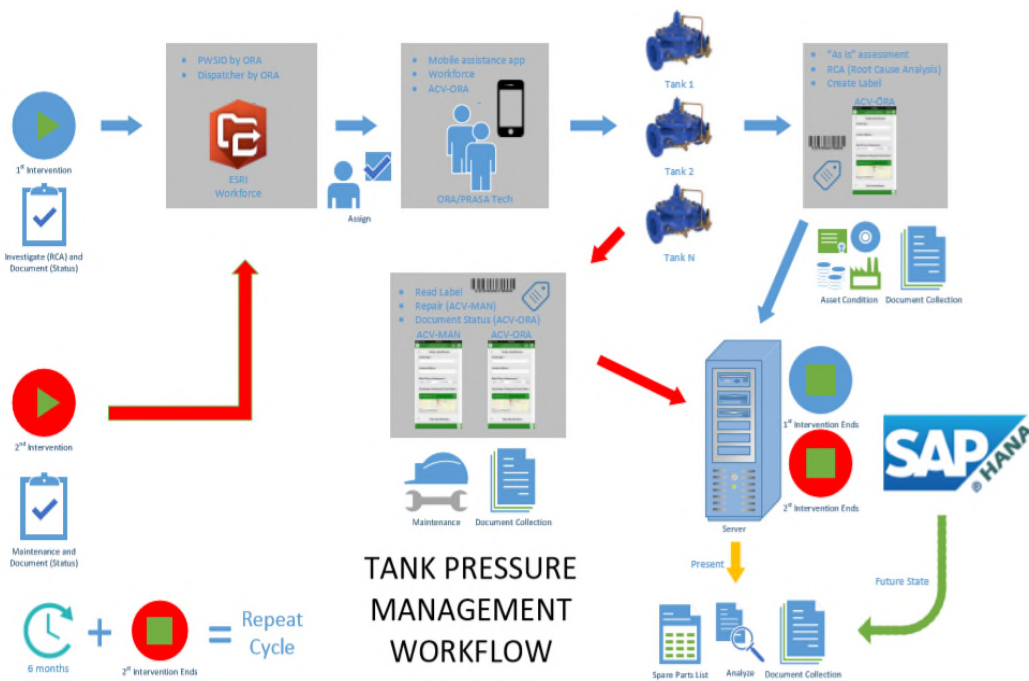


Figure 5-1. Tank Pressure Management / Visualization Workflow

Lastly, PRASA's Regions prioritize leak repairs in accordance to their severity, giving a higher priority of repair to major leaks which represent a higher monetary loss and higher reduction in NRW.

5.5.3 Comprehensive Energy Management Program

PRASA's energy cost is the second largest cost behind Payroll and Benefits. PRASA's energy cost has been mostly driven by energy consumption and the electric power costs (which in turn are mostly driven by fuel oil costs). During the past five fiscal years, PRASA's energy use has reduced from 744 million kWh during FY2013 to 643 million kWh during FY2017 and 472 million kWh during FY2018 (including impact of 2017 Hurricanes). Currently, energy costs are around 617 million kWh during FY2019 (updated to Sep-2019).

PRASA continues its Comprehensive Energy Management Program to manage and reduce its energy consumption and costs. PRASA is only continuing one of the two programs previously engaged. As mentioned, the EPCs were cancelled and only the Solar PPA continues. Additionally, PRASA continues its internal initiatives and activities being implemented by the operational Regions and PRASA's Infrastructure Department. A description of the different initiatives is provided in the following sub-sections.

5.5.3.1 Demand Side Projects through Energy Performance Contracts

The objective of this initiative, which began during FY2009, was to have Energy Service Companies (also referred to as ESCOs) perform assessments and guarantee savings obtained by installing equipment and implementing activities designed to reduce energy consumption. The most important benefit for PRASA in employing this type of performance contract is the operational benefit from improvements guaranteed by the ESCOs, i.e. if the energy savings are not achieved, the ESCO will pay PRASA for the non-achieved savings. However, the ESCOs savings guarantee extends until the investment is recovered and they have earned their agreed payments. In contrast, during the implementation of this initiative, PRASA encountered several issues with the contractor and achieving the Project's objective. This resulted in the cancellation of all EPCs. This initiative has been suspended until further notice.

5.5.3.2 Supply Side Projects through Power Purchase Agreements

In 2009, PRASA also undertook a parallel process for procuring companies who were interested in providing independent energy supply services through PPAs. The objective is to secure one or more PPAs for lower energy unit costs per kWh than what PRASA currently pays to PREPA. From this process, PRASA concluded successful agreements with three companies, of which one has been completed and is currently in operation. The gasification projects were cancelled. **Table 5-5** below provides a status summary of the PPAs in place. In addition, during FY2017, PRASA identified 14 sites for additional solar projects with a potential capacity of approximately 16 MW. As of FY2019, PRASA has saved approximately \$1.9M (production of 10 million kWh per year) from the solar PPAs currently in operation.

Table 5-5. PRASA PPAs

Proponent	Technology	Status
Windmar Renewable Energy (PV Properties)	Solar	Contract signed; 7 MW; 10 facilities (projects) have been completed and are currently in operation.

5.5.3.3 Regional Operational Initiatives

PRASA's Executive Management Team had set a goal to achieve additional energy consumption reductions, as per final budget, of at least five percent kWh per year island-wide, which has been already achieved. In FY2019 a new goal of one-half percent (1.5%) of energy consumption reduction was established across the regions. This is currently a challenge due to, in most cases, in order to be able to achieve this energy consumption reduction, a capital investment is necessary, and it cannot currently be funded. Since FY2014, PRASA's Operational Regions have been implementing energy conservation measures in its WTPs and WWTPs, and they are also leveraging hydraulic modeling analyses and optimization efforts to reduce energy consumption in the water distribution and wastewater collection systems (i.e., pump stations facilities). Some of the measures include, for example, simplifying and providing more flexibility to the system, reducing and optimizing the hours of operation at the facilities, elimination of WPS or WTPs, identifying energy conservation measures in the operation of the equipment, among others. Regions have identified energy conservation measures that reduce equipment operation time at the WWTPs with process control measures and at the WPSs by identifying and controlling system pressures and distribution tank overflows.

5.6 Treatment Plant Automation Program

In prior years, PRASA embarked on a Treatment Plant Automation Program, which consisted in the installation of the necessary equipment and the development of the system protocols to automatically operate and remotely monitor its WTPs. However, PRDOH requested that a WTP should not be maintained without operators for more than 4 hours, implementing partially automated shifts following the 8-4-8-4 Automation plan¹³. PRDOH and PRASA agreed on an endorsement procedure prior to the implementation of 8-4-8-4 and remote operation. This meant that while plants can have automatic shutdown or full automation capabilities, the WTPs must follow the endorsement procedure prior to implementation of reduced shifts or staff. During FY2019 there was no activity under this Program.

An effective automation program should be designed to be properly operated from the Remote Operating Center (ROC) at each of the five Operational Regions. Under PRASA's resiliency projects list, PRASA projects to invest at least \$150M for remote operational capabilities at its facilities.

¹³ The term 8-4-8-4 operations refers to having an operator at the facility for a period of eight hours followed by a remote monitoring and un-manned operation for the next four-hour period. This 12-hr cycle is repeated, reducing the number of operators needed and reducing overtime.

5.7 Conclusions

PRASA's O&M budgets are within the industry standards, mostly around the median benchmark results published by AWWA in 2018. Despite certain O&M related observations made during facility inspections, PRASA's O&M practices are adequate. A common challenge identified through Operational Regions and departments was the lack of personnel for O&M functions. Considering the existing condition of PRASA's System, maintenance and staffing needs, and upcoming compliance requirements, PRASA may require an increase or further optimization of their budget. Although the FY2019 PRASA's KPI results improved substantially from FY2018, they remain low as a result of the delays in the recovery efforts and the fiscal situation hindering the implementation of certain initiatives.

PRASA's main O&M efforts during FY2019 were focused on the reestablishment of the System in the aftermath of Hurricanes Irma and María and securing funding/reimbursements from FEMA and from insurance coverages. Although some of the FY2019 planned O&M investments and key PRASA initiatives were restarted, several continue delayed or suspended due to the slow recovery efforts or have been modified to meet commitments included in the 2019 PRASA Fiscal Plan. Initiatives like the NRW Reduction Program which started implementation of the Leak Detection and the Pressure Management Programs will be expanded with PRASA's P3 Project. PRASA expects benefits will surpass those already achieved under the Revenue Optimization Program. Other internal programs are expected to be reactivated during FY2020 or beyond once funding has been identified.

6 CAPITAL IMPROVEMENT PROGRAM AND REGULATORY COMPLIANCE STATUS

6.1 Introduction

PRASA has developed a multi-year CIP to improve and maintain their System. The CIP's main objectives are to maintain, modernize and simplify the System to achieve operational efficiency, protect public health and safeguard environmental quality, while enabling continued economic development and meeting all regulatory requirements. In addition, PRASA has included as part of the CIP objectives the restoration of damaged infrastructure to its condition prior to the 2017 Hurricanes and the implementation of sustainable measures in the longer-term to harden its System against the impacts of climate change and sea-level rise.

The CIP is a dynamic program that evolves and undergoes revisions as needs and sources of funds are identified, and as projects transition from pre-construction to construction phases to finally reach start-up and commissioning. Historically, the program has been funded with external financing from bond issuances and federal assistance in accordance with standard utility financing practices. From 2006 to 2016, PRASA invested approximately \$3.7B in its CIP, with the intention of bringing the System into compliance and supplement pre-existing capital needs from prior year funding shortfalls. The 2019 PRASA Fiscal Plan and public policies endorsed by PRASA's Governing Board includes a tapered transition in which financing of the CIP gradually shifts from bonds to self-financing via PRASA's Operating Revenues.

The number and budget of projects are updated regularly, as the CIP is continuously evolving considering needs and as projects are completed. The CIP is subject to review and approval by PRASA's Governing Board.

The CIP presented in this Report refers to the six-year CIP as included in the 2019 PRASA Fiscal Plan. The approval and execution of this six-year CIP is contingent upon funding availability and allocation, and approval by PRASA's Governing Board.

6.1.1 PRASA's CIP Status

The Government's fiscal situation and resulting rating agency classification downgrades had a major impact on PRASA, as each downgrade also resulted in a consequential downgrade for PRASA. This limited PRASA's ability to access the capital markets to obtain financing to cover immediate CIP related expenses. As a result, PRASA began cost-cutting efforts on its CIP in 2014. As previously mentioned, it was customary for PRASA to use a portion of its operating funds to cover expenses for its CIP projects. However, in FY2016, after spending all of its surplus operating income and reserves to repay bond anticipation notes and cover a portion of its unfunded CIP, PRASA was forced to postpone or cancel the execution of all CIP projects. This included the suspension of 55 projects under construction totaling \$352M and cancellation of an additional 86 projects totaling an additional \$247M in investment.

Currently, execution of almost all capital projects including the regulatory-driven projects is on hold indefinitely, except for some R&R and emergency recovery projects. There is a strong concern that the

lack of capital investment will accelerate infrastructure degradation and lead to a critical situation. As of FY2019, PRASA paid off all outstanding payments due to contractors and CIP consultants.

The suspension of CIP projects has resulted in both short and long-term effects on PRASA's operations and infrastructure, and on Puerto Rico's economy. In the short-term, PRASA is facing continuing deterioration of their infrastructure, and potential non-compliance with regulatory mandates or administrative orders. In the long-term, PRASA may see an increase in cost of capital projects as vendors price-in the risks associated with delays in payment or non-payments to contracted projects as well as increasing risks related to asset failures or operational challenges that could affect the quality and continuity of service, ultimately leading to reduced Operating Revenues and increased Operating Expenses.

6.2 CIP Implementation Management

In FY2019, PRASA initiated a procurement process to qualify and select program management consultants (PMCs) to support their Infrastructure Department in the planning, design, and management of CIP projects in each of the five Regions. Similar to the engagement of PMCs between 2005 and 2016, PRASA seeks to partner with qualified and experienced program managers that will oversee implementation and management of CIP projects throughout pre-construction, construction, and post-construction. As part of the pre-construction activities, the PMCs will manage key tasks that drive CIP project budgets, such as defining project scopes, negotiating consultant contracts for studies and design services, reviewing project constructability, preparing project construction cost estimates, preparing bid packages, and managing bid processes (in close coordination with PRASA's Bids Board). As part of the construction management services, the PMCs will serve as PRASA's representative on CIP projects and include such tasks as managing project schedules, negotiating project change orders, and administering construction contracts. Finally, as part of the post-construction services, the PMCs will support project start-up, training, and close-out activities. Contracts are expected to be executed with selected PMCs in late FY2020 or early FY2021 in preparation of the reactivation of PRASA's CIP.

6.3 CIP: Project Distribution and Costs

CIP projects are divided into categories, groups and types. Additionally, PRASA has implemented a prioritization system to better manage the large and complex CIP. Projects included in the CIP cover major capital improvements identified throughout all five Regions, as well as island-wide system improvement initiatives such as integration of technological advancements, telemetry implementation, and general R&R. The CIP was developed by PRASA with the following key points in mind: a) recovery of the system after hurricanes impacts and focus on improving resiliency, b) ensuring water quality, c) regulatory commitments as stipulated in consent decrees, administrative orders, and other agreements with Regulatory Agencies and d) current and future infrastructure and operational needs identified from system planning studies.

Once the need for a capital improvement project is identified, a project creation form is prepared. The form includes the project scope, preliminary schedule, and cost estimates. The project is then assigned a CIP project number and added to the CIP inventory, where it is categorized according to PRASA's

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

classification and prioritization system. Updates to the CIP are presented to PRASA's Governing Board at least once a year for revision and approval.

Total CIP investments per project are calculated taking into consideration the following estimated costs:

- Planning, studies, and land acquisition costs
- Design costs
- Construction costs
- Project management and inspection costs
- Contingencies
- Miscellaneous cost (includes financing costs, insurance, O&M documents and administrative costs)

Design costs typically use the College of Engineers and Land Surveyors of Puerto Rico (CIAPR, by its Spanish acronym) professional services compensation guidelines (vary by project type and complexity) and modified by the current market and availability of local designers. Previously, the construction management and inspection costs were estimated to be 5% of the net construction cost; general, administrative and insurance costs were estimated at approximately 15% of net construction cost, while contingencies were estimated to be about 10% of net construction cost. PRASA eliminated the annual inflation rate of 3.8% formerly used, considering the downturn in construction activity and lower project cost estimate results received during project bids. However, considering the construction materials cost increase after the 2017 Hurricanes and the recent boom in construction, when the CIP is activated the previously described cost percentages used to determine the various stages cost of project lifecycle should be reassessed.

Throughout the development of the planning and design phases of a project, the contingencies are modified as the construction cost estimates are updated. Once the project goes out to bid and is awarded, the amount calculated for contingencies is no longer updated and it remains as part of the assigned funds of the project until close-out. During the construction phase of projects, contingencies are used to cover change order costs and miscellaneous expenses that may arise, such as additional land acquisition, permitting, or design activities. Before the CIP suspension, PRASA reported that existing contract change order percent in construction projects was approximately 3%, which is much lower than typical industry average of 15-20%.

6.3.1 Project Classification and Prioritization

CIP projects, as recently redefined in the 2019 PRASA Fiscal Plan, are classified into the following mandatory and non-mandatory categories:

- Emergency/Permanent Works
- Renewal and Replacement (R&R)
- Compliance (Mandatory/Non-mandatory)
- Optimization and Emergencies
- Fleet and IT

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Quality
- Meter Replacement and Safety
- Resiliency and Others

Emergency/Permanent Works are projects to repair the infrastructure impacted by the Hurricanes Irma and María. R&R are aimed at renewing or replacing system assets (pipelines, pumps, motors, etc). The Compliance category covers projects required by agreements with USEPA & PRDOH (2015 USEPA Consent Decree projects, 2006 PRDOH Drinking Settlement Agreement projects, Civil Actions, Administrative Orders, and other mandatory projects), or that would be included in the future if not performed. The goal of Optimization and Emergencies projects is to increase efficiency, mainly pertaining to electrical consumption, and address emergencies and contingencies. Fleet and IT replace vehicles in PRASA's fleet and improve IT infrastructure. Quality projects increase the quality of the water and wastewater service provided to customers. Replacement of meters outside of the P3 project and safety, mainly around dams, are covered under Meter Replacement and Safety. The final category, Resiliency and Others, covers projects considered as necessary to make the system resilient to potential future events.

Projects are further classified as either water or wastewater system projects. Water system projects include projects for improvements or construction of new facilities for water supply, water distribution, WTPs, WPSs, and tanks, amongst others. Wastewater system projects include projects for improvements or construction of new facilities for wastewater collection, WWTP, and WWPSs, amongst others.

In addition to project classification, CIP projects are ranked according to a prioritization score. This score is the result of the weighted sum of the evaluation criteria adopted in PRASA's Master Plan and negotiated with Regulatory Agencies. Four main criteria were selected to prioritize CIP projects: Regulatory Compliance (40%), Quality of Service and Reliability (30%), Operational Efficiency and Improvements (20%), and Population Impacted by Project (10%). The implementation schedule of future long-term projects, currently not included in PRASA's CIP, will be subject to the prioritization system and PRASA's financial capacity. Additionally, at the reactivation of the new CIP, PRASA will pursue immediate restoration of all infrastructure damaged by the hurricanes and continued compliance with Regulatory Agencies. As such PRASA has identified the following priorities upon CIP reactivation:

1. Projects needed to restore the infrastructure damaged by Hurricanes Irma and María.
2. Compliance projects included in the 2015 USEPA Consent Decree and the 2006 PRDOH Settlement Agreement.
3. Construction projects that were stopped and postponed with the suspension of the CIP in 2016.

6.3.2 CIP Metrics and KPIs

As included in the 2019 PRASA Fiscal Plan, PRASA intends to review and update the CIP tracking tool used prior to the suspension of the CIP to ensure compliance with the forecasted execution schedules. The tracking tool was used to perform project time management, develop a detailed project baseline and track the actual progress of all projects on a monthly basis, to keep track of projects on target and off target, and to identify gaps root causes for delayed projects.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

In addition, PRASA will implement the CIP KPIs historically used to allow for detailed tracking of CIP compliance and success. These include: Cost Performance Index (CPI) and Schedule Performance Index (SPI). The CPI measures the cost efficiency of resources as compared to the budget and the SPI measures the relationship between the executed work against planned work.

6.4 Six-Year CIP (FY2019-FY2024)

PRASA's six-year CIP for FY2019 through FY2024, as included in the 2019 PRASA Fiscal Plan, amounts to \$2,410.5M. Annual capital expenditures by project category are presented in **Figure 6-1** and **Table 6-2**. As shown, the six-year CIP is mainly composed of Emergency/Permanent Work, R&R and Compliance projects, which account for 61% of the total forecasted expenditures. Key recommendations from PRASA's existing Master Plan are also included in the six-year CIP.

Emergency/Permanent Works category, which accounts for 31% of the projected CIP expenditures, was slightly less as a percentage of the total CIP budget, with an annual average expenditure \$125M and total of \$750.2M over six years. Renewal & Replacement totaling 15% of total CIP decreased by 34% but is still the second largest category in terms of dollars over the duration of this CIP period. Historically, the majority of PRASA's CIP investment (about 60%) was for mandatory and compliance driven projects. This shift in priorities is mainly due to repair needs for infrastructure impacted by the Hurricanes Irma and María and higher prioritization of hardening efforts to transition to a more resilient System. PRASA has allocated \$644.4M for Resiliency projects over the next six years in its CIP.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 6-1. Capital Improvement Program FY2019-FY2024 by Category (\$, Million)¹

Project Category	Fiscal Year Ending June 30						2019-2024 Total
	2019	2020	2021	2022	2023	2024	
Emergency/Permanent Works	\$10.1	\$220.5	\$175.9	\$192.4	\$118.0	\$33.4	\$750.2
Renewal & Replacement	\$51.8	\$70.2	\$50.0	\$61.0	\$71.5	\$63.0	\$367.5
Compliance (Mandatory/Non-mandatory)	\$1.4	\$25.8	\$83.8	\$110.7	\$81.4	\$55.4	\$358.5
Optimization & Emergencies	\$1.2	\$15.0	\$10.0	\$10.0	\$10.0	\$10.0	\$56.2
Fleet & IT	\$4.4	\$21.8	\$10.0	\$10.0	\$10.0	\$10.0	\$66.2
Quality (and Growth)	\$3.6	\$12.9	\$21.8	\$30.2	\$39.9	\$34.8	\$143.1
Meter Replacement and Safety	\$1.0	\$2.0	\$2.8	\$5.2	\$4.1	\$8.0	\$23.0
Resiliency and Others	\$0.04	\$-	\$34.9	\$180.8	\$185.6	\$244.4	\$645.7
Subtotal	\$73.5	\$368.3	\$389.2	\$600.2	\$520.3	\$458.9	\$2,410.5

¹Numbers may not add due to rounding.

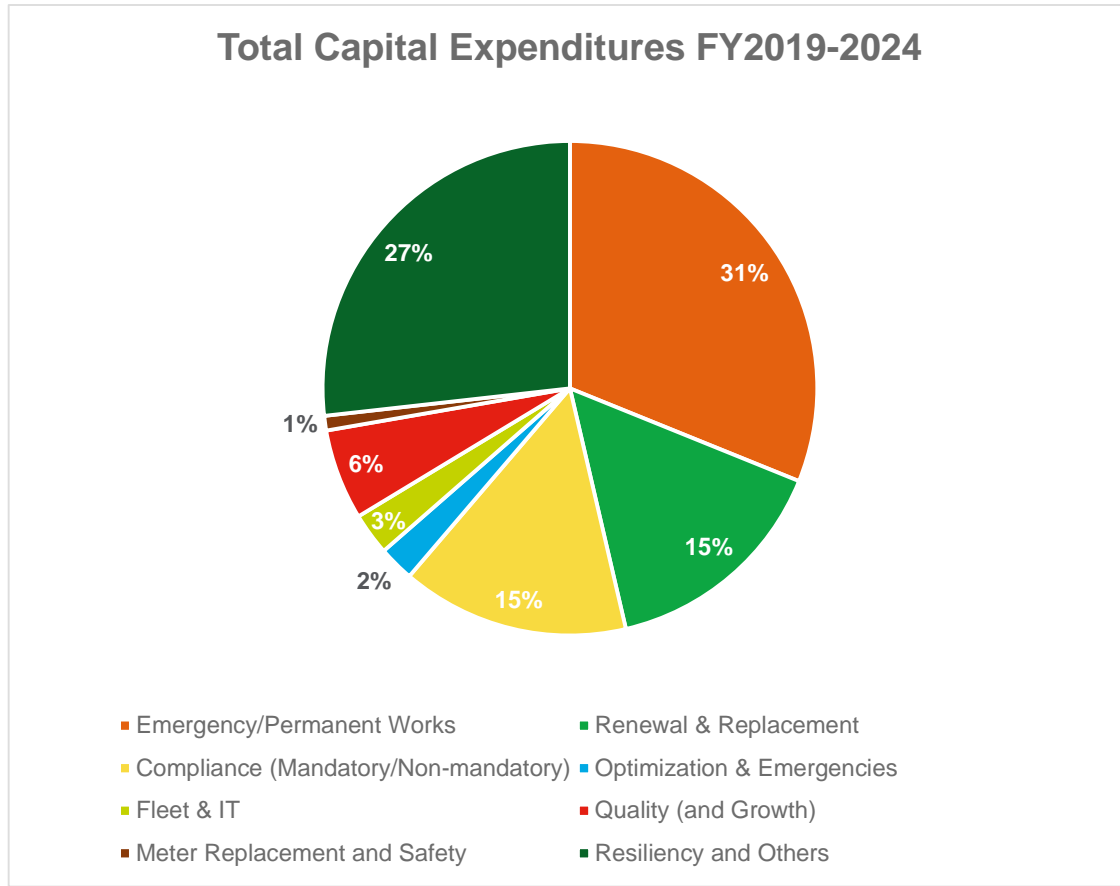


Figure 6-1. Six-Year CIP Capital Expenditures by Category

PRASA's six-year CIP consists of a total of 584 projects. As of July 1, 2019, 39.2% of the projects have not started, 53.6% are in the pre-construction stage (planning, design and bid), and 2.6% are in the construction and/or closeout stages. The remaining 4.6% are projects already in operation.

PRASA has identified a total of 183 projects under the Emergency/Permanent Works category that have priority. Fifty-seven (57) projects were identified for Renewal & Replacement, 68 projects to address Mandatory Compliance and 65 for Non-mandatory Compliance. In addition, PRASA has set aside \$644.4M for Resiliency projects.

6.4.1 Water System Projects

The water system projects include projects to improve compliance (mandated and not mandated), upgrades to WTPs, STSs and water distribution systems as well as construction of new water infrastructure. Total capital expenditures in water system projects for FY2019–FY2024 are estimated at approximately \$288.57M, of which approximately \$71.52M is allocated for projects classified as Mandatory Compliance and approximately \$78.07M is allocated for projects classified as Emergency/Permanent Works as a consequence of the hurricanes impact.

6.4.2 Wastewater System Projects

The wastewater system projects include projects to improve compliance, new WWTPs, and upgrades to wastewater collection systems. Total capital expenditures in wastewater system projects for FY2019–FY2024 are estimated at \$498.75M, of which approximately \$129.35M is allocated for projects classified as Mandatory Compliance and approximately \$67.38M is allocated for projects classified as Emergency/Permanent Works.

6.4.3 Adaptation for Climate Change and Resilience

PRASA completed a Vulnerability Study and Adaption Plan for its entire infrastructure in compliance with the February 2013 Executive Order signed by the Governor of Puerto Rico at the time. The Climate Change Vulnerability Study findings and the strategies selected in the Adaptation Plan will be further assessed and CIP projects shall then be developed. These projects will follow the same guidelines set in the prioritization system. These based projects will serve as a roadmap for PRASA in the planning process and in its preparation towards the expected impacts of climate change. Additionally, as part of the recovery efforts post 2017 Hurricanes, PRASA has identified needs and infrastructure improvements to increase the System resilience. PRASA has allocated approximately \$644.37M for these efforts.

6.4.4 Other Projects: Hurricane Repairs, R&R, Buildings, Energy Optimization, and Others

Total capital expenditures for all other capital projects are estimated at approximately \$978.80M for FY2019 – FY2024, of which approximately \$482.24M is allocated for repairs to infrastructure impacted island-wide by Hurricanes Irma and María not under water or wastewater systems. Renovation & Replacement projects are budgeted at \$247.47M. Buildings and Energy & Optimization projects have \$73.99M and \$70.95M allocated, respectively. The remaining \$104.15M is interspersed between Emergency/Contingency, Fleet, Technology, and Metering system upgrades.

Table 6-2 shows the project distribution and capital expenditures by Category and Project Type for FY2019 through FY2024.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 6-2. PRASA's Base CIP Projections FY 2019 - FY 2024 (\$, in Millions)¹

Category Type	Project type	Fiscal Year Ending on June 30						2019-2024
		2019	2020	2021	2022	2023	2024	
Wastewater System	Wastewater Pump Stations	\$0.00	\$0.65	\$3.29	\$6.57	\$8.52	\$3.07	\$22.10
	WWTP	\$20.35	\$70.97	\$69.14	\$63.70	\$54.53	\$43.84	\$322.52
	Wastewater Collection	\$2.44	\$17.01	\$36.46	\$36.21	\$33.45	\$28.55	\$154.12
	Subtotal	\$22.79	\$88.62	\$108.89	\$106.48	\$96.50	\$75.46	\$498.75
Water System	Water Supply	\$0.23	\$4.10	\$7.77	\$14.84	\$9.59	\$11.78	\$48.31
	Water Pump Stations	\$0.38	\$0.30	\$0.23	\$0.59	\$0.32	\$0.40	\$2.22
	WTP	\$0.45	\$56.80	\$48.37	\$42.52	\$31.83	\$16.98	\$196.96
	Water Distribution	\$1.61	\$13.22	\$10.43	\$2.98	\$4.44	\$8.39	\$41.09
	Subtotal	\$2.68	\$74.41	\$66.80	\$60.94	\$46.19	\$37.55	\$288.57
Resiliency	-	\$-	\$-	\$ 34.92	\$180.82	\$185.55	\$243.08	\$ 644.37
September 2017 Hurricanes Island-wide Project	-	\$-	\$40.76	\$102.39	\$188.76	\$116.94	\$33.39	\$482.24
Renovation & Replacement	-	\$31.80	\$ 50.17	\$30.00	\$ 41.00	\$ 51.50	\$ 43.00	\$247.47
Buildings	-	\$0.03	\$50.92	\$22.79	0.25	\$ -	\$ -	\$73.99
Energy & Optimization	-	\$10.84	\$37.59	\$8.90	\$ 2.50	\$4.17	\$6.96	\$70.95
Emergency/Contingency	-	\$-	\$10.00	\$7.50	\$7.50	\$ 7.50	\$7.50	\$40.00
Fleet	-	\$3.38	\$13.78	\$5.00	5.00	\$5.00	\$ 5.00	\$7.15
Technology	-	\$1.00	\$-	\$-	\$ 5.00	\$ 5.00	\$5.00	\$16.00
Meters	-	\$1.00	\$2.00	\$2.00	\$2.00	\$ 2.00	\$2.00	\$11.00
	Subtotal	\$8.04	\$205.22	\$178.57	\$252.01	\$192.11	\$102.85	\$978.80
Total		\$73.51	\$368.26	\$389.19	\$600.24	\$520.35	\$458.95	\$2,410.49

¹Numbers may not add due to rounding

6.5 CIP and Current Regulatory Compliance

The six-year CIP adequately addresses the requirements of existing consent decrees and agreements and considers proposed modifications to said consent decrees and agreements, as recently negotiated or in negotiations by and between PRASA and Regulatory Agencies. Nonetheless, it shall be noted that the actual cost of compliance with the consent decrees and agreements and PRASA's total capital expenditures may vary substantially depending on, among other things:

- Inflationary environment with respect to the costs of labor and supplies needed to implement the compliance program.
- Weather conditions that could adversely affect construction schedules and consumption patterns.
- Population trends and political and economic developments in Puerto Rico that could adversely impact the collection of operating revenues.
- Possibility of new environmental legislation or regulations affecting the System.
- Unanticipated costs or potential modifications to projects resulting from requirements and limitations imposed by environmental laws and regulations.
- Inherent uncertainty involved in CIP projects of the magnitude undertaken by PRASA.

Up until 2015, PRASA was subject to three consent decrees with USEPA and one settlement agreement with PRDOH to eliminate treatment plant non-compliance and unpermitted discharges of untreated sewage, and to improve the quality of potable water and STSs. These agreements included the following:

- 2003 Consent Decree (PRASA IV), U.S. v. PRASA, Commonwealth of Puerto Rico, and “Compañía de Aguas de Puerto Rico”, Inc., Civil Action No. 01-1709 (JAF) – Addresses violations to the Section 301 and 402 of the Clean Water Act (CWA) and regulations and PRASA's NPDES permits with regards to certain PRASA's WWPSs.
- 2006 Wastewater Consent Decree, U.S. v. PRASA and Commonwealth of Puerto Rico, Civil Action No. 06-1624 (SEC) – Addresses violations to the Section 301 and 402 of the CWA and regulations promulgated there under, and PRASA's NPDES permits with regards to PRASA's WWTPs.
- 2006 PRDOH Drinking Water Settlement Agreement (ATE for its Spanish Acronym), Civil Action KPE 2006-0858¹⁴ as amended – Addresses non-compliance and alleged violations with the Puerto Rico Potable Water Purity Protection Law, as amended (“*Ley para Proteger la Pureza de las Aguas Potables de Puerto Rico, Ley Núm. 5 de 21 de Julio de 1977, según enmendada*”), the Safe Drinking Water Act (SDWA) and applicable regulations, and the General Environmental Health Regulation (“*Reglamento General de Salud Ambiental, Reglamento Núm. 6090 de 4 de febrero de 2000*”).
- 2010 USEPA STS Consent Decree, U.S. v. PRASA and Commonwealth of Puerto Rico – Addresses alleged violations to the SDWA and the CWA specifically to the National Primary Drinking Water Regulations.

¹⁴ The Settlement Agreement was signed: March 15, 2007 and subsequently amended on June 16, 2008.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

In light of the challenges faced by PRASA, resulting from the continued uncertainty and strain on the Government's economy and despite the fact that PRASA substantially complies with the requirements of the consent decrees and agreements, PRASA requested and negotiated amendments. In 2012, PRASA and the Regulatory Agencies began discussions to modify certain requirements of the consent decrees and agreements to re-align compliance priorities and, in turn, help alleviate PRASA's financial burden. After an extensive negotiation process and under the terms agreed upon by PRASA and USEPA, on September 15, 2015, the U.S. Department of Justice (USDOJ) filed the 2015 USEPA Consent Decree executed among USEPA, PRASA and the Commonwealth of Puerto Rico in settlement of the matters addressed in a complaint brought against PRASA by USDOJ on behalf of USEPA also filed on such date. On May 23, 2016, the 2015 Consent Decree between USEPA and PRASA was officially logged and accepted by the Court, placing an end to the extensive renegotiation process. The 2015 USEPA Consent Decree consolidates and supersedes the three previous USEPA's Consent Decrees with PRASA (i.e. PRASA IV: 2003 Consent Decree, 2006 Wastewater Consent Decree and 2010 USEPA STS Consent Decree).

As for the 2006 PRDOH Settlement Agreement, as amended, PRASA restarted negotiation talks with PRDOH in January 2017. To date, PRASA have presented joint motions to PRDOH and renegotiation of certain terms and conditions on the Term 2 and Term 3 mandatory projects have been accomplished such as the renegotiation of Juncos Urbano System. Refer to Section 6.5.2 for more details.

The consent decree and settlement agreement currently in effect with the Regulatory Agencies are:

- 2015 USEPA Consent Decree: U.S. v. PRASA and Commonwealth of Puerto Rico, Civil Action No. 15-2283 (JAG) – Addresses violations to the Section 301 and 402 of the CWA and regulations promulgated there under, and PRASA's NPDES permits with regards to PRASA's WWTPs, WWPSs and WTP's STSs.
- 2006 PRDOH Drinking Water Settlement Agreement, Civil Action KPE 2006-0858, as amended – Addresses non-compliance and alleged violations with the Puerto Rico Potable Water Purity Protection Law, as amended, the SDWA and applicable regulations, and the General Environmental Health Regulation. Amendments to this Settlement Agreement are being addressed by the PRDOH and PRASA through independent motions.

Up to the two atmospheric events in September 2017, Hurricanes Irma and María, PRASA had been in continuous compliance with the 2015 USEPA Consent Decree and the 2006 Settlement Agreement as amended. On September 2017, upon declarations of "States of Emergency" for Hurricanes Irma and María, PRASA submitted a notification to both USEPA and PRDOH invoking Force Majeure and indicating the possibility of some delays in projects and programs due dates. In June 2018, another letter was sent to the Regulatory Agencies requesting time extensions with their corresponding justifications due to the lack of funding to reactivate the CIP, the ongoing debt renegotiation process, and the impact of the hurricanes. Essentially, PRASA requested a hold for a period to be determined for certain obligations and stipulated penalties be excused for such period. PRASA is currently going through a re-negotiation process with USEPA and USDOJ regarding deadlines to comply with certain programs contemplated under the 2015 USEPA Consent Decree. To support PRASA's Force Majeure claim, they met on several occasions, as recent as August 15, 2019 via conference call to discuss technical matters and facility inspections. PRASA provided and obtained additional information from these meetings with USEPA. There are ongoing discussions between PRASA, USEPA, and USDOJ in relation to the Force Majeure

protection that have resulted in the submission of Amendments. However, Force Majeure, will remain in effect until the new Amendments are approved. PRASA expects approvals to occur during the 3rd or 4th trimester of FY2020. On the other hand, there are no ongoing negotiations with respect to the 2006 PRDOH Settlement Agreement. At this time, no assurances can be given that the USEPA or the PRDOH will grant such project deadline extensions, although PRASA remains positive and maintains open communication channels with the Regulatory Agencies.

PRASA developed a Compliance Monitoring Tool to facilitate the review, monitoring, and tracking of the requirements of each program stipulated on the 2015 USEPA Consent Decree and the 2006 Settlement Agreement as amended. PRASA will address any discrepancies reported between the information included on the progress report and the Compliance Monitoring Tool.

6.5.1 2015 USEPA Consent Decree Modifications

The 2015 USEPA Consent Decree includes the following modifications:

- Postponement or advancement in deadlines and completion dates of certain projects currently included in the CIP. Compliance deadlines were extended through approximately 2034.
- Scope of work revisions negotiated for certain projects to better address certain facilities' current needs.
- Elimination of certain projects from the consent decrees and agreements given that the facility is: 1) in compliance, 2) due to the declining population trends the project no longer needs to be performed, or 3) because the project has already been completed and certified.
- Addition of new compliance projects (categorized as Other Regulatory Projects and New Mandatory Projects). Several projects that were not originally included in the consent decrees were negotiated to be included. Additional projects added include: capacity evaluation projects for compliance of STSs, I/I studies for the seven sanitary sewer systems covered by the first Sanitary Sewer System Evaluation Plan (SSSEP), and Caño Martin Peña/ENLACE projects. Also, PRASA shall develop and implement a second SSSEP for all other sanitary sewer systems by December 2016 (completed).
- Inclusion of the operation, maintenance and capital improvement program requirements related to the Puerto Nuevo wastewater collection system, including alleged CSWOs. PRASA shall comply with all the requirements of its NPDES Permit and with the Permit concerning CSWOs. The most recent NPDES permit for the Puerto Nuevo WWTP requires that PRASA implement the Nine Minimum Control (NMC) measures, to be revised annually, and a Long-Term Control Plan (LTCP) for the Puerto Nuevo WWTP service area to address wastewater collection system and CSWOs occurrences. As such, PRASA is currently undertaking the development and design of a Sewer SSOMP or S2OMP for the Puerto Nuevo WWTP service area. The SSOMP will manage both the combined sewer systems and the sanitary sewer system requirements as stipulated in the NPDES permit (NMC and LTCP) in addition to a comprehensive capacity, management, operations, and maintenance (CMOM) program for all the Puerto Nuevo sanitary sewer system. As required by the 2015 Consent Decree, PRASA submitted the SSOMP for USEPA's review and approval on June 30, 2016. By January 2017 USEPA commented PRASA's SSOMP and approved it. In addition, PRASA was required to submit annual reports on the status of the implementation of the SSOMP. The first annual report was submitted to USEPA in May 2017. For the subsequent SSOMP Annual Reports, as

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

discussed and agreed with USEPA, on May 31st, 2019 PRASA submitted the first consolidated SSOMP Annual Report 2018.

- The following tasks, at a minimum, shall be performed by either PRASA personnel or a private contractor as part of the SSOMP: sewer system reconnaissance to enable complete inspections, observation and cleaning of the sewers; fats, oil and grease control; sewer cleaning; sanitary sewer overflows, dry-weather overflows and unauthorized release prevention and control; and mapping. Through these efforts, PRASA expects to identify System needs related to overflows (including CSWOs) and to be able to better estimate the effort and expected costs of a future repair plan. After the inspections are completed, if deemed necessary, within 60 days of completing the sewer system reconnaissance of the Puerto Nuevo WWTP service area, PRASA shall submit to USEPA for review and approval its proposed plan to undertake the Condition Assessment of the Puerto Nuevo WWTP sewer system, which shall include a series of remedial measures.
- Amendments to the interim limits. PRASA requested interim limits for its WTPs and WWTPs to comply with NPDES compliance parameters and newly implemented regulations regarding numeric nutrient criteria for nitrogen and phosphorus. It is anticipated that to comply with the lower discharge limits imposed and/or to be imposed by USEPA for these parameters and others, operational modifications and even additional capital improvements to treatment facilities may be required, which would be subject to the CIP Prioritization System.
- Development of a Prioritization System. The Prioritization System is a project scheduling methodology developed to provide an objective and systematic guideline to prioritize the implementation of infrastructure projects and required regulatory projects. Specific criteria were defined for each project category (water, wastewater or STS) and a scoring methodology was developed to objectively prioritize, as much as possible, the list of projects. The criteria consider regulatory and environmental compliance, operational requirements and needs, as well as population served, among other characteristics. The prioritization system establishes the relative priority of all planned upcoming projects with the objectives of allocating PRASA's limited financial resources according to such priority. Hence, for example, any projects to address future regulations would only be funded if they are included within PRASA's approved annual spending level and based on its priority score.
- Completion of scheduled mandatory projects under the Base List of projects, including high priority mandatory compliance projects that have already started the process of planning, design or construction and will not be subjected to the prioritization process. Specific deadlines for these high priority projects were individually discussed and negotiated between PRASA and USEPA.

6.5.2 2006 PRDOH Drinking Water Settlement Agreement Renegotiation between PRASA and PRDOH

The 2006 PRDOH Drinking Water Settlement Agreement with PRDOH renegotiation status is as follows:

- PRASA and PRDOH requested a deadline extension for the Long Term 2 (LTP2) Juncos Urbano System projects (which included the elimination projects in Ceiba Sur WTP and the Quebrada Grande WTP) for a Long Term 3 (LTP3) deadline. In October 2018, PRASA presented Joint Motion

KPE2006-0858 (904), in which, LTP3 deadline extension of December 2021 was granted. Additionally, to prevent future compliance exceedances in the Juncos Urbano System, several additional measures were included in the joint motion, which included, but is not limited to the following: more stringent drainage control measures, improvements to be performed at the Ceiba Sur WTP by December 2017, and measures to reduce water production to a maximum of 1 MGD at the Quebrada Grande WTP by February 2019. On May 2019, PRASA and PRDOH presented an Amendment to the joint motion for the Quebrada Grande WTP measure previously stated, in which, instead of limiting the water production to a 1MGD, PRASA would implement a series of procedures at operational level. These procedures include, but not limited to, adjustment and control of chlorine application in the treatment process to ensure that the required chlorine residual is maintained throughout the distribution system.

- In May 4, 2018, PRASA and PRDOH had a meeting to discuss several motions to LTP3 projects. A motion was revised and agreed upon on May 11, 2018. No discussions with PRDOH transpired during FY2019, but additional discussions regarding LTP3 projects and other Agreement requirements are expected to be discussed in the near future.
- In addition to the 2006 PRDOH Drinking Water Settlement Agreement, PRASA has agreed with the PRDOH to give priority to the compliance projects required by the LTP2 Enhanced Surface Water Treatment Rule (ESWTR). This rule requires further treatment of cryptosporidium and other pathogenic microorganisms with the purpose of reducing the illness associated with them.
- Moreover, Joint Motion KPE2006-0858 (904) addresses Continuous Monitoring violations of the requirements stipulated on the Appendix C-4 of the 2006 PRDOH Drinking Water Settlement Agreement for PF Aguadilla Urbano. The joint motion specifically includes additional remedial measures determined to address DBP violations. To address DBPs exceedances and meet compliance with these requirements, several additional measures were included, such as: monthly monitoring, tank repairs and cleaning, rehabilitation of filter units, implement and maintain pipelines and tanks flushing program, and operational adjustments.
- Progress Report #45, period April 2019 to June 2019, includes several LTP3 Projects that were completed prior to the December 31st, 2019 deadline. These projects correspond to the following systems: Guzmán Arriba, Metropolitano (La Plata), Esperanza, Tatúm, Guajataca, La Máquina, and Rocha.
- Although, completion deadline for the LTP3 is December 31st, 2021, Ceiba Sur WTP is included on the CIP list and Culebra WTP and La Pica WTP are included in the Prioritization List of the 2015 USEPA Consent Decree Appendix H and I. CIP projects are currently on hold due to funding limitations. For this reason, delays on the completion of this projects may occur and renegotiation of deadlines for LTP3 projects might be expected in the near future.

6.5.3 Consent Decrees and Agreements Progress Reports

The consent decree with USEPA and the settlement agreement with PRDOH require PRASA to implement remedial plans, develop and implement CIP projects to bring the System into compliance with regulatory requirements, and conduct evaluations concerning specific System's infrastructure and

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

operational issues. In the preparation of this CER, Arcadis reviewed the following progress reports, submitted to Regulatory Agencies:

- 2015 USEPA Consent Decree Biannual Progress Report (BPR) No. 6 covering the period from March 1st, 2018 to August 31, 2018; No. 7 covering the period from September 1st, 2018 to February 28th, 2019; and No. 8 covering the period from March 1st, 2019 to August 31st, 2019.
- 2006 PRDOH Agreement Quarterly Progress Reports: No. 42, covering the period from July 1 to September 30, 2018; No. 43, covering the period from October 1 to December 31, 2018; No. 44, covering the period from January 1, 2019 to March 31, 2019; and No. 45, covering the period from April 1 to June 30, 2019.

A summary of the assessed progress reports is presented in the following subsections.

6.5.3.1 2015 USEPA Consent Decree, Civil Action No. 15-2283 (JAG)

As previously discussed, the USEPA consent decrees from 2003, 2006, and 2010, respectively, were consolidated into the 2015 USEPA Consent Decree. The 2015 USEPA Consent Decree requires PRASA to submit BPRs. BPRs No. 6, No. 7, and No. 8 covering from March 1st, 2018 to August 31st, 2019 were considered for this section.

- Up to August 2019, PRASA had been in significant compliance with the consent decree. Yet pressed by the aftermath of the 2017 hurricanes, the efforts needed to restore the System and sustain operations made continued work pursuant to the consent decree extremely difficult and in some cases impossible. In addition, PRASA still facing significant challenges in the recovery process after the 2017 Hurricanes due to funding and staffing limitations.
- To such effect, PRASA requested Force Majeure protection for ongoing and upcoming work and deadlines and stipulated penalties under the 2015 USEPA Consent Decree.
- PRASA, EPA, and USDOJ are currently working towards presenting in court a partial modification of the 2015 USEPA Consent Decree to address the effects of Force Majeure Event.
- On July 26, 2019, PRASA was able to reach a debt restructuring agreement with the funding programs of the Clean Water and Drinking Water State Revolving Funds (CWSRF and DWSRF, respectively). This initiative will allow PRASA access to the funds needed for the execution of CIPs included on the Appendices H and J of the 2015 USEPA Consent Decree. PRASA, CWSRF and DWSRF are currently in the process of completing the new financial agreements and new proposed dates for the Base List that were presented to USEPA on October 2019.
- As reported by PRASA in the BPR No. 6, the reasons that impaired compliance efforts after the 2017 Hurricanes were, or a combination thereof, due to but not limited to:
 - Lack of electricity and/or water
 - Fuel shortage
 - No or poor communication
 - Providing and sustaining operation of installations and equipment with alternate power
 - Destruction or damages to PRASA installations and equipment, including Caguas Central Laboratory's destruction

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Lack of access to equipment within installations
- Logistics
- Emergency and recovery phase priorities
- Inability of personnel to report to work
- Deployment of personnel available to attend emergencies and alternate supply of water and sewer services
- Reestablishment of water and sewer services
- Reinitiating and reopening of offices and installations

The 2015 USEPA Consent Decree specifies that PRASA shall continue to implement systemwide remedial measures at all WTPs STS and at all WWTPs and their corresponding Sewer Systems owned/operated by PRASA.

- Remedial Measures: Remedial measures include the 2006 USEPA Consent Decree and 2010 USEPA STS Consent Decree renegotiated projects as previously discussed and as included in the 2015 USEPA Consent Decree Appendix H (Base List for Remedial Measures to address wash water discharges at WTPs), Appendix I (Capital Projects subject to Prioritization) and Appendix J (Base List of Remedial Measures for WWTPs). Compliance dates were renegotiated with USEPA and vary among projects.
 - All remedial measures regarding wash water discharges as included in the Base List were addressed by February 29, 2016, except for the Ceiba Sur WTP Elimination, which is scheduled for December 2020. However, the construction contract for this project was terminated by convenience due to PRASA's fiscal situation. A new proposed completion date of April 2025 was presented to USEPA as part of the ongoing STS modification discussions between PRASA and USEPA. Proposed completion date is subject on the completion of a financial agreement based on debt restructuring reached for funding under CWA and SDWA revolving funds. PRASA's requested extension is under review and discussions with USEPA.
 - Also, as stipulated by paragraphs 9, 10 and 11 of the 2015 USEPA Consent Decree, flow meter devices with flow totalizers and level indicators were installed at the point of discharge for most WTPs, however there are a number of flow meters and totalizers, and high level alarm that were reported out of service on Table 1 and 2 of the Bi-Annual Report No. 8. These are expected to be repaired between November 2019 to June 2021.
 - As for the WWTPs remedial measures, despite the best efforts taken to implement an infrastructure program to fulfill the commitments established with the Regulatory Agencies, the status regarding PRASA's fiscal situation remained unchanged and PRASA had to request another extension which also included the Force Majeure component. PRASA presented to the USEPA nine outstanding projects as part of the ongoing modification discussion of the 2015 USEPA Consent Decree. The requested extension, currently under review, includes the new completion dates, which are subject to the financial agreement terms to be established based on the CWSRF and DWSRF debt restructuring.
 - PRASA previously completed the process of analyzing the rain and wastewater flow relationships, infiltration/inflow (I/I) studies, for 45 WWTPs. Repair projects for the Sewer Systems with completed I/I studies are included in the Prioritization List with expected completion by 2034.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

However, as per the 2015 USEPA Consent Decree, the repair projects have to be completed by 2021, otherwise the I/I study will have to be updated to address any new conditions or changes on the particular sewer system. In addition, as a result of the Force Majeure events impact on projects schedule in Appendices H, I, and J included on the 2015 USEPA Consent Decree need review and may require changes to meet this requirement. For those reasons, PRASA is currently under renegotiation regarding this matter.

- Modification/Prioritization of Remedial Measures:
 - In a letter dated December 15, 2016 to the USEPA and the USDOJ, PRASA requested a modification of the expected compliance dates established in the Consent Decree Appendices H and J (Base List Projects). The request is premised on the recognized fiscal crisis that the Government of Puerto Rico confronts and its cumbersome path towards to recovery that has impacted PRASA's financial conditions and continuity of its CIP. The proposed revised compliance dates requested were based on the assumption that the CIP would be reactivated by January 2018, which has not happened to date.
 - In addition, as previously stated, as a result of PRASA's Force Majeure notification the extension of the expected compliance dates of the projects established in Appendices H, I and J (Base List and Prioritization List Projects) of the 2015 USEPA Consent Decree may require changes to address the need to develop new and /or modified projects .
 - As previously stated, on July 2019, PRASA was able to reach a debt restructuring agreement with the funding programs of the CWSRF and DWSRF.

The following presents a status summary of the applicable programs, standards and special conditions of probation:

- Sludge Treatment Systems at WTP: Paragraphs 13 and 14 in section VI of the 2015 USEPA Consent Decree stipulates that any new PRASA WTP that begins operation after the day of lodging shall include an alternative power unit (APU) and an STS with sufficient hydraulic capacity to manage wash water discharges. For the period covered in the BPRs No. 6, 7, and 8 there were no new STS constructed.
- SSOMP Program and Condition Assessment Program with respect to the Puerto Nuevo WWTP sewer system: PRASA submitted the SSOMP on June 30, 2016 for comments and approval by USEPA. On May 1, 2017, the Puerto Nuevo 2016 SSOMP Annual Report was submitted to the USEPA. As stated on the Bi-Annual Reports No. 6 and 7, PRASA and USEPA discussed the submission of a consolidated SSOMP Annual Report by May 2019. PRASA submitted a written request to consolidate the report on September 26, 2018. As discussed, and agreed by USEPA, PRASA submitted the first consolidated SSOMP Annual Report 2018 on May 31st, 2019.
 - As of August 31st, 2019 PRASA, has recognized approximate 900,000 linear feet of pipeline that are connected to the Puerto Nuevo WWTP system. As part of PRASA, USEPA, and USDOJ discussions regarding delays caused by the Force Majeure event, an extension of the Sewer System Reconnaissance High Priority Area deadline is being sought up for June 2020 for all sewer lines with a diameter less than 30-inch. For the sewer lines with diameters of 30-inch or greater located within the High Priority Areas, PRASA will complete reconnaissance of the mentioned sewer line by June 30, 2026. Three illegal interconnections to the Puerto Nuevo

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

WWTP sewer system were found during the period of March 1st, 2018 to February 28th, 2019, however one was eliminated on October 2018 and two were eliminated on September 2019.

- By August 31st, 2019, the following has been found and/or achieved regarding the Puerto Nuevo WWTP sewer system:
 - Cleaning of 705,000 linear feet of sanitary sewer pipeline.
 - PRASA contracted four separate sewer cleaning projects that included 320,000 linear feet of sanitary sewer pipeline. In 2019, PRASA started a bidding process to include a project for 193,000 linear feet of sewer cleaning. PRASA will initiate a bidding process for additional sewer cleaning projects in fiscal year 2020.
 - From March 1, 2018, to August 31, 2019, 33 PRASA sewer lines were identified with sewer defects within the Puerto Nuevo WWTP sewer system. Since SSOMP implementation, 164 sanitary sewer defects have been identified and 76 sanitary sewer defects have been corrected. Additional seven sewer defects will be corrected under the CIP Project, when activated.
- PRASA seeks modification of the one-year period to correct defects that hinder the operation of the Puerto Nuevo RWWTP sewer system. PRASA proposes the period of correction for the sanitary defects to be determined based on a case by case evaluation. PRASA and USEPA met in multiple occasions to discuss the criteria to correct defects based on sewer repair and re-inspection criteria; a prioritization process will be established. As a result of Force Majeure Event schedule delay encountered, PRASA has had to reinitiate the process for evaluation of alternatives, PRASA continues to investigate options to monitor the occurrence of discharges from CSWO outfalls and means to estimate the discharge flow. PRASA has acquired level monitors with cellular connectivity for long deployment at the CSWO outfalls. PRASA continues to perform site inspections of the CSWO outfalls and will continue to inform USEPA of Dry Weather overflow events. As part of the discussion between PRASA, USEPA, and USDOJ an extension for January 2020 to estimate the flow of CSWO outfall discharges was presented and sought.
- Puerto Nuevo WWTP sewer system initiatives, PRASA's SSOMP Program and status of FOG Program:
 - On June 2017, PRASA conducted a training program to inspectors and supervisors of the FOG Control Program. During FY2018, prior to the 2017 Hurricanes, a total of 3,509 establishments were inspected island wide.
 - FOG Control Program inspections were suspended between September 2017 and February 2018 as PRASA resources were reassigned to recovery efforts.
 - On March 2018, PRASA resumed the public education program. Orientations and meetings were held with food associations, non-profit organizations, government agencies and municipalities to introduce the new requirements and guidelines of the program. The inspections schedule was established according to the Prioritization System.
 - From March 2018 to August 2019, PRASA conducted refresh training to approximate 72 inspectors and supervisor, which included the following topics: overview of the FOG and POGS Control Program, grease control equipment requirements, inspection process, best management practices and education program. Furthermore, on June 2019, PRASA

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

launched a public educational campaign entitled: “*Tuberías Limpias*”. The goal of the campaign is to educate citizens, establishments, and industries about the proper management of fats, oils, and grease. Summary of inspections conducted from March 2018 to August 2019 are included on **Table 6-3** below:

Table 6-3. Summary of FOG Program Inspections March 2018 to August 2018

Region	Number of Inspections
East	3,284
Metro	5,672
North	3,186
South	2,682
West	2,328

- PRASA corrected all 12 Dry Weather Overflows that were notified to USEPA for the period encompassed by BPRs No. 6, 7, and 8.
- PRASA performed a pilot study to evaluate flow/level monitoring technologies, but after assessing the results it was determined that they were not feasible due to the physical configuration of the outfalls and the hydraulic conditions. PRASA continues to investigate alternatives to monitor occurrence of CSWO and conducting site inspections. As of BPR No. 8, PRASA presented to USEPA an extension request for January 2020 to estimate the flow of CSWO discharges. As part of the USEPA/USDOJ/PRASA discussions regarding the Notifications of Force Majeure events, said extensions are being presented and discussed.
 - Three sanitary sewer overflow events have not been corrected within a six-month period of the BPRs No. 6, 7, and 8 are:
 - BPR No. 6: Villa Margarita Ward. St. 175, Km. 2.12 E-29 - Trujillo Alto due to complexities encountered and additional costs required, an amendment to the contract is needed to complete the project.
 - BPR No. 7: 406 St. Alcaniz San José San Juan- expected completion November 2019.
 - BPR No. 8: Calle Loíza Esq. San Jorge, San Juan- expected completion December 2019.
- Caño Martin Peña Projects: None of these projects were performed during the period of March 2018 to August 2019. These projects are contingent upon the completion of related prerequisite projects to be developed by parties not affiliated with PRASA.
- Puerto Nuevo WWTP Sewer System Evaluation and Repairs:
 - Paragraph 34 of the consent decree establishes that a study and mapping of the Barriada Figueroa Sanitary Sewer System shall be completed and submitted by December 1, 2016. However, PRASA submitted a status report of the sewer inventory and mapping project on March 17, 2017. The final report was submitted to EPA on March 29, 2019.
 - Sewer Systems and Mapping Projects:

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- PRASA submitted to USEPA electronic maps of its Puerto Nuevo WWTP Sewer System in GIS format on December 28, 2016.
- PRASA included the Puerto Nuevo WWTP Sewer System revised maps into the consolidated SSOMP Annual Report 2018 submitted on May 2019.
- As of February 28th, 2019, PRASA GIS has identified approximately 116,000 linear feet of gravity sewer mains, a 52% increase of the amount previously mapped.
- At least 700 sewer manholes were identified with additional information included in the PRASA GIS.
- A total of 96% of PRASA linear assets within the Barriada Figueroa sewer system were successfully recognized.
- Linear feet of sanitary sewer system that was cleaned: During the Barriada Figueroa project, approximately 79,000 linear feet of gravity sewer main were cleaned at least once.
- o Several areas of concern (18) within the Puerto Nuevo WWTP system were identified on Paragraph 36 of the 2015 USEPA Consent Decree. Remedial measures were stipulated for each one of these areas and PRASA addressed the corresponding actions for each of the measures. As a result of the Force Majeure Events raised, certain actions for the areas of concern identified were not fully undertaken. Food establishment related activities under the Areas of Concern Program halted and resumed March 18, 2018. Additionally, on February 21, 2018, PRASA requested USEPA to remove two particular areas of concern (Highland Park Residential Development and Montecarlo Residential Development) from the listed areas on Paragraph 36 of the Consent Decree and such request was granted. In addition, on May 2019, PRASA submitted a request to USEPA to include a new location to the Area of Concern List as established on the 2015 USEPA Consent Decree for a total of 17 active Areas of Concern.
- Interim Effluent Limits for WTPs and WWTPs: PRASA has continued to monitor compliance with the interim limits as established in Appendices S and T (Interim Effluent Limits for WWTP's and WTPs) and final NPDES limits. Notwithstanding, the Force Majeure events impact to treatment facilities and water sampling equipment have affected PRASA's effluent monitoring data activities. Therefore, despite preparatory measures and best efforts taken, PRASA has been unable to meet the full breath of its water quality sampling and analysis, and reporting obligations under the CWA and 2015 USEPA Consent Decree for all its facilities. The reasons attributable to PRASA's inability to do so were and are:
 - o Water Quality Sampling: PRASA operated with a Central Laboratory located in the Municipality of Caguas and satellite laboratories in the Municipalities of Arecibo, Mayaguez and Ponce. The Caguas Laboratory, PRASA's full scale laboratory, was severely damaged by Hurricane María. As stated on BPR No. 6, PRASA resumed discharge sampling and analysis of the 51 WWTPs and 113 WTPs for the STS. PRASA has established a temporary lab at Caguas, while the new Central Lab is finalized. Currently, the demolition project was awarded and is ongoing. However, this temporary lab is only partially certified, approximately for 60-70% of analysis requirements. Therefore, private laboratories are still under contract for the bulk of the water sampling and analysis.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- NPDES Permit Compliance, Interim and Financial Limits: PRASA's compliance with NPDES permit limitations at its WWTP's, WTP's, and STS's were too jeopardized by the passing of the hurricanes. Until facilities and sewer lines repairs are completed PRASA compliance with permit and 2015 USEPA Consent Decree limitations is compromised. For NPDES obligations not being complied, including new restrictive limits of some parameters, PRASA continues to seek interim limits protection.
- For the period covered by the BPRs No. 6 and 7, there were requests and renegotiations of Interim Limits. Appendix 13 and 14 of the respective BPR includes a letter of the Interim Limits Renegotiation Summary sent on to the USEPA. Parameters renegotiated include: Enterococci, Phosphorus, Total Nitrogen, Copper, Cadmium, Silver, Zinc, Lead, among others.
- PRASA's IMP: FEMA and USACE are collaborating with PRASA in obtaining and providing EGU's for PRASA installations. As of August 31, 2019, a total of 34 EGU's provided by FEMA and other 62 rented EGU's were installed at multiple PRASA locations. The equipment calibrations were performed as usual; however corrective maintenance was executed with limitations. As stated on the Bi-Annual Reports No. 7 and 8 for the period covered, preventive and corrective maintenance continues being implemented with limitations. The program is currently working with Human Resources Department in recruiting towards the restructuring of the IMP.
- Corrosion Control Program (CCP): Consent Decree's section XV, paragraph 54 states that no later than March 1, 2017 PRASA shall develop and submit to USEPA for review and approval a CCP. The CCP was submitted on June 1, 2017 per time extension granted by USEPA. Development of such program has been impaired by the 2017 Hurricanes. PRASA began implementation of the CCP with site visits conducted on September 3rd, 2019 .
- Operator Training Program: Per paragraph 56 of the 2015 USEPA Consent Decree stipulate that all new STS or WWTP operators hired by PRASA must be trained in monitoring, recording, and reporting requirements of the individual NPDES Permits as applicable. During the period of February 28, 2018 to August 1st, 2019, PRASA hired 70 operators. Eight (8) operators that still within the 24 months window from the hiring date are on schedule to take the training. In accordance with recent restructuring the Directorate of Training and Continued Education, improvements to SAP are ongoing to accommodate and adjust the needs as part of the automation process changes regarding PRASA's Training Program.
- Process Control Systems (PCSs): PCSs are being implemented at PRASA's WTP STSs and WWTPs as stipulated by Paragraph 59 of the 2015 USEPA Consent Decree. During the period from March 1st, 2019 and August 31st, 2019 (BPR No.8) the PCS revisions and updates started at Metro and West Regions and it is expected to be completed by June 30th, 2020. For East, North, and South Regions according to the scheduled discussed with USEPA, the PCS revisions and updates are expected to be completed by June 30th, 2021.
- Spill Response and Cleanup Plan (SRCP): PRASA submitted the updated version of the plan on March 25, 2016. The review process of the updated SRCP was interrupted by the 2017 Hurricanes. As part of the pending meetings between PRASA and USEPA, the updated review process is expected to be resumed.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Monitoring, Records and Reporting requirements for Unpermitted STS: In accordance with Section XIX, Paragraph 66 of the Consent Decree the STSs identified pending NPDES Permit applications at the time of lodging of the Consent Decree are and their NPDES Permit status is:
 - For the period covered on the BPRs No.6, 7, and 8 all PRASA's STSs have a final NPDES Permit,
 - WWTP Capacity and Flow Management: PRASA reported that Force Majeure events impact to treatment facilities have affected PRASA's flow monitoring equipment and flow monitoring activities.
 - Wastewater Treatment Capacity and Flow Management: In accordance with paragraphs 70 and 71 of the 2015 Consent Decree, flow meter devices with flow totalizers and level indicators were installed at the point of discharge of most WWTPs, however there were a number of equipment (flow meters and totalizers) that were reported out of service on the BPR No. 8 that are expected to be repaired by the end of 2019.

Stipulated Penalties: During the period from March 1st, 2018 to August 31st, 2019, consisting of BPRs No. 6, 7, & 8), penalties were not assessed or adjudicated due to the Force Majeure protection still in force.

6.5.3.2 2006 PRDOH Drinking Water Settlement Agreement

As part of the 2006 Drinking Water Settlement Agreement between PRASA and the PRDOH, PRASA submits a Quarterly Settlement Agreement Reports (QSAR). Arcadis reviewed QSARs number 41 through 45 covering the period from April 1, 2018 through June 30, 2019. Section VII of the 2006 PRDOH Settlement Agreement states that PRASA will implement remedial actions in multiple systems or components. These remedial measures are classified as short, mid, and long-term remedial measures. A summary of the status of the remedial actions as of August 31st, 2019 is described below.

- Long-Term Measures 3: LTP3 projects have completion deadline of December 2021. As of the period evaluated, July 1st, 2019 through June 30th, 2019 none of the eight outstanding projects were completed. The eight projects are: Monte del Estado WTP, La Pica WTP, Frontón WTP, Canalizo WTP, El Duque WTP, Culebras WTP, the elimination of Ceiba Sur WTP and Quebrada Grande WTP. As previously mentioned, the elimination of Ceiba Sur WTP and Quebrada Grande WTP were LTP2 projects renegotiated via a joint motion with PRDOH to be completed under Term 3 projects. Two of the remedial measures are going to be renegotiated with the PRDOH to be eliminated; these are El Duque WTP and Canalizo WTP projects. Two projects (Monte del Estado WTP and Culebras) were included in the Prioritization List of the 2015 USEPA Consent Decree with expected completion date in 2032 and 2033, respectively. PRASA expects to renegotiate with PRDOH some of the completion dates for the outstanding projects.
 - The project for the decommission of the Vega Baja WTP was completed in August 31, 2018, as part of the PRDOH ATE Certification Civil Action No. KPE 2006-0858 (904).
- Continuous Monitoring Program: Section VII of the Settlement Agreement states that PRASA shall implement a Continuous Monitoring Program in all the WTPs. Continuous monitoring is implemented at each individual filter effluent and in the combined filter effluent. Each month PRASA submits to the PRDOH a compliance certification, which are included in each of the corresponding Settlement Agreement Reports.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- QSAR No. 42 states that PRASA submitted the required compliance certification for the period of July, August and September 2018 to the PRDOH as agreed in the Section VII of the Settlement Agreement.
- QSAR No. 43 states that PRASA submitted the required compliance certification for the period of October, November, and December 2018 to the PRDOH as agreed in the Section VII of the Settlement Agreement.
- QSAR No. 44 states that PRASA submitted the required compliance certification for the period of January, February, and March 2019 to the PRDOH as agreed in the Section VII of the Settlement Agreement.
- QSAR No. 45 states that PRASA submitted the required compliance certification for the period of April, May, and June 2019 to the PRDOH as agreed in the Section VII of the Settlement Agreement.
- **Process Control Program:** Section VII of the Settlement Agreement states that PRASA shall develop a program aimed to optimize treatment processes to be implemented in larger systems. As per Quarterly Progress Report No. 44, PRASA met with the parties involved in this program. On Dec. 14, 2018 PRASA submitted the proposal for the language to be used, as agreed. Also, PRASA must implement preventive measures on those systems with frequent DBPs violations as stipulated in Section IX. PRASA will discuss with the PRDOH the amendment to the agreement.
- **Training Program:** As stipulated in Section XI, PRASA must train all personnel for the adequate operation and management of its facilities. As of March 31st, 2019, 100% of the required employees completed the training. In accordance with recent restructuring, the Directorate of Training and Continued Education, improvements to SAP are ongoing to accommodate and adjust the needs as part of the automation process changes regarding PRASA's Training Program.
- **Stipulated Penalties:** During the period from July 1st, 2018 to June 30th, 2019 PRASA incurred in penalties related to exceedances to the primary standards, required deliverables, remedial measures, and mitigation measures. The amount of the penalties PRASA incurred during this period added up to \$861,200, as summarizes in **Table 6-4**. Furthermore, it is important to note that 90% of the penalties were associated to missing or late deliverables and 9% was related to primary standard DBPs exceedances; while 1% was related to other penalties including primary standards such as Bacteriology, Turbidity, and CT, and Remedial Measures and Mitigation Measures. Penalties associated to these requirements represented only 1% of the total amount. Some of the measures included in the action plans currently being implemented are the following: tank oscillation, lowering tank levels, elimination of tanks, elimination of pre-chlorine injection points, flushing, among other initiatives.

Table 6-4. Stipulated Penalties

Reporting Period	Penalty Amount
July 1, 2018 to September 30, 2018	\$32,825.00
October 1, 2018 to December 31, 2018	\$710,675.00
January 1, 2019 to March 31, 2019	\$12,900.00

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Reporting Period	Penalty Amount
April 1, 2019 to June 30, 2019	\$104,800.00
Total	\$861,200.00

- Supplementary Environmental Project (SEP): The SEP project presented to PRDOH, was divided in three projects and it impacts Non-PRASA Water Systems that due to technical, administrative or financial limitations, find it difficult to operate and maintain a public water system in compliance with state and federal laws and regulations. The project is divided as follows:
 - Sampling and analysis of regulated chemical contaminants in potable water. The task was completed.
 - Installation of disinfection equipment, which was already completed as previously reported.
 - PRASA service connections to schools served by Non-PRASA systems. The task was completed.
- A second SEP project was presented to PRDOH. The project's proposed title is "*Segundo Proyecto Ambiental de Salud Publica en Sistemas de Agua Públicos Comunes no servidos por la AAA, conocidos como sistemas Non PRASA, para el Muestreo de Contaminantes Químicos Regulados en Agua Potable*" or Second Environmental Public Health Project in a Community with a Public Non PRASA Potable Water System for the Sampling of Regulated Chemical Contaminants in Potable Water, in English.
 - An escrow account with an initial deposit of \$563,700.00 was opened by PRASA on June 7, 2017 for the funding of the second SEP project.
 - Through a bidding process, PRASA awarded the second SEP project to Environmental Quality Inc. and the contract was signed on July 18th, 2019.

6.6 Future Regulations and Other Regulatory Requirements

The CIP was reviewed for adequacy to comply with future regulations and other regulatory requirements that could impact compliance limits for PRASA's water and wastewater facilities. With respect to the new discharge limits for residual chlorine, nitrogen, and phosphorus, PRASA is mostly using interim limits due to their inability of meeting the new lower limits for the abovementioned parameters as a result of the fiscal situation which prevents PRASA from optimizing treatment and increasing the removal of these contaminants.

Regarding wastewater systems, PRASA has indicated that once the sewer system improvements in the Puerto Nuevo WWTP service area are completed, it will expand the program to the rest of the Metro Region and, eventually, to the rest of the island (where applicable). At this time, PRASA does not have a specific time frame for when this will occur. However, it is likely that USEPA will include conditions and requirements such as those included in the Puerto Nuevo WWTP NPDES, on the NPDES permits for other facilities.

Regarding the water system, future regulations for potable water systems (PWSs) include:

- Unregulated Contaminant Monitoring Program – The USEPA uses the Unregulated Contaminant Monitoring Program to collect data for contaminants suspected to be present in drinking water, but do not have health-based standards set under the SDWA. Every six years, the USEPA reviews the list of contaminants, largely based on the Contaminant Candidate List (CCL). Unregulated contaminant data gathered will help USEPA shape the future regulatory environment.
- Candidate Contaminant List – The CCL is a list of contaminants which are currently not subject to any proposed or promulgated national primary drinking water regulations but are known or anticipated to occur in public water systems, and that may require regulation under the SDWA. The list includes pesticides, DBPs, chemicals used in commerce, waterborne pathogens, pharmaceuticals, biological toxins, among others.
- Also, as previously noted, PRASA will be likely required to implement remediation measures in water wells that, under the GWUDI regulation, are found to be influenced by surface water sources. Currently, the evaluation program is still underway. PRASA continues the evaluation process at these facilities to determine the improvement needs and to develop the well remediation program and action plan.
- On October 10, 2019, USEPA announced the proposal for the revision of the Lead and Copper Rule. Under the proposal new actions include but not limited to identifying the most impacted areas, strengthening drinking water treatment, replacing lead lines, increase drinking water sampling reliability, improving risk communication to customers, and better protecting children in schools and child facility cares. PRASA must be wary of these new Rules, if approved.

Finally, PRASA may identify additional CIP needs to bring the water system into compliance with the Stage 2 D/DBPR. PRASA is currently implementing changes in its O&M practices to bring and/or maintain the PWSs in compliance. However, any additional projects identified and included in PRASA's CIP will be subject to prioritization system.

6.7 Conclusions

PRASA's six-year CIP generally addresses the needs of the System and complies with PRASA's existing commitments with Regulatory Agencies. It includes projects that cover a broad array of current and future needs, as identified by PRASA, and as required by consent decrees and agreements. The six-year CIP also includes funding for minor repair projects and PRASA's R&R program, as well as funding for recovery efforts and for System resilience/strengthening. Most of the projected six-year CIP investment is related to Emergency/Permanent Work projects. However, as noted in previous reports, given PRASA's high rate of leaks and overflows and continuing aging infrastructure, additional funds and a reactivation and acceleration of the R&R program are required to reduce and minimize these incidences. Hence, PRASA may need to further re-prioritize its funding and capital projects to address these critical system issues. Finally, PRASA's six-year CIP includes funding for maintenance improvements, as well as for other necessary infrastructure projects (i.e., fleet and building renovation, and technological improvements) essential to maintaining and preserving the utility assets.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

After continuous efforts of PRASA to explore and find opportunities for funding of compliance projects, on July 26, 2019, PRASA was able to reach a debt restructuring agreement with the funding programs of USDA RD, and USEPA CWSRF and DWSRF. This will allow PRASA to access new funding sources through these programs to execute compliance-driven projects.

PRASA will need to perform additional assessments and implement operational changes or additional capital improvements to bring non-compliant facilities into compliance. Also, as the impact of future regulations becomes more defined, CIP modifications will be required to adequately accommodate resulting needs. One of these future regulations is the Lead and Copper Rule, which is currently under revision to become more stringent.

PRASA continues to evaluate the potential impact of new regulations; however, the full impact of future regulations and other regulatory requirements on PRASA's System are not known at this time. In some cases, future regulations and additional regulatory requirements are expected to require minor process changes and in other cases major capital improvements, such as construction of new treatment processes and intensive repair programs. As the impact of future regulations becomes more defined, CIP modifications may be required to adequately accommodate resulting needs. These CIP needs, as negotiated or as currently being negotiated with Regulatory Agencies, will be prioritized and implementation schedules will depend on PRASA's financial capacity.

Lastly, additional CIP needs will need to be prioritized and implementation schedules will depend on PRASA's funding sources. To the extent that PRASA's fiscal situation does not improve and that the identification of CIP financing continues unresolved, PRASA's CIP will continue on hold. The delay in CIP reactivation and implementation could further affect the condition of the System and PRASA's ability to meet regulatory obligations, including environmental compliance regulations under the SDWA and the CWA.

7 INSURANCE PROGRAM

7.1 Introduction

Section 7.08 of the MAT establishes that “[PRASA] shall employ an Insurance Consultant to review the insurance program of the Authority from time to time (but not less frequently than biennially). If the insurance Consultant makes recommendations for the increase of any coverage PRASA shall increase or cause to be increased such coverage in accordance with such recommendations, subject to a good faith determination of PRASA that such recommendations in whole or in part are in its best interest.”

Arcadis has reviewed PRASA’s current insurance coverage and determined its adequacy considering the type and value of PRASA’s fixed assets. Also, addressed in the following sections, are some outstanding recommendations to PRASA’s insurance coverage from a previous evaluation originally made by MARSH and validated or commented by AON, PRASA’s Broker of Record (BOR) in FY2016. The BOR for FY2017 and FY2018, Lone Star Insurance Producers, LLC (Lone Star), was consulted to verify if the recommendations were addressed in the policy renewals or if they were not adopted. For FY2019 PRASA changed its BOR from Lone Star to Goas & Associates, Inc (GOAS). Furthermore, the policies for FY2019 suffered changes, in some cases significant changes in coverage and primarily in premiums, as an effect of the upshot of the hurricanes that struck Puerto Rico on September 2017. In addition to the 2017 Hurricanes, insurance companies may have dealt with other catastrophic events impacting the Caribbean and the United States. The vast damages and losses suffered by the insured directly impacted the insurance market and resulted in premiums increases, stricter subscription guidelines and risk assessments. The data, opinions, and comments included in this section have been based on PRASA’s copies of policies and other documents provided by PRASA for this purpose.

PRASA maintained GOAS as its BOR for the 1st quarter of FY2020 but decided to change to *Fedelta Insurance* as its BOR for the rest of FY2020.

7.2 Risk Management

Risk is exposure to loss. It is the chance of something happening that will lead to a loss or an undesirable outcome and it is measured in terms of consequences and likelihood. Risk management is an effective process that is directed towards management of risks and hazards to produce a desired set of results.

The treatment of risk takes the following forms:

- Loss Control:
 - Elimination or reduction of risk by physical, technical or mechanical means, loss prevention techniques, loss prevention engineering.
- Contractual transfer:
 - Hold harmless agreements, indemnity agreements in contracts with suppliers, contractors, service providers, customer agreements.
- Transfer of risk through insurance:

- Self-insurance.
- Insurance policies and coverage available from insurance companies.
- Insurance products/programs available from government's Federal Emergency Management Agency (FEMA) and state (Commonwealth of Puerto Rico) including workers' compensation, and health/medical, among others.

7.2.1 PRASA Insurance Department

The risk management function is an integral part of the management function. Within PRASA, risk identification and treatment are performed by all departments at all levels in conformity with local and federal regulations, including the Occupational Safety and Health Administration (OSHA) regulations. Risk management is applied through the employment of independent engineering and consulting firms in planning, design, and construction and in the implementation of excellence in practices and processes. Furthermore, new construction is carried out in accordance with applicable building codes and regulations.

7.2.2 Identification of Risk

The risks affecting PRASA can be broadly categorized as follows:

1. Risks to property, facilities, and physical assets from natural and human causes.
2. Financial risks arising from damage to, or loss of, physical assets, such as loss of income, interruption of operations and an increase in operating expenses to continue operations.
3. Financial risks resulting in management liability related to economic downturns.
4. Regulatory issues that might result in liability or service interruption.
5. Theft of owned and non-owned property.
6. Theft of water production.
7. Liability risks, including suits from third parties for injury or loss of property, fines/penalties, injuries caused by vehicles or properties, advertising injury, products, libel, slander, false arrest/detainment and injuries occurring on or off premises.
8. Pollution liability claims and fines.
9. Public authority/errors and omissions liability, which is liability arising from financial loss incurred by other that does not result in physical injury to persons or property.
10. Reputation risk which includes incidents, events or human actions which seriously damage the image and reputation of the organization.
11. Epidemic or pandemic that causes wide-spread injury or sickness to PRASA employees.
12. Kidnap, ransom, extortion risks.
13. Privacy & Cyber Liability arising from alleged failure to adequately secure customer data.
14. Acts of Terrorism affecting PRASA's facilities or customers.

15. Strikes and Labor unrest causing loss of income, interruption of operations and an increase in operating expenses to continue operations.

7.3 Assessment of Insurance Program

This section of the report provides MARSH's outstanding recommendations and BOR's responses/confirmation with respect to PRASA's insurance policies currently in force.

7.3.1 Property Insurance

The following are the findings and recommendations under the Commercial Property Program for FY2019 placed through MAPFRE PRAICO Insurance Company (MAPFRE). PRASA's Schedule of Values amounts to \$11,021,002,890.00.

PRASA's property is insured by a policy issued by MAPFRE and includes the London & International Markets. Renewal of the policy occurred in April 2018 and extended until April 2019. PRASA's premium for all coverage under this policy was \$16,112,931; \$13,500,000.00 for Primary coverage and \$2,612,931 for 1st Layer coverage. Other insurance companies are shown on the MAPFRE policy as "subscribers." This means they have each agreed to bear a portion of each loss, as follows:

Primary of \$150M with \$100M SIR:

- MAPFRE – assumed 42% of \$150M primary; PRASA's premium share for this policy amounts to \$5,670,000.00.
- Certain Underwriters at Lloyd's & International Markets – assumed 58% of \$150M primary; This has several subscribers from London and from International markets covering the 58%. Refer to Policy for details. PRASA's premium share for this policy amounts to \$7,830,000.00

1st Layer of \$150M in excess of \$150M with \$100M SIR:

- MAPFRE – assumed 42% of \$150M in excess of \$150M; PRASA's premium share for this policy amounts to \$1,097,431.02.
- International General Insurance (IGI) – assumed 38% of \$150m in excess of \$150M. PRASA's premium share for this policy amounts to \$992,913.78.
- Houston Casualty Company (HCC) – assumed 15% of \$150M in excess of \$150M. PRASA's premium share for this policy amounts to \$391,939.65.
- Ironshore Insurance Ltd. – assumed 5% of \$150M in excess of \$150M. PRASA's premium share for this policy amounts to \$130,646.55.

Coverage is written on an "all risks" basis. The policy insures real and business personal property, impounded water, dams, underground piping and covers business interruption resulting from covered physical damage/loss to property as stated in the policy.

Major policy limits and deductibles are shown in **Table 7-1**.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 7-1. FY2019 Property Coverage, Limits and Deductibles

Coverage	Limit	Deductible
Total Insurable Value	\$300 million	As stated below
Property – All Other Perils (AOP) (including Data Processing, In Transit and equipment breakdown)	\$150 million per occurrence, All Risks of Direct physical Loss or damage Insurance including Business interruption and Extra Expense, excess of applicable deductibles.	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Windstorm	Included in \$150 million property coverage.	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Earthquake (EQ)	\$150 million Combined Single Limit for Property Damage and Business Interruption each and every occurrence, excess of applicable deductibles and excluding wind driven water.	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Flood	\$150 million Combined Single Limit for Property Damage and Business Interruption each and very occurrence, excess of applicable deductibles and excluding wind driven water.	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Business Interruption	Included in \$150 million property for AOP.	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Extra Expense	Included in \$150 million property for AOP, subject to a \$35 million Sublimit	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Contingent Business Interruption	Included in \$150 million property for AOP, subject to a \$35 million Sublimit	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Coverage	Limit	Deductible
Professional Services Fees	Included in \$150 million property for AOP, subject to a \$2 million Sublimit	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Newly Acquired Locations	Included in \$150 million property for AOP.	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery
Boiler and Machinery	Included in \$150 million property coverage	\$100 million Each and every occurrence combined for Property Damage and Business Interruption, including Windstorm, Flood, Earthquake and Boiler & Machinery

In addition, property insurance coverage for: Asbestos with \$1M Sublimit, Professional Fees with \$2M Sublimit, and Contingent Business Interruption / Extra Expense with \$35M Sublimit. All Sub-limits are part of and not in addition to the Loss Limits and are per occurrence.

PRASA was able to collect the \$300M coverage in the policy from the Insurance for the Hurricane María event. About half went to cover Business Interruption and the remaining will be used for projects. Moreover, PRASA is still in the process of negotiations with the Insurance for the claims regarding Hurricane Irma and post hurricane heavy rains. PRASA can claim up to the limit of \$300M for each event. Furthermore, it is important to note that PRASA will claim FEMA for assistance to pay for the damages not covered by the Insurance.

Renewal of this policy for FY2020 covers from April 2019 and extends until April 2020. The policy coverages for the primary and each excess layer remains the same as presented in **Table 7-1**. As the policy premiums significantly increased from FY2018 to FY2019 already, for FY2020 they remained the same at \$16,112,931.

The new Policy coverage is as follows:

- Total Insurable Limit of \$300M.
- Primary of \$150M with \$100M SIR: MAPFRE assumes 42% of \$150M (\$63M); Certain Underwriters at Lloyd's assumes 29% of \$150M (\$43.5M); Sompo International assumes 10% of \$150M (\$15M); Axis assumes 9% of \$150M (\$13.5M); and IGI assumes 10% of \$150M (\$15M). PRASA's premium share for this policy amounts to \$13,500,000.00, distributed between the providers. Refer to item 1 below.
- First Layer of \$150M in excess of \$150M, with \$100M SIR: MAPFRE assumes 42% of \$150M in excess of \$150M (\$63M); IGI assumes 43% of \$150M in excess of \$150M (\$64.5M); and HCC (UK branch) assumes 15% of \$150M in excess of \$150M (\$22.5M). PRASA's premium share for this policy amounts to \$2,612,931.00, distributed between the providers. Refer to item 2 below.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

1. All Risks, including Windstorm, Flood, Earthquake and Boiler and Machinery: \$150 million per occurrence, Combined Single Limit for Property Damage and Business Interruption, excess of applicable deductibles. Deductible of \$100M Property Damage and Business Interruption combined each and every occurrence.
2. Earthquake and Flood (excluding wind driven water): \$150 million per occurrence, Combined Single Limit for Property Damage and Business Interruption, excess of applicable deductibles. Deductible of \$100M Property Damage and Business Interruption combined each and every occurrence.

In addition, property insurance coverage for: Asbestos with \$1M Sublimit, Professional Fees with \$2M Sublimit, and Contingent Business Interruption / Extra Expense with \$35M Sublimit. All Sub-limits are part of and not in addition to the Loss Limits and are per occurrence.

Recommendations

After reflecting on the financial burden and stress caused by the significant damages of Hurricanes Irma and María, the bureaucracy and slow progression of reimbursements, and even with PRASA's Rainy-Day Fund of around \$20 million for eventualities and the Operating Reserve Fund (which had over \$40 million), PRASA should consider establishing a FUND to cover possible financial losses from any future catastrophic or any non-catastrophic, peril that might affect infrastructure and operations and, therefore, impose an unexpected financial burden.

Recommendations & Responses Unrelated to Policy Contract

The following outstanding recommendation was previously made by MARSH including AON comments, regarding PRASA's property insurance policy. Also, included is confirmation of action by Lone Star of said recommendations:

1. The current Property Maximum Loss (PML) Estimates for PRASA for quantifying Catastrophic Risk Exposures were performed in 2010 by MARSH Risk Consulting, through AIR Worldwide Corporation, based on a valorization study from 2006. Since then, modules, maps and projections have changed, and new modules might prove economically beneficial to PRASA; therefore, MARSH strongly recommended that PRASA undertake a new PML Study.

AON agreed with this recommendation. Lone Star indicated that PML analysis was performed for underwriting purposes only, resulting in FY2018 policy limits being accepted by PRASA.

Nevertheless, Arcadis still recommends that PRASA undertake a new PML study particularly after the impacts and lessons learned from the September 2017 major hurricanes.

7.3.2 Crime

PRASA maintains a crime policy issued by Chubb, providing the coverage and limits shown in **Table 7-2** for loss discovered during the policy period. Renewal of policy occurred in July 2018 and extended until July 2019. The premium remains the same at \$28,500. However, the significant change is that the deductibles for each crime coverage increased 650% from \$10,000 to \$75,000. This escalation on crime coverage deductibles resulted from Chubb's Head Office instructions, applicable to all the accounts they manage.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 7-2. FY2019 Crime Coverage, Limits and Deductibles

Coverage	Limit	Deductible
Employee Dishonesty – Insured Indemnity	\$1 million	\$75,000
Employee Dishonesty – Employee benefit Plan (ERISA) Indemnity	\$500,000	\$0
Forgery or Alteration	\$1 million	\$75,000
Loss Inside Premises	\$1 million	\$75,000
Computer Fraud and Fraudulent Transfer Instructions	\$1 million	\$75,000
Audit Expense	\$150,000	\$0
Loss Outside Premises (In Transit)	\$1 million	\$75,000
Securities	\$1 million	\$75,000
Claim Expense	\$150,000	\$0
Voiced Initiated Transfer	\$1 million	\$75,000
Extortion Threats to Persons	\$100,000	\$75,000
Extortion Threats to Property	\$100,000	\$75,000
Counterfeit Currency and Money Orders	\$1 million	\$75,000
Policy Aggregate	\$1 million	Not Applicable

Renewal of this policy for FY2020 covers from Sep 2019 and extends until Sep 2020. Coverage and limits are the same as shown in **Table 7-2**. The premium increase to \$50,000.00. Deductibles were reduced to \$50,000.00.

Recommendations & Responses

The following pending recommendation was previously made by MARSH including AON comments regarding PRASA's Crime Policy. Also, included is confirmation of action by Lone Star of said recommendations:

1. Knowledge or Discovery of Loss clauses should be re-negotiated to specifically identify positions triggering knowledge of incidents to minimize the risk of carrier declines for late reporting.

AON agreed with this recommendation and requested insurer for an endorsement. Lone Star confirmed that this was not included in the FY2018 policy.

It is recommended to include in the next renewal. Arcadis requested confirmation from GOAS via PRASA. At the time of submission of this Report, no response has been provided to confirm whether

the recommendation was adopted for the FY2019 policy. However, Arcadis was able to verify Endorsement, Amend Section 6, Notice (first paragraph) was included in the 2019-20 renewal.

7.3.3 General Liability

PRASA's FY2019 commercial general liability program is issued by MAPFRE with the limits detailed in **Table 7-3**, below. Renewal of policy occurred in July 2018 and extended until July 2019. Policy aggregate limit of \$20 million. Also, aggregate limits apply per location and per construction project as per ISO forms CG-2504 (03-97), and CG-2503 (05-09), attached to the MAPFRE policy. A \$100,000 Deductible Liability Insurance, as per ISO form CG-0300 (01-96), which contemplates both indemnity and claims adjustment expenses for bodily injury and property damage liability combined under premises/operations coverage; applies to each occurrence. This Deductible Liability Insurance has a \$750,000 Aggregate or Cap as respects to claims adjustment expenses per policy year, so once this amount is paid by PRASA, the Insurance Company will pay these amounts from the first dollar and the Self-Insured Retention (SIR) would apply to indemnity payments only. Additionally, policy includes a SIR of \$5,000.00 for each occurrence or offense not covered by Underlying Insurance.

Table 7-3. General Liability Coverages and Limits

Coverage	Limit
General Liability – Each Occurrence	\$1,000,000
General Liability – General Aggregate	\$2,000,000
Personal and Advertising Injury	\$1,000,000
Products - Completed Operations Aggregate	\$2,000,000
Damage to Premises Rented	\$1,000,000
Medical Expense	\$10,000
Employer's Liability Stop-Gap (Bodily Injury by Accident)	\$1,000,000
Employer's Liability Stop-Gap (Bodily Injury by Disease)	\$1,000,000
Employee Benefits Liability	\$1,000,000

Both the Stop-Gap Liability (Bodily Injury by Disease) and the Employees Benefit Liability have \$1M limit Aggregate. The deductible for Employees Benefits Liability is \$1,000.

Renewal with MAPFRE of this policy for FY2020 covers from July 2019 and extends until July 2020. Coverage and limits remain the same, as shown in **Table 7-3**. The premium remains the same at \$920,550.

Recommendations & Responses

The following pending recommendations were previously made by MARSH including AON comments regarding PRASA's general liability program. Also, included is confirmation of action by Lone Star of said recommendations:

1. Under the "Special Conditions" endorsement attached to the MAPFRE policy; MARSH recommended the following amendment be performed.

- a. Severity of Interest (item 9) should be revised to read Severability of Interest.

Arcadis agrees with AON previous recommendation and recommends that it should be included in the next policy renewal.

Change was included in the FY2020 renewal.

2. Commercial General Liability program excludes coverage for any Terrorism event. Considering the Insured operations and act of Terrorism is an important and potentially severe exposure with considerable implications. MARSH recommended that Terrorism coverage should be considered under PRASA's Commercial General Liability program.

AON agreed with this recommendation and has urged PRASA to include such coverage on renewals but PRASA has declined the recommendation.

This was not included in the FY2019 policy nor the FY2020 renewal. PRASA continues to decline its inclusion, citing that it will represent an increase on premium.

Nevertheless, Arcadis still recommends that it should be included in the policy.

3. Commercial General Liability program excludes coverage for Fungi or Bacteria (CG 2167 (12-04). Considering the lessons learned after the 2017 Hurricanes and the Insured operations there is potentially some PRASA assets vulnerable to fungi and/or bacteria as such, PRASA's employees/property may be at risk of exposure. Furthermore, Puerto Rico's tropical weather is a factor to potentially exacerbate the risk of exposure. Arcadis recommends that Fungi or Bacteria coverage should be considered under PRASA's Commercial General Liability program.

7.3.4 Automobile Liability

PRASA maintains automobile liability coverage through MAPFRE. Renewal of policy occurred in July 2018 and extended until July 2019 and includes:

- Bodily Injury and /or Property Damage caused by **Any** automobile, including Hired and Non-Owned, with a \$1,000,000 Combined Single Limit per accident and includes a \$5,000 per person Medical Expense limit for owned autos only.
- Physical Damage to owned autos of the Insured is not included in the policy except for Specific Catastrophic events which includes Lightning, Fire, Explosion, Windstorm, Hail, Flood and Earthquake, with a limit of \$2,000,000 per event and subject to a \$50,000 per event deductible for Comprehensive and Collision coverage.
- Drive Other Car Coverage is included for Liability coverage on a blanket basis for up to 50 individuals.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Policy provides automatic Physical damage coverage for Hired and Acquired Autos with a value up to \$40,000 with a \$500 Deductible. Any vehicle with a value greater than \$40,000 must be submitted to the Company for approval. This coverage is subject to a deposit premium of \$23,750.00 and an annual revision at a rate of 7.5%.
- Garage liability coverage is under the Compulsory Liability Insurance policy.
- Comprehensive and collision Trailer interchange coverage is provided for non-owned trailers under the care, custody or control of the Insured, with a physical damage limit of \$35,000 each trailer; \$35,000 each tank/refrigerated unit; \$20,000 each non-refrigerated or van unit; and \$15,000 each flatbed, chassis and "gen set". All subject to a \$500 Comprehensive and Collision deductible. Losses to chassis will be paid under replacement cost basis. Coverage excludes the exchange of any container, moving trailer, or related equipment between municipalities or governmental agencies.
- Rental Reimbursement coverage with a maximum payment (each covered auto) of \$50.00 any one day / 30 days or \$1,500.00 any one period.

Also, under MAPFRE the following policy was included:

- Garage Keeper coverage is included on a Direct Primary basis for Comprehensive and Collision with a limit of \$1,000,000 per event for each covered location for "Autos left with you for service, repair, storage or safekeeping; and for Theft or Mischief or Vandalism". Comprehensive coverage is subject to a \$250 per event deductible, subject to a maximum of \$1,000 per event and collision coverage is subject to a \$500 deductible. Premium for this coverage totaled \$18,000.

Renewal with MAPFRE of the commercial auto policy for FY2020 covers from July 2019 and extends until July 2020. Coverage and limits remain the same as presented above. However, there are 2,867 units included, which is 85 more than the previous policy. The premium for this coverage increase 0.8% to \$593,700.

The Garage Keeper's coverage for FY2019 remains the same as well. No increase in premium.

Recommendations & Responses

The following pending recommendations were previously made by MARSH, including AON comments regarding PRASA's Commercial Auto, Garage Liability and Garage Keeper's programs. Also, included is confirmation of action by Lone Star of said recommendations:

1. MARSH recommended that form U-6 (11-93) "Liability Coverage Exclusion Endorsement" be eliminated since the language utilized is too broad and may present coverage interpretations unfavorable to PRASA.

AON agreed with this recommendation and submitted it to the insurer for review and approval.

Lone Star indicated that it submitted recommendation to insurer for the FY2018 policy, but no response was received prior to renewal. Furthermore, Lone Star said that it was included in the specifications for the FY2019 renewal. Arcadis requested confirmation from GOAS via PRASA. At the time of submission of this Report, no response has been provided to confirm whether the recommendation was adopted for the 2018-2019 renewal period.

Form U-6 (11-93) was eliminated.

2. Drive Other Car coverage is included only for Liability to Named Individuals. MARSH recommended that it be broadened to include both Physical Damage and Medical Payments coverage.

AON agreed with this recommendation and submitted it to the insurer for review and approval.

This was not included in the FY2018 policy nor the FY2019 renewal. However for the FY2020 renewal Medical Payment coverage was included for Named Insured and his/her family member (related by blood who reside in the same household) while "occupying" or while a pedestrian when being struck by any "auto" you don't own, except any "auto" owned by that individual or family member.

Also Physical Damage coverage was included to any passenger type "auto" you don't own, hire or borrow while in the care, custody or control of any Named Individual listed or his/her partner while a resident of the same household. Except any "auto" owned by that individual or any member or his/her household or any "auto" used while working in a business of selling, servicing, repairing or parking "autos".

7.3.5 Umbrella and Excess Liability

PRASA maintains a primary umbrella policy which provides a first layer of \$20M limit excess of the primary general, automobile and employer's liability policies for each occurrence and aggregate. The umbrella is otherwise subject to a \$5,000.00 SIR for each occurrence of bodily injury, property damage and personal and advertising injury losses not covered by the underlying insurance. Renewal of policy occurred in July 2018 and extended until July 2019. Coverage is provided through MAPFRE on a \$591,550 premium.

PRASA also maintains a second layer excess liability policy providing a \$40M limit in excess of the \$20M umbrella limit described in the preceding paragraph for each occurrence and aggregate with a \$5,000 SIR. Coverage is also provided through MAPFRE with a \$163,450 premium for a total Umbrella and Excess premium of \$755,000.

Renewal with MAPFRE of the umbrella and excess liability for FY2020 covers from July 2019 and extends until July 2020 and included in one policy. Coverage is the same but to includes a limit of \$60M per occurrence. Also, the same SIR of \$5,000 applies. Policy premium increased 12.6% to \$850,000.

7.3.6 Directors and Officers Liability

PRASA maintains one primary and two excess layers of directors & officers (D&O) liability insurance. Coverage provided through Chubb. Renewal of policy occurred in July 2018 and extended until July 2019. Coverage is written on a claims-made basis and is subject to a prior litigation date of July 1, 2007 on the primary policy, July 1, 2010 on the first excess issued by Liberty, second excess layers by Berkley and Liberty, and July 1, 2016 for the last second excess layer issued by AIG. The D&O carriers and limits are shown in **Table 7-4**.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 7-4. FY2019 Directors and Officers Liability

Insurer	Limit	Premium
Chubb Insurance Company (Primary)	\$15 million	\$150,000
Liberty International Underwriters (First Excess Layer)	\$10 million excess of \$15 million	\$50,000
Berkley Insurance Company (Second Excess Layer)	\$10 million excess of \$25 million	\$40,000
Liberty International Underwriters (Second Excess Layer)	\$10 million excess of \$35 million	\$35,000
AIG Insurance Company (Second Excess Layer)	\$5 million excess of \$45 million	\$25,000
Total D&O Limit	\$50 million	\$300,000

The primary layer of D&O insurance is subject to a \$500,000 SIR for claims against indemnified persons or a claim against PRASA alleging a breach of duties.

Renewal of this policy for FY2020 covers from July 2019 and extends until July 2020. Details of coverage could not be verified as copy of the FY2020 Policy was not provided at the time of this Report.

The following pending recommendations were previously made by MARSH, including AON comments regarding PRASA's Directors and Officers insurance. Also, included is confirmation of action by Lone Star of said recommendations:

1. **Consider Re-negotiating Definition of Application Endorsement so that it is pertinent.** The Amend Definition of Application Endorsement makes reference to documents filed with the Securities & Exchange Commission. The intent of this endorsement should be to limit information used in underwriting to information received within the last year. This clarification is important because when faced with large claims insurance carriers frequently evaluate the opportunity to rescind the policy. When documentation is limited to that submitted within the past year, it is more difficult for them to rescind the policy.

AON agreed with this recommendation and requested insurer for the correct endorsement.

Lone Star indicated that insurer said that endorsement could be renegotiated upon renewal as it was not included in FY2018 policy. Lone Star said that recommendation was included in specifications for FY2019 renewal.

Arcadis was able to verify that it was included.

2. **Consider Eliminating the Private Company Endorsement.** There appears to be a conflict in wording regarding the Securities Coverage. The policy has a Private Company Endorsement that adds coverage for the corporate entity by changing Insuring Clause C from Company Securities Liability to Company Liability eliminating the securities coverage. The Private Company endorsement has a specific Public Offering of Securities exclusion. MARSH recommended eliminating the Private

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Company endorsement. Chubb can include the employees as Insured's by an additional endorsement.

AON, as PRASA's BOR, will not recommend eliminating the Private Company endorsement but will instead revise its wording to harmonize the securities coverage.

Lone Star said that upon receiving recommendation insurer indicated that endorsement could be renegotiated upon renewal, as such, it was included in specifications for FY2019 renewal.

Arcadis was able to verify that it was included.

7.3.7 Employment Practices Liability

PRASA maintains primary and excess employment practices liability (EPL) policies providing total limits of \$5M in the aggregate annually for employee claims alleging wrongful termination, employment related misrepresentation, sexual harassment, retaliation or other violation of an employee's civil rights. A \$100,000 SIR applies to each claim. Coverage is written on a claims-made basis and is subject to a prior litigation date of November 30, 2007 on the primary policy. Primary coverage is \$5M provided through Chubb. Excess EPL coverage is through Berkley Insurance Company for \$5M each claim in excess of \$5M but in no event exceeding \$5M in the aggregate for all claims. Also, it is subject to a prior litigation date of July 1, 2014. Renewal of this policy occurred in July 2018 and extended until July 2019. PRASA's premium for the primary policy was \$135,375 and \$38,000 for the excess policy.

A benchmarking study, shown in **Figure 7-1** based on limits carried by other public corporations in the industry class with similar level of corporate and economical characteristics showed that on average, limits of \$6.8M were carried. The study also shows a 75th percentile with limits of \$10M and a 25th percentile with limits of \$3M with a median of \$5M. PRASA decided a couple of years ago to reduce the EPL limits from \$10M in FY2015 to the median, based on data from previous years, and has maintain those limits.



Figure 7-1. Employment Practices Liability Benchmarking Analysis

Renewal of the EPL for FY2020 covers from July 2019 and extends until July 2020. Details of coverage could not be verified as copy of the FY2020 Policy was not provided at the time of this Report.

7.3.8 Premises Pollution Liability

Chubb provides pollution liability coverage on a claims-made basis at \$10M per pollution condition, \$10M annual aggregate limits. Coverage is subject to a \$250,000 per accident SIR. Policy was renewed on July 1, 2018 and extended until July 2019. A retroactive date of July 1, 2002 applies. PRASA's premium for this policy was \$253,740. An added coverage for "Terrorism Risk Insurance Act" was offered but not accepted by PRASA due to higher premiums.

Renewal of this policy for FY2020 covers from July 2019 and extends until July 2020. Coverage, limits and premium remain the same as presented above.

Recommendations

PRASA should consider adding the "Terrorism Risk Insurance Act" policy.

7.3.9 Accident Liabilities for Travel and Divers

PRASA's FY2019 accident coverage program for travel is issued by Chubb with the limits detailed in **Table 7-5**, below. Renewal occurred on July 1, 2018 and extended until July 2019. Policy has a \$2.5M annual aggregate limits. Coverage is available for PRASA employees named as Insured. PRASA's premium for this policy was \$1,000.

Table 7-5. FY2019 Accident (Travel) Liabilities

Coverage	Limit
Accidental Death and Dismemberment	\$500,000
Accidental Medical Expenses Reimbursement*	\$7,000
Medical Sickness Reimbursement	\$3,500
Emergency Medical Transfer	\$50,000
Repatriation of Remains	\$5,000
Cancellation and Interruption of Travel	\$500
Loss of Personal Belonging	\$1,000
Assistance Service Included	-

*If participant is covered under any Medical Health Plan, the Company will cover the excess of the Medical Expenses incurred. If not covered by any Medical Health Plan, the Company will cover charges after applying the \$100.00 deductible.

Renewal of this policy for FY2020 covers from July 2019 and extends until July 2020. Coverage, limits and premium remain the same as presented above.

In addition, PRASA maintains an accident coverage program for divers, as issued by Chubb. Renewal occurred on July 1, 2018 and extended until July 2019. Policy has a \$750,000 annual aggregate limits. Coverage is available for PRASA employees named as Insured. Coverage includes \$250,000 limit for

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Accidental Death as well as for Accidental Dismemberment. PRASA's premium for this policy was \$19,900. Same caveat for Accidental Medical Expense reimbursement as for Accident (travel).

Renewal of this policy for FY2020 covers from July 2019 and extends until July 20120. Coverage, limits and premium remain the same as the previous fiscal year.

7.3.10 Cyber Liability

PRASA does not currently purchase cyber liability insurance. PRASA retains client information as part of the operations that might include data that is considered Personal Identification Information (PII) in Puerto Rico. This information includes social security numbers, driver's license numbers, bank account numbers (with or without access codes), among other things. There have been many well publicized breaches and cybersecurity awareness continues to grow. This new cyber consciousness has had an impact on litigation, cyber claims, and how companies respond to data breach attacks. A privacy breach or cyber-attack can affect any company.

Recommendations & Responses

The following outstanding recommendation was previously made by MARSH including AON comment regarding PRASA's cyber liability policy:

1. **Consider cyber liability coverage.** MARSH recommended that PRASA complete a self-assessment to determine potential areas of weakness as compared to international standards and also to determine the potential frequency and severity of a breach. These two studies will help to gauge limits. With this information in hand, MARSH recommended that PRASA purchase a Privacy & Cyber Liability policy to insure against liability arising from potential allegations such as PRASA failed to adequately secure customer data and the associated identification theft costs needed to repair customer credit.

AON agreed with this recommendation to purchase a Privacy & Cyber Liability Policy and has advocated so at the last two renewals but has not been approved by PRASA.

PRASA requests such professional policy from subconsultants (IBM, Accenture, etc.), however are still exposed to liability for all work not performed by subconsultants. Arcadis agrees with previous recommendations that PRASA should purchase a Privacy & Cyber Liability Policy.

7.4 Owner Controlled Insurance Program

PRASA maintains an OCIP for its multi-year Capital Improvements Program - CIP. In addition to covering PRASA, the OCIP is designed to insure enrolled contractors, subcontractors (and design professionals for General Liability only) of all tiers working on the CIP. The OCIP does not cover vendors, installers, truckers, delivery persons, concrete/asphalt haulers, and/or contractors who do not have on-site dedicated payroll, except as otherwise endorsed into the policy. The OCIP program provides builder's risk, general liability, umbrella, pollution liability insurance and miscellaneous errors & omissions professional liability insurance. Each of these coverages is discussed below.

7.4.1 Contractors All Risk –Completed value Builder’s Risk

PRASA maintains a builder’s risk policy as part of its OCIP program. Chubb Insurance Company is the insurer. Policy period from March 9, 2018 to March 9, 2019. Coverage applies to all risks of direct physical loss, except as excluded by the policy. Estimated value of all projects \$150,000,000.00. The maximum contract value per contract is US\$25,000,000.00 and maximum project period is 18 months. The Limit of Liability in any one occurrence and in the annual aggregate for the policy term is US\$100,000,000.00. Policy period Aggregate Limits of Liability are \$50,000,000.00 for Earthquake and Windstorm, and \$20,000,000.00 for Flood.

Certain sub limits apply to additional exposures, such as off-site storage, inland transit and debris removal, but these sub limits are part of and not in addition to the Limit of Liability and are subject to the per project reported value as maximum limit of liability. PRASA’s premium for this policy was \$714,226.15 and includes Sublimits as shown in **Table 7-6**.

Table 7-6. FY2019 OCIP Builder’s Risk Sublimits of Liability

Coverage	Sublimit
Maximum Physical Loss of or damage to insured Property per Insured Project	Contract Value
Professional Fees	\$1,000,000 or 10% of the loss in any one occurrence, whichever is less.
Property in Transit	\$1,000,000 any one conveyance
Principal's Existing Property	\$1,000,000- each and every loss in the annual aggregate
Offsite Storage	\$2,000,000 any one storage location
Expediting Expense	\$1,000,000 or 25% of the physical loss of or damage to insured property in any one occurrence, whichever is less.
Fire Brigade Charges/ Extinguishing Expenses	\$250,000 – any one occurrence
Debris Removal	25% of the amount of loss
Plans, Blueprints, Drawings or Other Documents	\$250,000

The Physical Loss of or damage to property insured deductible is US\$20,000.00 for any one occurrence. Other deductibles are 2% for Flood and Windstorm, and 5% for Earthquake of the total insured values at risk at the time and place of loss any one occurrence, with a minimum of US\$50,000.00 any one occurrence for projects with a contract value of less than or equal to US\$10,000,000.00. Conversely, deductibles of 2% for Flood and Windstorm, and 5% for Earthquake of the total insured values at risk at the time and place of loss any one occurrence, with a minimum of US\$100,000.00 any one occurrence for projects with a contract value of more than US\$10,000,000.00. In addition, a US\$50,000.00 deductible in any one occurrence applies for damage to Principal’s Existing Property; and \$100,000.00 deductible for Property insured while undergoing Testing and Commissioning.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Renewal of the EPL for FY2020 covers from March 2019 and extends until March 2020. Details of coverage could not be verified as copy of the FY2020 Policy was not provided at the time of this Report.

Recommendations & Responses

The following outstanding recommendations were previously made by MARSH, including AON comments regarding PRASA's OCIP builder's risk policy. Also, included is confirmation of action by Lone Star of said recommendations:

1. Request an endorsement to include a "Partial Occupancy Provision" to grant permission for partial occupancy of project areas. Therefore, coverage will not cease or expire due to the partial occupation of any project area or due to the project's substantial completion.

AON agreed with this recommendation and submitted it to the insurer for review and approval.

Lone Star confirms that this was not included in the FY2018 policy renewal. Arcadis requested confirmation from GOAS via PRASA. No response was provided for the FY2019 policy and no response has been provided to confirm whether the recommendation was adopted for the 2019-2020 renewal period.

2. MARSH recommended negotiating coverage for: Wet Works and any type of roads, ways, expressway works, overpasses and bridges, viaducts and tunneling works. These are usually impacted during water mains and sewer pipes construction and should be covered with at least a reasonable sub limit.

AON stated that this kind of sublimit would require additional premium. To be discussed with PRASA for the next renewal presentation.

Lone Star confirms that this was not included on the FY2018 policy renewal. Due to the ongoing fiscal situation PRASA is hesitant to add additional costs. Arcadis requested confirmation from GOAS via PRASA. No response was provided for the FY2019 policy and no response has been provided to confirm whether the recommendation was adopted for the 2019-2020 renewal period.

3. Requested deleting endorsement MR106- Warranty concerning sections limiting the length of certain ground works, to a maximum length of section of 1,000 feet.

Lone Star agreed with this recommendation and submitted it to the insurer for review and approval for FY2019 renewal. Insurer indicated that endorsement could be negotiated, however, it was not considered in the recent renewal.

Although it was not confirmed by GOAS, Arcadis did not find the MR106- Warranty endorsement in the policy provided by PRASA thus understands it was deleted.

4. Consider including a "Claims Preparation Expense" additional coverage sublimit to provide for the necessary and reasonable fees or expenses incurred by the insured's customary auditors, accountants, architects or engineers that may assist the insured proving a claim.

AON states that this kind of sublimit will require additional premium. To be discussed with PRASA for the next renewal presentation.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA declined to include in FY2018 policy renewal, as it is cautious to increase premium costs due to its unfavorable fiscal situation. It was also declined by PRASA for the FY2019 policy and PRASA could confirm if it was included in the FY2020 renewal.

7.4.2 Commercial General Liability

The OCIP general liability policy is as “per occurrence” policy provided by Chubb and includes the limits shown in **Table 7-7**. Coverage was reduced from previous policy to reduce costs and considering coverage in other policies. Policy period covers from March 9, 2018 to March 9, 2019.

Table 7-7. FY2019 OCIP General Liability Coverages and Limits

Coverage	Limit
Each Occurrence	\$1 million
General liability – General Aggregate	\$2 million
Personal and Advertising Injury	\$1 million
Products/ Completed Operations - Aggregate	\$2 million
Employer's Liability Stop Gap	\$2 million
Damages to Premises Rented to You (Any One Premises)	\$250,000
Medical Expense (Any One Person)	\$5,000

A US\$5,000 per claim deductible applies for bodily injury and a US\$5,000 per claim deductible applies to property damage for each loss. Policy is silent as to who is responsible for deductibles. The OCIP Manual states the Contractor should assume this deductible.

This policy covers PRASA/AAA and contractors and all tiers of subcontractors and consultants performing operations at or from the project site in connection with the work for PRASA under the contract documents. PRASA's premium for this policy is \$114,000.00.

Renewal of this policy for FY2020 covers from April 23, 2019 and extends until April 23, 2020. Coverage, limits remain the same as presented above. Premium was reduced by 13% to \$99,194.00.

Recommendations & Responses

The Completed Operations coverage extension is for five (5) years from the termination date of the policy or its renewal(s). MARSH recommended changing it to ten (10) years to cover the full statutory limit (Statute of Limitations Law).

AON states that this kind of amendment will require additional premium. AON submitted this recommendation to the carrier to discuss it with PRASA for the next renewal presentation.

PRASA maintained the 5 years in the February 2019 policy renewal, as it is cautious to increase premium costs due to the dire fiscal situation.

7.4.3 Commercial Umbrella Liability

The OCIP commercial umbrella liability policy is provided by Chubb. The limit of insurance of US\$25,000,000.00. Each incident retained limit is the underlying insurance or US\$10,000.00 SIR. Each Incident and US\$1,000,000,000.00 Policy aggregate, in excess of the primary OCIP commercial general liability limits of insurance. PRASA's premium for this policy is \$60,000.00. Policy period covers from March 9, 2018 to March 9, 2019.

The Completed Operations coverage extension is for five years from the termination date of the policy or its renewal(s). Should consider requesting change to ten years to cover the full statutory limit (Statute of Limitations Law).

7.4.4 Contractor's Pollution Liability

The OCIP contractor's pollution liability insurance is provided by Chubb. Coverage applies on an occurrence basis and covers pollution arising from construction activities involving PRASA's wrap-up program. Coverage from March 9, 2018 to March 9, 2019. The policy provides a \$20M limit each loss and annual aggregate subject to a \$25,000 SIR and covers PRASA and OCIP contractor participants. Premium of \$37,500.

7.4.5 Professional Liability

PRASA maintains a miscellaneous errors and omissions liability policy through Chubb, providing a \$25M per claim limit and a \$50M annual aggregate limit, subject to a \$100,000 per claim deductible. Renewal of policy occurred in June 30, 2018 and extended until June 30, 2019. The policy is written on a claims-made basis and claims and defense costs are included within the limit. The policy has a September 21, 2004 retroactive date. Coverage applies to contract administration, design, engineering, consulting, inspection, and construction management, including planning, permitting, regulatory compliance services, land acquisition, assisting in construction, procurement assistance, start-up services, testing and extended commissioning under the PRASA multi-year CIP as modified by the PRASA Board of Directors from time to time. PRASA's premium for this policy was \$689,989.

7.5 Conclusions

In the opinion of Arcadis, the insurance program covering PRASA's exposures to risks of accidental property and liability losses arising from on-going operations provides reasonable coverage. However, several recommendations to PRASA's insurance program are provided.

Particularly, PRASA should address the following key recommendations:

1. Conduct a PML Study considering new CAT Modellings and parameters. Specially after the lessons learned in the aftermath of the September 2017 Hurricanes.
2. PRASA should consider establishing a fund to cover possible financial losses from any future catastrophic or any non-catastrophic, peril that might affect infrastructure and operations and, therefore, impose an unexpected financial burden.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

3. Consideration to Cyber Security Coverage, which is excluded under all current PRASA's Insurance Programs. Also, complete a self-assessment to determine potential areas of weakness as compared to international standards and to determine the potential frequency and severity of a breach.
4. Consideration to Terrorism Coverage, which is excluded under all current PRASA's Insurance Programs.
5. PRASA should consider including Fungi and/or Bacteria coverage, which is excluded under General liability and umbrella coverage and other programs.
6. PRASA should consider including a "Claims Preparation Expense" additional coverage sublimit in the OCIP Builder's Risk policy to provide for the necessary and reasonable fees or expenses incurred by the insured's customary auditors, accountants, architects, or engineers that may assist the insured proving a claim.
7. PRASA should consider requesting an endorsement to include a "Partial Occupancy Provision" to grant permission for partial occupancy of project areas in the OCIP Builder's Risk Policy. Therefore, coverage will not cease or expire due to the partial occupation of any project area or due to the project's substantial completion.
8. PRASA should consider changing the "Completed Operations" coverage extension to ten years to cover the full statutory limit (Statute of Limitations Law) in the OCIP Commercial General Liability Policy. Currently is for five years from the termination date of the policy or its renewal(s). Should also consider same action for the OCIP Commercial Umbrella Liability Policy.

8 SYSTEM ASSETS AND FINANCIAL ANALYSIS

8.1 Introduction

In accordance with the MAT (as amended), Arcadis hereby provides a statement of the estimated cost of all additions made to the System and of all the retirements of property made in FY2019. The statement relies on most recent preliminary data available from and provided by PRASA. Also, Arcadis evaluated PRASA's financial forecast as included in the 2019 PRASA Fiscal Plan as certified by the Oversight Board on June 25, 2019 (2019 PRASA Fiscal Plan) and assessed the appropriateness of rates and charges. A summary of the findings is provided in this section.

8.2 System Assets

Table 8-1 summarizes PRASA's book value of fixed (capital) assets as of June 30, 2018, inclusive of registered impairment losses caused by the 2017 Hurricanes. Following the Restoration Cost Approach outlined by GASB 42, the calculated impairment loss (net of insurance recoveries) totaled \$184M. Including land and other non-depreciable assets, and "Construction (Work) in Progress", the ending book value balance of PRASA's capital (fixed) assets amounts to \$6,447M (net of accumulated depreciation).

Table 8-1. Fixed Assets Balance through June 30, 2018 (\$, Millions)

	Book Value	Accumulated Depreciation	Net Book Value
Fixed Assets	\$10,664.3	(\$4,614.3)	\$6,050.0
Construction (Work) in Progress	321.5	-	321.5
Land and other Non-Depreciable Assets	75.0	-	75.0
Total Capital (Fixed) Assets	\$11,060.8	(\$4,614.3)	\$6,446.5

Table 8-2 summarizes PRASA's preliminary book value of capital (fixed) assets as of June 30, 2019. Including land and other non-depreciable assets, and "Construction (Work) in Progress", the preliminary ending book value balance of PRASA's capital (fixed) assets amounts to \$6,237M (net of accumulated depreciation).

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-2. Preliminary Fixed Assets Balance through June 30, 2019 (\$, Millions)

	Original Cost	Accumulated Depreciation	Book Value ¹
Fixed Assets	\$10,693.7	(\$4,882.0)	\$5,811.7
Construction (Work) in Progress	350.1	-	350.1
Land and other Non-Depreciable Assets	75.0	-	75.0
Total Capital (Fixed) Assets	\$11,118.8	(\$4,882.0)	\$6,236.8

¹ Subject to change.

Table 8-3 provides a summary of the fixed assets changes from FY2017 to FY2018 and from FY2018 to FY2019.

Table 8-3. Fixed Assets Changes (\$, Millions)

	FY2017 to FY2018 ¹	FY2018 to FY2019 ²
Fixed Assets (Net of Accumulated Depreciation)	(\$540.2)	(\$238.3)
Construction (Work) in Progress	(11.9)	28.5
Land and other Non-Depreciable Assets	44.0	-
Total Fixed Asset Changes	(\$552.1)	\$209.8

¹ Considers impairment losses registered in FY2018.

² Based on preliminary results for FY2019; subject to change.

8.3 PRASA's Rate Structure

PRASA's base and volumetric rate structures for Residential customers and Non-Residential customers (commercial, industrial and certain government customer classes) were approved on July 15, 2013. On December 18, 2013, PRASA further amended the rate structure for Non-Residential accounts. Both Residential and Non-Residential account are summarized in **Tables 8-4** through **8-10**. Furthermore, to cover all projected operating expenses, CIP needs, and debt service obligations (assuming debt restructuring, or new external financing is attained), the 2019 PRASA Fiscal Plan includes a series of moderate rate adjustments (as required by the Oversight Board), the first of which was implemented on January 1, 2018 followed by another on July 1, 2018 and again on July 1, 2019.

The 2019 PRASA Fiscal Plan adjustments are calculated separate from the base and volumetric amounts, as compounded percentages of the total customer invoice amount. Additional adjustments are projected to be implemented annually on July 1st of each year through FY2024. **Table 8-11** summarizes the proposed annual adjustment amounts by customer type. Note, the 2019 PRASA Fiscal Plan assumes a 2.0% rate adjustment across all customer types starting in FY2024, a change from the individualized annual rate adjustments by customer type assumed in the projections for fiscal years 2019 through 2023.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-4. 2013 Residential Monthly Base Charge per Account (includes first 10 cubic meters of monthly consumption)

Water Service Line	Water	Wastewater	Water & Wastewater
1/2" & 5/8"	\$10.60	\$9.11	\$19.71
3/4"	18.40	15.86	34.26
1"	30.23	20.36	50.59
1-1/2"	57.12	31.32	88.44
2"	97.24	53.56	150.80
3"	149.15	89.23	238.38
4"	335.50	156.69	492.19
6"	894.72	731.19	1,625.91
8"	1,431.55	835.64	2,267.19
10"	2,290.50	1,337.02	3,627.52
12"	3,664.80	2,139.25	5,804.05

Table 8-5. Residential Volumetric Rate per Cubic Meter

Use Block (m ³)	Water	Wastewater	Water & Wastewater
>10 – 15	\$1.25	\$1.02	\$2.27
>15 – 25	1.99	1.59	3.58
> 25-35	2.69	2.14	4.83
>35	2.84	2.27	5.11

Table 8-6. Residential Environmental Compliance and Regulatory Charge (ECRC)

Use Block (m ³)	Water	Wastewater	Water & Wastewater
Base Charge (0 – 10)	\$1.00	\$1.00	\$2.00
>10 - 15	6.50	6.50	13.00
>15 - 25	10.50	10.50	21.00
>25 - 35	17.50	17.50	35.00
> 35	31.50	31.50	63.00

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-7. Non-Residential Monthly Base Charge per Account

Water Service Line	Water	Wastewater	Water & Wastewater
1/2" & 5/8"	\$24.37	\$20.10	\$44.47
3/4"	36.09	31.85	67.94
1"	61.10	44.85	105.95
1-1/2"	122.43	75.23	197.66
2"	194.62	117.32	311.94
3"	436.87	243.86	680.73
4"	725.75	459.81	1,185.56
6"	1,858.58	1,474.93	3,303.51
8"	2,939.80	2,288.04	5,227.84
10"	4,703.70	3,660.87	8,364.57
12"	7,525.91	5,857.39	13,383.30

Table 8-8. Commercial and Government Volumetric Rate per Cubic Meter

Use Block (m ³)	Water	Wastewater	Water & Wastewater
>0 – 100	\$1.74	\$1.44	\$3.18
>100 – 200	2.16	1.73	3.89
> 200	2.84	2.27	5.11

Table 8-9. Industrial Volumetric Rate per Cubic Meter

Use Block (m ³)	Water	Wastewater	Water & Wastewater
>0	\$2.27	\$1.82	\$4.09

Table 8-10. ECRC for Non-Residential Customers

Commercial and Government ECRC Meter Size Equal to or Less than 2-inches			
Use Block (m ³)	Water	Wastewater	Water & Wastewater
>0-100	\$1.18	\$0.98	\$2.16
>100-200	1.22	1.01	2.23
>200	1.26	1.04	2.30

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Commercial and Government ECRC Meter Size Equal to or Less than 2-inches			
Use Block (m ³)	Water	Wastewater	Water & Wastewater
Industrial ECRC Meter Size Equal to or Less than 2-inches			
>0	\$1.54	\$1.22	\$2.76
Non-Residential ECRC Meter Size Greater than 2-inches			
Meter Size	Water	Wastewater	Water & Wastewater
3"	\$482.00	\$482.00	\$964.00
4"	839.50	839.50	1,679.00
6"	2,340.00	2,340.00	4,680.00
8"	3,703.00	3,703.00	7,406.00
10"	5,924.50	5,924.50	11,849.00
12"	9,479.50	9,479.50	18,959.00

As stated previously, to cover all projected operating expenses, CIP needs, and debt service obligations (assuming debt restructuring, or new external financing is attained), the 2019 PRASA Fiscal Plan included moderate annual rate increases (as required by the Oversight Board). Assuming that all initiatives will be implemented, and that debt relief will be achieved through the current negotiations, the following rate increases shall be effective on July 1st annually through FY2024.

Table 8-11. PRASA's Proposed Fiscal Plan Annual Rate Adjustments by Customer Type

Customer Type	Annual Rate Increase FY2019 – FY2023	Rate Increase FY2024
Residential	2.5%	2.0%
Commercial	2.8%	2.0%
Industrial	3.5%	2.0%
Government	4.5%	2.0%

The rate increases due on July 1st of 2018 and 2019 have already been implemented in compliance with the 2019 PRASA Fiscal Plan. Since the proposed rate increase is less than 4.5% per year, PRASA expects to implement the rate changes through FY2022 automatically as permitted by the provisions, as amended, approved under Resolution No. 2167. However, to implement the rate increases shown in FY2023 and beyond, it is expected that PRASA will need to follow the formal rate increase approval process required under Act 21 of 1985, as the limit on the cumulative increase of 25% (since January 1, 2018) is expected to be reached by FY2022. The impact of these rate increases is further discussed in the next section.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Additionally, PRASA charges customers for other services summarized in **Table 8-12**. These rates became effective as of July 1, 2016.

Table 8-12. PRASA's Other Customer Service Charges

Activity	Charges
Service Reconnection – Residential	\$40.00
Service Reconnection – Commercial	\$75.00
Service Reconnection – Industrial	\$75.00
Sprinkler System 1"	\$38.17
Sprinkler System 2"	\$57.26
Sprinkler System 3"	\$85.90
Sprinkler System 4"	\$128.86
Sprinkler System 6"	\$193.29
Sprinkler System 8"	\$289.94
Sprinkler System 10"	\$434.91
Sprinkler System 12"	\$652.37
New Service Connection 5/8"	\$800.00
Meter Testing In-Situ 1/2" a 1 1/2"	\$30.00
Meter Testing In-Situ >= 2"	\$80.00

8.3.1 Additional Provisions for Rate Increases

As approved by PRASA's Governing Board, future rate increases, shall follow the provisions, as amended, that had been previously approved under Resolution No. 2167 (dated October 6, 2005) as follows:

- a. Adjustments and increases after July 1, 2017 will be calculated according to a specified formula (Coefficient of Annual Adjustment [CAA] described below).
- b. Beginning July 1, 2017, there is a cap or limit on future annual increases of 4.5% and a limit on the cumulative increases of 25% (as approved by PRASA's Governing Board).
- c. If PRASA requires an increase in excess of 4.5% in any single year, or once the 25% cumulative limit is reached, PRASA must follow the formal approval process required under Act 21 of 1985 (Act 21-1985) requesting a rate increase.

Adjustments and increases implemented after July 1, 2017 are limited by the calculation of the CAA described in the Resolution and as presented herein. There are three steps to determining the CAA as follows:

1. Calculate the Coefficient of Deficiency (CD) for the applicable year:

$$CD = \text{Operating Expenses and Debt Service} / \text{Operating Revenues}$$

2. Calculate the Coefficient of Annual Base (CAB) for the Base Year:

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

$$CAB = \text{Operating Expenses and Debt Service (FY2007)} / \text{Operating Revenues (FY2007)}$$

3. Calculate the CAA:

$$CAA = CD/CAB$$

If the CD for any year is greater than the CAB from FY2007, i.e., CD for FY2017 greater than CAB, then the rates can be increased by the lesser of the CAA minus one (CAA-1) or 4.5% until the 25% cumulative maximum is reached. If the cumulative maximum is reached or should PRASA in any given year require a higher rate increase than maximum annual adjustment amount of 4.5%, PRASA shall then follow the rate increase process required by Act 21-1985, as amended.

- The first step under Act 21-1985 requires review, ratification, and approval of the proposed rate structure by PRASA's Governing Board to initiate the rate modification/increase process.
- Next, an independent Official Examiner is appointed to conduct an independent review of the proposed changes and increases in addition to leading public hearings.
- The third step is the development of a report by the Official Examiner that would include his/her findings and recommendations, to be considered by PRASA's management and Governing Board prior to final approval of the proposed rate structure modifications and increases. Following this, the report is published for public commentary.
- The final step is the review and final approval by PRASA's Governing Board, in consideration of the Official Examiner's recommendations.

8.4 FY2019 Preliminary Results and FY2020-FY2024 Forecast

Arcadis reviewed the financial information provided by PRASA, the 2019 PRASA Fiscal Plan and the amendment that incorporates the benefit of the federal debt restructuring as approved by PRASA's Governing Board in October 2019, which is summarized in Exhibit 1. This section summarizes Arcadis's review and provides an assessment of PRASA's financial condition, particularly as it relates to assessing PRASA's financial preliminary results for FY2019 and the reasonableness of PRASA's assumptions in the preparation of the five-year financial projections (the forecast period or the Forecast) from FY2020-FY2024, to assess the sufficiency of the revenues necessary to support the projected operations and capital costs as shown in Exhibit 1; including O&M expenses, debt service payments, and required deposits in compliance with the MAT (as amended). Additionally, the Forecast illustrates the anticipated DSC, for the forecast period.

The following information, provided by PRASA, was reviewed:

- MAT, as amended and restated
- Preliminary revenue and expense projections for FY2019
- Revenue and expense projections for FY2020
- PRASA's June 25, 2019 certified Fiscal Plan (2019 PRASA Fiscal Plan)
- PRASA's FY2020 Annual Budget approved by PRASA's Governing Board under Resolution 3125
- PRASA's amended FY2020 Annual Budget approved by PRASA's Governing Board on October 29, 2019 under Resolution 3144

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Debt service schedules for all currently outstanding debt service and preliminary projected debt obligations, and DSCs
- The amount, if any, required to be deposited in the Operating Reserve Fund to make the amount on deposit therein equal to the Operating Reserve Requirement
- The amount, if any, required to be deposited in the Capital Improvement Fund
- The amount, if any, required to be deposited in the Rate Stabilization Account of the Surplus Fund
- The amount of Operating and Authority Revenues (as per amended MAT) that will be sufficient to meet the Rate Covenant for FY2020
- The amount received and expected to be received from PRASA's insurance company and FEMA as a result of the impacts from Hurricanes Irma and María on September 2017

8.4.1 Operating Revenues

As defined in the MAT, **Operating Revenues** “shall mean all moneys received by or on behalf of the Authority, including (i) the moneys derived by or on behalf of the Authority from the sale of water produced, treated or distributed by, or the collection, transmission, treatment or disposal of sewage by the Systems, (ii) any proceeds of use and occupancy insurance on the Systems or any part thereof, (iii) except as provided in the following sentence, any income from the investments made under this Agreement, (iv) any special assessments, including assessments in the nature of impact fees, (v) amounts, if any, paid from the Rate Stabilization Account into the Operating Revenue Fund in any Fiscal Year minus the amounts, if any, paid from the Operating Revenue Fund into the Rate Stabilization Account during the same Fiscal Year; and (vi) regularly scheduled payments received under any Qualified Swap or Hedge Agreement during such period. In no event shall Operating Revenues include (i) income from the investment of moneys on deposit to the credit of the Construction Fund, proceeds of insurance (except use and occupancy insurance) or condemnation awards (which are required to be deposited directly to the credit of the Capital Improvement Fund), (ii) proceeds of sales of property constituting a part of the Systems (which are required to be deposited directly to the credit of the Capital Improvement Fund), (iii) the proceeds of Bonds or other Indebtedness, (iv) any governmental grants or appropriations available to pay Current Expenses of the Authority, including grants or appropriations received by the Authority and specifically made for the payments of principal of and interest on obligations of the Authority or for reimbursing the Authority for such payments, (v) any amounts received from the Commonwealth of Puerto Rico on account of Commonwealth Guaranteed Indebtedness (which is required to be deposited directly in the Commonwealth Payments Fund) or Commonwealth Supported Obligations (which is required to be deposited in the Commonwealth Payments Fund), (vi) any amounts transferred from the Budgetary Reserve Fund to the Trustee and (vii) any termination or similar payment under any interest rate swap or similar hedge agreement received by the Authority (which are required to be deposited directly to the credit of the Capital Improvement Fund).”

PRASA's annual operating revenue projections for FY2019 through FY2024 net of 1) the 2019 PRASA Fiscal Plan revenue enhancing initiatives and 2) the expected insurance reimbursement from revenue loss from the September 2017 Hurricanes impact, on an accrual basis, are presented in **Table 8-13**.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-13. PRASA Operating Revenues (\$, Millions)

Fiscal Year	Operating Revenues
FY2019 Projection based on Preliminary Results	\$1,050.2
FY2020 Annual Budget ¹	\$1,028.3
FY2021 Projected	\$1,108.3
FY2022 Projected	\$1,139.7
FY2023 Projected	\$1,149.1
FY2024 Projected	\$1,183.0

¹ As amended and approved by PRASA's Governing Board under Resolution 3144 on October 29, 2019.

PRASA's Operating Revenue assumptions are discussed below:

1. Base Fee and Service Charges, Net of Subsidies (Exhibit 1, Line 1) – PRASA's single largest source of revenue is from the monthly base charge and volume rate for services, the ECRC, and the Special Charge of \$2.00. **Table 8-14** provides a breakdown of PRASA's Service Revenues for FY2019 through FY2024, including rate increases that were implemented starting in 2018, as well as future projected rate increases. PRASA's Service Revenues are presented net of subsidies.

Table 8-14. PRASA Service Revenues Net of Subsidies (\$, Millions)

Service Revenue Category	FY2019 Preliminary	FY2020 Annual Budget	FY2021 Projected	FY2022 Projected	FY2023 Projected	FY2024 Projected
Base Fee, Volume Charges, and ECRC and Special Charges ¹	\$954.9	\$960.4	\$958.4	\$957.6	\$949.8	\$942.7
Rate Increases ²	40.5	76.1	104.4	132.6	159.7	177.3
Total (Net of Subsidies)	\$995.4	\$1,036.5	\$1,062.8	\$1,090.2	\$1,109.5	\$1,120.0

¹ Based on existing rates, includes rate adjustments, and projected reductions due to consumption reduction.

² Revenues generated from rate adjustments implemented in each year, net of new electronic bill discount.

Table 8-15 summarizes the number of Residential customers that are provided a subsidy for water and wastewater bills as of June 30, 2019.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-15. Water and Wastewater Subsidized Customer Accounts FY2019

Subsidy	Number of Customers	Percent of Total Residential Customers ¹
PAN Subsidy	64,221	5.5%
TANF Subsidy	9,850	0.8%
ASES Subsidy	5,993	0.5%
Fixed Tariff (Public Housing)	51,132	4.4%

¹Based on a total number of Residential customers of 1,172,922 provided by PRASA as of June 30, 2019.

PRASA's Service Revenue projections are based on certain assumptions, including growth and consumption assumptions that could be affected by numerous factors. For example, the continued strain on the economy as well as the continued population outmigration could cause a further decline in the consumption patterns of PRASA customers. Also, the timeliness or results of the revenue initiatives may differ from projections.

Further discussion of PRASA's Service Revenue assumptions is detailed below.

Growth and Consumption Assumptions

PRASA has experienced a compound annual reduction in number of accounts of about 0.1% per year in the last five fiscal years. Furthermore, as shown in **Table 8-16**, from FY2018 to FY2019 the number of customer accounts decreased slightly, with a 0.2% decrease in Residential accounts. The number of accounts of all other customer classes also reduced with the higher percentage observed in the number of government accounts which reduced by approximately 5.2% from FY2018 to FY2019; followed by industrial accounts which reduced by approximately 4.9% over the same period.

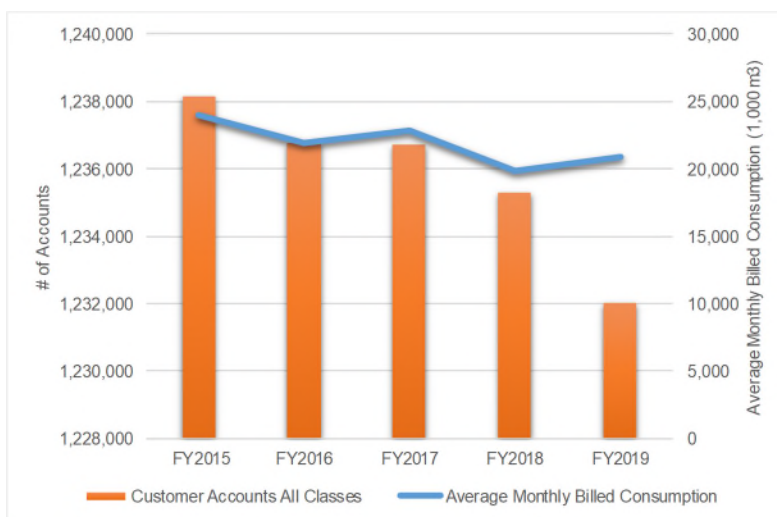


Figure 8-1. Customer Accounts and Average Monthly Billed Consumption FY2015-FY2019

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-16. PRASA Customer Accounts

Fiscal Year	Customer Class				Total
	Residential	Commercial	Industrial	Government	
FY 2018 ¹	1,175,315	49,487	792	9,697	1,235,291
FY 2019 ²	1,172,922	49,154	753	9,190	1,232,019
% Difference	-0.2%	-0.7%	-4.9%	-5.2%	-0.26%

¹ Number of accounts by customer class through June 30, 2018.

² Number of accounts by customer class through June 30, 2019.

In FY2017, PRASA's average monthly billed consumption per account increased by approximately 4.1% compared to FY2016. This increase, however, was expected as customer consumption stabilized after the 2015 drought ended. That said, FY2018 and FY2019 consumption results were lower than those registered prior to the drought period: in FY2014, PRASA's average monthly consumption per account was 20.6 m³ whereas in FY2018 and FY2019 it was 16.0 m³ and 16.9 m³, respectively, suggesting customer consumption had not reached pre-drought conditions.

In FY2019, the total average monthly billed consumption increased by approximately 5.3% compared to FY2018, while the average billed consumption per account increased 5.6% as compared to FY2018, as shown in **Tables 8-17** and **8-18**.

Table 8-17. Average Monthly Billed Consumption by Class (1,000 Cubic Meters)

Fiscal Year	Customer Class				Total
	Residential	Commercial	Industrial	Government	
FY 2018 ¹	13,739	2,460	1,171	2,424	19,795
FY 2019 ²	14,851	2,445	1,177	2,373	20,846
% Difference	8.1%	-0.6%	0.5%	-2.1%	5.3%

¹ Based on billed consumption through June 30, 2018.

² Based on billed consumption through June 30, 2019.

Table 8-18. Average Monthly Consumption per Account (Cubic Meters)

Fiscal Year	Customer Class				Equivalent Average
	Residential	Commercial	Industrial	Government	
FY 2018 ¹	11.7	49.7	1,479.1	250.0	16.0
FY 2019 ²	12.7	49.7	1,563.1	258.2	16.9
% Difference	8.3%	0.1%	5.7%	3.3%	5.6%

¹ Based on information through June 30, 2018.

² Based on information through June 30, 2019.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

According to the U.S. Census Bureau, there was a 2.1% annual decline in Puerto Rico's population between 2012 and 2018.¹⁵ The Oversight Board projects Puerto Rico population dropped by 6.9% since FY2017 as a result of the September 2017 Hurricanes¹⁶. Prior to the hurricanes impact, the Oversight Board was projecting that Puerto Rico's population was going to continue to decline over the next ten years at an estimated annual rate of 0.25%. Post 2017 Hurricanes, the Oversight Board developed updated and more aggressive population projections to account for the population outmigration experienced and to be experienced as a result of the Hurricanes. The updated estimates project an average 1.8% annual population decline through FY2024, that is a 7.5% decline from FY2018 to FY2024. This trend in population decline is one of the reasons for the water consumption reduction pattern experienced in the recent years, which worsened in 2016 due to the drought that affected a large portion of the Island towards the end of FY2015 and the first half of FY2016; and declined further as a result of the 2017 hurricanes. However, this level of population decline is not reflected in PRASA's numbers of active accounts. This may be due to 1) customers not requesting PRASA for a disconnection order, and/or 2) backlog in disconnections.

To account for the possibility of further reductions in customer accounts and consumption during FY2020, PRASA's FY2020 Annual Budget assumes the projected macroeconomics indicators provided by the Central Government: 1.7% population decline compared to FY2019 for Residential, Commercial, and Government accounts and 1.5% GNP increase when compared to FY2019 for industrial accounts. **Table 8-19** contains the projected macroeconomics indicators provided by the Central Government:

Table 8-19: Macroeconomic Indicators Assumption for Service Revenue Projection

FY	Population Change (compared to prior year)	GNP Change (compared to prior year)
2020	-1.66%	1.51%
2021	-1.54%	-0.95%
2022	-1.39%	0.15%
2023	-1.23%	0.07%
2024	-1.08%	0.55%

Considering the projected reduction in population and the average monthly billed consumption per account of the past five fiscal years, Arcadis finds the Forecast amount for Service Revenues reasonable.

¹ The U.S. Census Bureau shows Puerto Rico population estimate as of July 2012 was 3,634,488 and 3,195,153 as of July 2018.

¹⁶ The Central Government's Revised New Fiscal Plan for Puerto Rico (March 10, 2019) estimates the population for FY2019 to be at 3,107,759.

Rate Increases Assumptions

PRASA has included a rate increase for each customer class in accordance with the 2019 PRASA Fiscal Plan and presented in **Table 8-11**. PRASA expects to obtain a total of approximately \$690.5M additional revenues by FY2024 from the annual rate increases, from which \$76.1M additional revenues are projected and included in the FY2020 Annual Budget, as presented in **Table 8-14**. This amount is net of the electronic bill discount initiative which would give a monthly \$1.00 credit to those customers who subscribe to electronic billing and forego paper billing.

Arcadis believes that PRASA's assumptions for Service Revenues are reasonable based on historical results and the assumptions listed above. Nevertheless, the following should be noted:

- Despite the consumption adjustment from FY2016 to FY2017 after the drought, historical results show that average consumption per account has continued a downward trend in recent years.
- Continued strain on the economy, the high unemployment rate in Puerto Rico¹⁷, and the reduction in new construction permits and economic activity index¹⁸, among other economic factors, could continue to materially affect consumption profiles, resulting in further declines in the consumption patterns and/or number of PRASA customers.
- Proposed rate increases could vary depending on PRASA's revenue and expense results, and ability to achieve the expected results from the initiatives included in the 2019 PRASA Fiscal Plan.

Adjustment for Billings Not Collected

Adjustments for billings not collected are netted from PRASA's FY2019 preliminary results and Forecast Service Revenues presented in Exhibit 1, Line 1.

Since FY2012, PRASA's rate of adjustment for billings not collected (including collections from prior years) has stabilized below 6% of Service Revenues. In FY2019, the percentage of billings not collected increased to 8% given a reduction in collections due to the on-going fiscal crisis affecting Puerto Rico, exacerbated by the September 2017 Hurricanes.

In the FY2020 Annual Budget, PRASA has assumed an adjustment of billings not collected of 6%. This assumes billings not collected as follows: Residential, Commercial and Industrial account collections of 96%, and government account collections of 80%. For FY2021 through FY2024, PRASA has assumed that adjustments of billings not collected reduce from 6% in FY2020 to 4% in FY2024.

Arcadis finds this amount reasonable; however, PRASA should closely monitor changes in economic indices for the island and continuously monitor collection results given the uncertain economic and fiscal situation for Puerto Rico as a whole. Also, the assumed rate of uncollectibles could be materially affected: 1) if the proposed rate increases cause customer consumption adjustments or further reductions in number of accounts, 2) if collections from Government accounts do not improve

¹⁷ Based on the U.S. Bureau of Labor Statistics, as of June of 2016 the unemployment rate in Puerto Rico was 11.2%; Source: www.bls.gov/lau/

¹⁸ Source: Puerto Rico Economic Indicators; Puerto Rico Planning Board

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

as a result of cost controls or budgetary restraints, or 3) worsening conditions or further delays in economic recovery in Puerto Rico.

2. Transfers to/from the Rate Stabilization Account (Exhibit 1, Line 2) – In accordance with the MAT, a Rate Stabilization Account, the balance of which is determined in the annual budget, shall be established. This account is established within the Surplus Fund, which contains any remaining money after all required deposits are made. Equivalent monthly deposits during the fiscal year must be made into the account equal to the balance set forth in the annual budget. In compliance with the MAT, Operating Revenues shall include all transfers from the Rate Stabilization Account minus any deposits made to the Rate Stabilization Account during the same fiscal year. In FY2019, PRASA did not make any transfers (deposits) into the Rate Stabilization Account. PRASA has included a \$20.8M deposit into the Rate Stabilization Account in the FY2020 Annual budget, following the successful restructuring of PRASA's SRF and RD debt with USEPA and USDA, respectively, completed in July 2019. The Rate Stabilization Account is discussed in further detail in section 8.6.6.
3. Other Income (Exhibit 1, Line 3) – PRASA's Other Income includes: Miscellaneous Income, Special Assessments (fees paid by developers), and income from other sources. Miscellaneous Income mainly includes interest income and other miscellaneous revenues. Special Assessments are fees paid by developers for construction projects or new development connections. These fees apply to new water and sewer connections to the System. The FY2020 fees were about \$500 each for water and sewer connections (\$1,000 total per unit for both). Special Assessments depend on the fees paid by developers of new projects and it is expected that the current economic situation will continue to impact the local new housing market during the foreseeable future.

PRASA's Other Income revenues for FY2019 preliminary projections totaled \$2.0M, of which approximately \$0.5M are from Miscellaneous Income and \$1.5M from Special Assessments. PRASA is projecting \$0.5M from Miscellaneous Income annually during the forecast period. Special Assessment revenues are projected to fall to \$0 in FY 2020, increase to \$0.3M in FY2021 and FY2022, then increase once again to \$0.6M in FY2023 and FY2024. Thus, PRASA projects an average of approximately \$0.9M additional revenues annually from Other during the forecast period.

Arcadis believes that PRASA's assumptions for Service Revenues are reasonable based on historical results and the assumptions listed above. PRASA has taken a more conservative approach for this revenue line due to the continued strain on the economy, Puerto Rico's population outmigration, and the reduction in new construction permits and economic activity index.

4. 2019 PRASA Fiscal Plan Revenue Enhancing Initiatives (Exhibit 1, Line 4) – In addition to the annual rate increases and electronic bill discount previously discussed, which totaled \$40.5M in FY2019 and is estimated at about \$76.1M in FY2020, PRASA has also included the benefits of the following revenue enhancing initiatives as presented in the 2019 PRASA Fiscal Plan: P3 Project, adjustment policy revision, new disconnection fee, and government accounts collections. Additional revenues from these initiatives are expected to be obtained every year of the Forecast thereafter as summarized in **Table 8-20**.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-20. 2019 PRASA Fiscal Plan Revenue Enhancing Initiatives (\$, Millions)

2019 PRASA Fiscal Plan	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024
Initiatives	Preliminary Projections	Annual Budget	Projected	Projected	Projected	Projected
P3 Project	\$0.0	\$4.4	\$16.6	\$41.2	\$45.7	\$49.8
Adjustment Policy Revision	1.9	2.0	2.0	2.0	2.0	2.0
Disconnection Fee	0.9	1.5	1.2	1.2	0.9	0.9
Government Accounts Collections	0.0	4.1	4.2	4.3	4.4	4.5
Total Additional Revenues	\$2.8	\$12.0	\$24.0	\$48.7	\$53.0	\$57.2

¹ 2019 PRASA Fiscal Plan Revenue Enhancing Initiatives also include: Annual Rate Increase and Electronic Bill Discount (See Table 8-11), included under Base Fee and Service Charges for effect of this report.

² Numbers may not add up due to rounding.

Private-Public Partnership (P3) Project

PRASA is in the process of developing and entering into a public-private partnership (P3) agreement with one or more firms for the design, build, finance, maintenance, and operation of a series of improvements and technologies to enhance PRASA's customer service activities and to reduce the current high volume of NRW. The P3 Project originates from PRASA's need and goals to change the way it currently operates its customer services and metering and billing practices, to address its NRW issue, and to increase operational efficiency and operating revenues through the incorporation of advanced technologies and processes. Because of PRASA's current financial situation, its executive management team has determined that it requires private enterprise expertise and capital funds to cover the estimated technological investments.

The Puerto Rico Public-Private Partnerships Authority (P3 Authority), together with PRASA commenced the procurement process for the P3 Project in FY2018. A Desirability and Convenience (D&C) Study was published on March 27, 2018, which concluded that a P3 procurement method was desirable for the project. The issuance of the request for qualifications (RFQ) was completed on June 18, 2018. Four proponents were qualified and on September 26, 2018 the request for proposals (RFP) was issued. PRASA is currently in negotiations with the selected proponent. The net estimated cash flow benefit to PRASA for FY2020 through FY2024 is \$157.6M.

A significant component of the P3 Project net benefits for PRASA is conditioned on PRASA's ability to reduce its customer service headcount. While it is expected that a number of current PRASA employees will be hired by the private partner, to the extent that PRASA is not able to make the necessary staff adjustments, the expected P3 Project benefits could be materially affected.

Adjustment Policy Revision and Disconnection Fee

In February 2017, PRASA's Governing Board Approved Regulation 8901, which among other customer service updated requirements and measures, states that adjustments made for bills where a hidden leak is detected will only apply to the sewer bill portion (not both water and sewer) as the water has already been consumed or lost in the system and PRASA has already incurred in its production cost. Starting in FY2018, PRASA projected to reduce current adjustments by 60% or \$2M per year. In FY2019, PRASA is projecting \$1.9M, just \$0.1M short of the \$2M budgeted; and has included \$2M in savings in its FY2020 Annual Budget and for each year thereafter included in the Forecast.

Also, Regulation 8901, creates a new \$15 charge for the cost of disconnecting service (in addition to the reconnection fee already in place). Based on the annual number of disconnections performed (approximately 200,000 per year), PRASA estimates that the maximum revenue amount to be achieved from this initiative would be about \$3M per year. PRASA expects that the new disconnection fee will deter clients from having their services suspended, thereby reducing the projected amount of annual disconnections performed. PRASA imposed the disconnection fee in the second half of FY2019 and preliminary results total \$0.9M. Over the forecast period, PRASA is assuming that the additional revenues from this initiative will average approximately \$1.1M annually.

Government Accounts Collections

Historically, collections of government accounts have been a challenging process for PRASA. In its 2019 PRASA Fiscal Plan, PRASA included the implementation of an aggressive program to enforce collections from government accounts, which consists of increasing collection rate performance by an additional 2% above the existing government collections baseline. In the amended FY2020 Annual Budget, PRASA included \$4.1M from government accounts collections by increasing the collection rate from 80% to 82% to be achieved by implementing a more proactive and progressive collection effort with the Government. Over the remainder of the forecast period, PRASA is assuming that the additional revenues from this initiative will average approximately \$4.4M annually.

Support from the Central Government and AAFAP is crucial for the successful implementation of this initiative.

5. Insurance Reimbursement from Revenue Loss (Exhibit 1, Line 5) – PRASA has made claims under its insurance policies for business interruption and property damage and has requested FEMA disaster grants for property repair, replacement and restoration in excess of insurance proceeds and for certain emergency expenses. Arcadis reviewed the MAT, as amended, to determine the adequacy of the allocation of both insurance proceeds and FEMA reimbursements/grants to be obtained as a result of the impact of the September 2017 Hurricanes; whether these proceeds can be applied as Operating Revenues or Authority Revenues. Arcadis requested PRASA to obtain legal opinion on the appropriateness of these assumptions.

As per the definition established in the MAT for Operating Revenues (as defined in Section 8.4.1 of this report), "*insurance proceeds (except use and occupancy insurance) or condemnation awards, are in no event to be included as Operating Revenues...*". Additionally, the MAT includes the following in the definition of Operating Revenues; "*Operating Revenues shall mean all moneys received by or on behalf of the Authority, including...(ii) any proceeds of use and occupancy insurance on the Systems or any*

part thereof...". Use and occupancy insurance refers to business interruption insurance coverage. Hence, proceeds for business interruption insurance have been included as part of the Operating Revenues for the FY2020 Annual Budget.

FEMA grants, on the other hand, do not cover loss of income. FEMA grants and insurance proceeds to the extent that they are to reimburse PRASA for Current Expenses have been treated as a deposit to the Current Expense Fund. Insurance proceeds and FEMA grants received for the repair, replacement or reconstruction of the damaged or destroyed property have been applied to the CIP.

PRASA has received funding from both its insurance carriers and FEMA in order to recover from damages sustained from Hurricanes Irma and María. These amounts have been included in PRASA's FY2019 preliminary projections and FY2020 Annual Budget. PRASA's insurance policy provides for \$300M in coverage per event for property damages and business interruption losses.

8.4.2 Authority Revenues (Other Sources of Revenues)

Based on the MAT, **Authority Revenues** *"shall mean Operating Revenues plus (i) any governmental grants or appropriations available to pay Current Expenses of the Authority, including grants or appropriations received by the Authority and specifically made for the payments of principal of and interest on obligations of the Authority or for reimbursing the Authority for such payments, (ii) any amounts received from the Commonwealth of Puerto Rico on account of Commonwealth Guaranteed Indebtedness (which is required to be deposited directly in the Commonwealth Payments Fund) or Commonwealth Supported Obligations (which is required to be deposited in the Commonwealth Payments Fund), (iii) any amounts transferred from the Budgetary Reserve Fund to the Trustee and (iv) any amounts received by the Authority from any source of funding that does not otherwise constitute Authority Revenues as reimbursement for Costs of Improvements paid by the Authority in the current or the immediately preceding three fiscal years from Operating Revenues.*

PRASA is not projecting any additional sources of revenues. Therefore, PRASA's Authority Revenues shall equal Operating Revenues for the forecast period from FY2019 through FY2024.

8.4.3 Operational (Current) Expenses

As defined in the MAT:

"Current Expenses *"shall mean the reasonable and necessary current expenses, incurred by the Authority in the ordinary course of business, calculated on an accrual basis, of maintaining, repairing and operating the properties constituting the Systems or causing said maintenance, repair and operation, which expenses shall exclude depreciation, reserves for allowances for doubtful accounts and other non-cash reserves or expenses. For purposes of the Rate Covenant and the Annual Budget required by Section 7.02 of the MAT, Current Expenses will be calculated on an accrual basis. For all other purposes of the MAT, Current Expenses will be calculated on a cash basis. Notwithstanding any accounting treatment to the contrary, the amount of any termination or similar payment under any interest rate swap or similar hedge agreement shall, if payable by the Authority, not be taken into account in computing Current Expenses to the extent the same is paid by or on behalf of the Authority from the proceeds of any Indebtedness."*

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

PRASA's Operating (Current) Expenses are presented on an accrual basis as required by the MAT. PRASA's preliminary Operational Expenses for FY2019 and operating expense projections for FY2020 to FY2024 net of (i) capitalized expenses, (ii) the 2019 PRASA Fiscal Plan expense reduction initiatives, and (iii) the September 2017 Hurricanes impact, are presented in **Table 8-21**.

Table 8-21. PRASA Operating Expenses (\$, Millions)

Fiscal Year	Operating Expenses w/o FEMA Reimbursements	Operating Expenses net of FEMA Reimbursements
FY2019 Preliminary	\$781.7	\$718.2
FY2020 Annual Budget ¹	\$710.9	\$639.8
FY2021 Projected	\$708.5	\$708.5
FY2022 Projected	\$718.0	\$718.0
FY2023 Projected	\$720.0	\$720.0
FY2024 Projected	\$726.7	\$726.7

¹ As approved by the PRASA Board on November 4, 2019.

PRASA's projections for Operating (Current) Expenses, on an accrual basis, and associated assumptions are discussed below. Note that for certain expense categories, PRASA has assumed that expenses will increase year-over-year at an assumed rate of inflation. Following AAFAF's and the Oversight Board guidelines, PRASA has assumed that the inflation rate will be on average about 1.47% for the forecast period (FY2020 through FY2024), that is from 1.15% in FY2020 to 1.62% in FY2024, as applied for the Government's Fiscal Plan and adopted by other agencies and public corporations. However, Puerto Rico's inflation rate during the last quarter of FY2019 was recorded at about 0.2% (November 2019) and projections show a projected increase to slightly over 1% by end of FY2020¹⁹.

1. **Payroll and Benefits (Exhibit 1, line 12)** – Payroll and Benefits continue to be PRASA's largest expense category. Since FY2009, PRASA has implemented cost control methods to reduce its staff levels and, in turn, Payroll and Benefits costs.

Prior to 1) expense reductions due to the 2019 PRASA Fiscal Plan expense savings initiatives, 2) the September 2017 Hurricanes impact on operating expenses, and 3) capitalization:

- PRASA's FY2019 Payroll and Benefits preliminary results amounts to \$321.0M, or about \$14.2M less than the FY2019 budget
- For FY2020, PRASA is projecting Payroll and Benefits in the amount of \$326.6M. For the remainder of the forecast period, PRASA is projecting the Payroll and Benefits expense to average approximately \$335.1M annually.

Up until FY2017, assumptions regarding Payroll and Benefits costs per employee and overtime costs (as a percentage of total payroll and benefits costs) were increased mainly to cover the required contribution increases to the Employees Retirement System (ERS). However, starting on FY2018, the Payroll and Benefits costs assumptions have been increased primarily to cover for the self-funding of PRASA's pension costs in lieu of the contributions to the ERS, net of expected savings with the

¹⁹ Source: Trading Economics (<https://tradingeconomics.com/puerto-rico/inflation-cpi/forecast>)

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

implementation of Act 26-2017. Also, PRASA is projecting to a headcount of 4,700 employees in FY2020, increasing to 4,800 by FY2021, and maintaining it at that level for the remainder of the forecast period.

Based on the historical results and the assumptions made by PRASA in its projections (discussed below), Arcadis believes that the Payroll and Benefits projections are reasonable.

Headcount and Overtime Assumptions

PRASA has gradually reduced its headcount by over 1,000 employees, or around 20%, during the last 10 years to become more operationally efficient. As of June 30, 2019, PRASA had a total headcount of 4,593 employees (including 327 employees qualified under the Voluntary Pre-Retirement Program to be discussed in more detail below).

As of June 30, 2019, PRASA had over 1,326 vacant positions and was looking to supplement certain key areas. As of June 25, 2019, PRASA's hiring plan focused mainly in employing personnel for the Maintenance and Operations Departments. Staffing needs identified involve water and wastewater brigades, electromechanics, plant operators, heavy equipment operators, and supervising and managerial positions in both departments. The FY2020 Annual Budget assumes a total of 4,700 employees, or a net increase of 107 employees from the FY2019 headcount. The 2019 PRASA Fiscal Plan assumes a total of 4,800 employees by FY2021 and holds headcount steady at that level for the remainder of the forecast period.

Based on FY2019 preliminary results through June 30, 2019, the current overtime level is at approximately 8% of total payroll costs, slightly higher than the 7% PRASA had estimated in its FY2019 Annual Budget. PRASA has assumed a rate of overtime of 8% (as percentage of payroll) along with other adjustments that result in an increase of the average annual cost per employee for the FY2020 Annual Budget. For the remainder of the forecast period, PRASA assumes a rate of overtime of approximately 7% of total payroll costs.

Legislated Acts Assumptions

Act 26-2017, as amended – Act No. 26 was enacted on April 29, 2017 (Act 26-2017) to ensure compliance with the Government's Fiscal Plan approved and certified by the PROMESA Oversight Board on May 13, 2017 and re-certified post Hurricanes Irma and María on June 29, 2018. Act 26-2017 supersedes any previous act. Among other measures, Act 26-2017 requires all marginal benefits to be the same for all employees of the Government of Puerto Rico including all public agencies, instrumentalities and corporations, such as PRASA. The act froze and reduced some payroll benefits or compensation including vacation and sickness licenses, payout terms of licenses, and bonuses. Subsequently, under Act 176-2019, certain amendments were reverted. Currently, PRASA employees' benefits include:

- Vacation licenses accumulate at a rate of 2.5 days per month of service and may be accumulated to up to a maximum of 60 days by the end of each natural year.
- Sickness licenses accumulate at a rate of 1.5 days per month of service and may be accumulated to up to a maximum of 90 days by the end of each natural year.
- Licenses in excess will not be paid out, except for vacation days accrued up to 60 days.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Elimination of all bonuses, except for Christmas bonuses, which shall have a maximum of \$600
- Extra hours will be compensated at a maximum rate of 1.5x regular hourly rate

The impact of Act 26-2017, as amended, was incorporated in PRASA's Payroll and Benefits costs for the Forecast, except for the elimination of the Christmas Bonus required by the Oversight Board. However, following the Central Government's public policy, PRASA and PRFAFAA consider local laws, such as Act 26-2017, to have supremacy over any other stipulation. As such, PRASA will pay the Christmas bonus to its qualifying employees up to \$600 per year. Nonetheless, PRASA has indicated that efforts will be made to identify savings from other Operating Expense categories to achieve the bottom line total Operating Expenses as budgeted and required by the Oversight Board for the forecast period.

Voluntary Pre-Retirement Program (Act 211-2015) – As a result of the fiscal crisis, the Puerto Rico Government enacted Act No. 211 on December 8, 2015 (Act 211-2015), which created a "Voluntary Pre-Retirement Program". Act 211-2015 intends to create a program, "whereby eligible employees of the Government of the Commonwealth of Puerto Rico may voluntarily separate from service by receiving incentives until they meet the requirements for retirement; provide for the requirement of credited years of service needed to qualify for this Program; establish the timeframe for employees to exercise their option to avail themselves of the Voluntary Pre-Retirement Program; provide the special incentives that shall be granted to employees who avail themselves of the Program; provide the requirements needed to implement the Program; and for other related purposes".

The program seeks to offer incentives to certain eligible employees to voluntarily retire early and still receive compensation equal to 60% of their average salary, payout of unused vacation and sick leaves (as per Act 66-2014) and keep their health insurance coverage for a term of two years. These incentives are applicable until they meet the requirements for full retirement. Consequently, the program attempts to reduce the workforce progressively and voluntarily, thus allowing for the economy to undergo a transition process. This may reduce expenses such as payroll and "fringe benefits" costs on PRASA but requires that OMB evaluate and certify that employees eligible for the program and under consideration represent savings for PRASA. Besides the reduction of expenses, Act 211-2015 stipulates that the resulting vacant positions from the retirement program be eliminated, and that agencies take administrative or operational measures to restructure in the absence of these positions. However, OMB might authorize to maintain positions, if certified to be essential, and in accordance with the plan submitted by PRASA. PRASA has included the projected benefits from this program as part of the 2019 PRASA Fiscal Plan cost savings initiatives discussed in line 18 of Exhibit 1.

As stated, this pre-retirement program will impact headcount and consequently overtime. As of June 30, 2019, over 350 had retired under the Voluntary Pre-Retirement Program.

ERS Voluntary Transition Program Assumptions

As a result of the fiscal crisis and the hurricanes impact which exacerbated such crisis, AAFAF on behalf of the Puerto Rico Government circulated an Administrative Order (OA-2017-5) on November 7, 2017, which created an "ERS Voluntary Transition Program" intended to create an alternate program for eligible employees under the ERS. On April 18, 2018 a second Administrative Order (OA-2018-5; amended on June 29, 2018 as OA-2018-9) was circulated extending the program to a

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

second phase, and on October 23, 2018, a new Administrative Order (OA-2018-13; amended on November 15, 2018 as OA-2018-14) further extended the program to a third phase. Employees will have until November 30 and December 15, respectively to enroll the programs.

Eligible employees who avail from the program and voluntarily resign to their position shall receive economic incentives consisting of 6-month salary as well as a medical plan incentive and payout of unused vacation leaves up to 60 days, according to Act 26-2017.

As previously mentioned in Section 3, during the first phase of the program, a total of approximately 107 employees applied of which 58 were approved and voluntarily resigned by June 30, 2018. No employees retired on the second phase. For the third phase of the ERS Voluntary Transition Program, 92 employees were eligible and approved of which 41 employees resigned effectively by November 30, 2018 and 51 resigned effectively by December 31, 2018. No additional participants are projected to be processed under this program in FY2020.

Collective Bargaining Agreements Assumptions

In FY2012, PRASA and its larger employee union, the UIA-AAA by its Spanish acronym, signed a new Collective Bargaining Agreement (CBA), effective from January 2012 through December 2015. It included certain retroactive and future economic agreements that have an impact on PRASA's payroll and benefits expense projections, which started in FY2013. Also, PRASA and its second employee union, the HIEPAAA by its Spanish acronym, signed a new CBA effective from May 2012 through June 2016. It also contains certain economic agreements (i.e., salary increases) that also have an impact on PRASA's Payroll and Benefits expenses. Under Act 66-2014, PRASA was able to negotiate some terms included under the CBAs with both UIA-AAA and HIEPAAA. Both UIA-AAA and HIEPAAA unionized personnel agreed with PRASA that the CBAs will continue as stipulated except for certain terms which include: the saving plans, salary increases, holiday and sick day benefits, among others. Act 3-2017 extends the negotiation term until June 30, 2021 for the non-economic clauses included in the CBAs. However, Act 26-2017 supersedes all previous agreements or laws and requires that the new stipulated measures regarding human resources, payroll, benefits and compensation to be implemented even for union employees. PRASA has included in its Payroll and Benefits forecast period the costs and savings associated with Act 26-2017 implementation.

Pension Costs Assumptions

The Central Government's ERS has been facing a significant number of financial difficulties, as reflected in its net pension liability and historical funding shortfalls which are expected to continue. Because PRASA's employees and retired employees participate in the ERS, PRASA is responsible for the portion of the net pension liability attributable to its employees.

As provided in a circular letter from the Department of Treasury on June 27, 2017 (Number 1300-46-17), beginning in FY2018, employers that participate in the ERS have to pay the pension benefit of its retired employees on a Pay-Go basis due to the lack of sufficient liquid assets in the ERS. Therefore, PRASA's FY2019 preliminary projections and FY2020 Annual Budget consider the impact of fully funding the retirement (pension) benefit payments for PRASA's retired employees on a Pay-Go basis, based on actuarial reports provided by the ERS. Also, PRASA eliminated from its projections all the employer contributions to the retirement system including the Cost of Living Allowance (COLA)

contribution and the Annual Additional Contribution to the ERS. The amount projected does not include any additional future contributions to the ERS, which PRASA is not expected to comply with.

The Oversight Board, however, has requested PRASA to include in its forecast period a reduction in the pension payments made on a Pay-Go basis as is presented in **Table 8-22**. Nonetheless, PRASA has indicated that in line with the Central Government's public policy, pension costs will not be reduced to the extent it is possible.

2. Electric Power (Exhibit 1, line 13) – PRASA's FY2019 preliminary projections for Electric Power total \$136.0M, prior to 1) reductions due to the 2019 PRASA Fiscal Plan expense savings initiatives, and 2) the impact of the 2017 Hurricanes. This amount is approximately \$4.2M less than the budgeted amount. PRASA has projected an electric power expense of \$152.5M for FY2020, assuming a standard PREPA rate of \$0.229 per kWh (\$0.009 per kWh increase over the FY2019 rate) and a more consistent projected electric power consumption as PREPA's service interruptions reduce. Per the 2019 PRASA Fiscal Plan, electricity consumption is expected to decrease over time, but with rates increases projected during the Forecast, costs are expected to increase. PRASA's electricity cost is highly sensitive to PREPA rates, with an approximate \$7M per year impact on PRASA's expense per \$0.01 variation in the PREPA rate. By FY2024, the PREPA rate is projected to escalate to \$0.264 per kWh resulting in an electric power expense of \$169.4M (a total cost increase of \$33.4M from the FY2019 preliminary projections).

PRASA's projected cost of electric power considers the projected and expected reductions in consumption from Energy Performance Contracts (EPCs) and reductions in cost from Power Purchase Agreements (PPAs, i.e. renewable energy) that have been completed YTD as part of PRASA's Comprehensive Energy Management Program.

Arcadis finds PRASA's forecast period projection for Electric Power reasonable. However, PRASA is susceptible to varying prices. Close monitoring of electric energy usage must continue and PRASA shall adjust its projections, as necessary. Additional discussion on PRASA's Electric Power assumptions is provided below.

Electric Energy Tariff Assumptions

The average PREPA (blended) rate cost applicable to PRASA has been constantly fluctuating between \$0.21-\$0.23 per kWh from FY2017 through FY2019. Thereby, the assumption used in the forecast period averaging around \$0.25 per kWh is slightly conservative yet appropriate considering the great variability and fluctuations oil barrel costs and considering PREPA's underdevelopment restructuring plan.

Comprehensive Energy Management Program and Regional Initiatives Assumptions

PRASA has included projected savings in consumption and costs as a result of its Comprehensive Energy Management Program, which PRASA has undertaken to help manage and reduce its electricity expense. Since 2014, PRASA has implemented separate processes to engage the private sector in investing in energy related projects with Demand Side Projects through EPCs and Supply Side Projects through PPAs, and other internal measures such as Regional Initiatives. However, due to PRASA's fiscal situation, the status of such projects has been impacted since FY2016. A description of the different initiatives and their current status is provided below:

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- **EPCs:** EPCs were placed on hold since FY2016. Three out of the six EPCs under the contract were completed (Caguas, Barceloneta and Bayamón WWTPs). However, the third-party contract for the execution of the measurement and verification phase and the operation and maintenance of these three completed EPCs were placed on hold because of the September 2017 hurricanes and subsequently cancelled. PRASA projects that the other three EPCs (Sergio Cuevas, Superaqueduct and Puerto Nuevo) will remain on hold during FY2020; PRASA has not budgeted any additional savings from EPCs in FY2020.
- **Regional Initiatives:** PRASA has implemented a Regional level commitment to execute energy conservation measures in its WTPs and WWTPs and find savings at the operational level (with minimum or no investment). PRASA is also leveraging hydraulic modeling analyses and optimization efforts to reduce energy consumption in the water distribution and wastewater collection systems (i.e., pump stations facilities). Some of the measures include, for example, simplifying and providing more flexibility to the system, reducing and optimizing the hours of operation at the facilities, identifying energy conservation measures in the operation of the equipment, among others. These initiatives are still ongoing for FY2019, although these have also been impacted by PRASA's fiscal situation.
- **PPAs:** For FY2020, PRASA projects that the PPA initiative will generate 11.5 million kWh at \$0.15 per kWh blended rate

Consumption Growth Rate Assumptions

PRASA has reduced the electric power consumption from PREPA from 743 million kWh (FY2013) down to 617 million kWh in FY2019. For FY2020, PRASA is projecting that its total consumption will be 678 million kWh, of which 666 million kWh will be power consumption bought from PREPA, net of the physical losses' initiative (refer to the 2019 PRASA Fiscal Plan cost savings initiative in Line 18 of Exhibit 1). This PREPA consumption projection also considers the Regional Initiatives expected to be achieved in FY2020 and does not consider any additional contribution from EPCs. For the Forecast period, PRASA is projecting that its total consumption will be at an average of 665 million kWh, of which an average of 656 million kWh will be power consumption bought from PREPA, net of the physical losses' initiative (refer to the 2019 PRASA Fiscal Plan cost savings initiative in line 18 of Exhibit 1).

3. Maintenance and Repair (Exhibit 1, Line 14) – The FY2020 Annual Budget for Maintenance and Repair is \$57.4M, which is about \$7M more than the FY2019 preliminary projections based on the assumption that a portion of the maintenance works delayed or postponed as a result of the 2017 hurricanes, will be performed during FY2020. PRASA projects Maintenance and Repair expenses to increase from \$55.6M in FY2021 to \$58.1M in FY2024.

Arcadis believes PRASA's forecast period projections for Maintenance & Repair expenses are reasonable.

4. Chemicals (Exhibit 1, Line 15) – PRASA's FY2019 preliminary projections for Chemical costs amount to \$33.9M (\$0.7M more than the budgeted amount), prior to the 2019 PRASA Fiscal Plan expense

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

savings initiatives. Although Chemical costs are usually affected by inflation and worldwide demand as they are mostly commodities, over the past few years PRASA has been able to control these costs with consumption optimization savings, and by negotiating costs given the high volumes of chemicals purchased. In FY2020, PRASA is projecting approximately \$33.3M in Chemical costs, prior to the 2019 PRASA Fiscal Plan expense savings initiatives and the September 2017 Hurricanes impact. For FY2021 through FY2024, PRASA has applied an annual increase based on the assumed inflation rate (1.46% average over forecast period) on Chemical expenses, increasing from \$34.9M in FY2021 to \$36.4M in FY2024, prior to the 2019 PRASA Fiscal Plan expense savings initiatives.

Arcadis believes PRASA's Forecast period projections for Chemical expenses is reasonable, so long as inflation rates are not above those assumed by the Government and PRASA.

5. Insurance (Exhibit 1, Line 16) – Preliminary projections for Insurance expenses in FY2019 total \$19.1M, which is in line with the budget. PRASA has budgeted \$19.3M for Insurance expenses in FY2020, which is \$0.2M higher than the FY2019 preliminary projections. This amount includes adjustments to PRASA's insurance premiums due to the FY2017 Hurricanes emergency claims. PRASA has applied an annual increase based on the assumed adjusted inflation rate (1.46% average over forecast period) on Insurance expenses throughout the forecast period, increasing from \$19.6M in FY2021 to \$20.4M in FY2024.

Arcadis believes the projections for Insurance expenses is reasonable and its coverages are adequate. However, several recommendations were made to PRASA to modify or add insurance coverages including cyber security and terrorism coverage. If PRASA adopts these recommendations, if the inflation rate is higher, and/or if insurance premiums increase, PRASA's Insurance expense could be higher than projected.

6. Other Expenses (Exhibit 1, line 17) – Other Expenses includes, for example: the Superaqueduct O&M contract, professional services (i.e. the NRW recovery office and call centers), materials and supplies, security, sludge treatment and disposition, rentals, and water transport.

FY2019 preliminary projections for Other Expenses total \$150.7M (\$2.5M less than what was budgeted) prior to the 2019 PRASA Fiscal Plan expense savings initiatives and the September 2017 Hurricanes impact. PRASA has included \$156.9M for Other Expenses in its FY2020 Annual Budget, prior to the 2019 PRASA Fiscal Plan expense savings initiatives and the September 2017 Hurricanes impact, which represents an increase of approximately 4.1% over FY2019 preliminary projections and assumes return to normal level of operations and requirements after the September 2017 Hurricanes impact. PRASA is projecting that Other Expenses will increase year-over-year based on the adjusted assumed inflation rate (1.46% average over forecast period), increasing from \$159.2M in FY2021 up to \$166.3M in FY2024.

Arcadis has reviewed PRASA's projections for this expense category and finds the budget amount reasonable. However, PRASA should monitor actual costs, particularly for fuels and oils, given the projected increases that could materialize throughout the fiscal year.

7. The 2019 PRASA Fiscal Plan Expense Savings Initiatives (Exhibit 1, Line 18) – The Expense Savings initiatives as included in the 2019 PRASA Fiscal Plan comprise: reduction of physical water losses, other expense reductions, elimination of the Christmas bonus, uniform healthcare, and pension reductions. However, as previously discussed, the elimination of the Christmas bonus and the

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

reduction in pension payments were included by the Oversight Board and not agreed to by PRASA. As will be discussed further below, in lieu of carrying out these initiatives PRASA intends to identify savings from other Operating Expense categories upholding the Central Government's and PRASA's public policy of not reducing benefits to its employees. **Table 8-22** presents the financial projection of these initiatives for the forecast period.

Table 8-22. 2019 PRASA Fiscal Plan Expense Savings Initiatives (\$, Millions)

	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024
2019 PRASA Fiscal Plan Initiatives	Preliminary	Annual Budget	Projected	Projected	Projected	Projected
Physical Water Losses	\$(2.0)	\$0.1	\$3.7	\$8.1	\$12.0	\$15.4
Other Expenses Reduction	6.2	6.2	7.0	6.2	5.3	4.3
Christmas Bonus Elimination ²	3.1	3.1	3.2	3.2	3.2	3.2
Uniform Healthcare	4.0	3.4	2.9	2.3	1.5	0.7
Pension Reduction ²	0.0	0.0	9.8	9.7	9.5	9.3
Total Expense Savings¹	\$11.3	\$12.9	\$26.6	\$29.4	\$31.5	\$32.9

¹ Numbers may not add up due to rounding.

² Following the Central Government's and PRASA's public policy, in lieu of implementing these initiatives, PRASA intends to identify savings from other Operating Expense categories.

While PRASA is committed to these initiatives, excluding the elimination of Christmas bonus and the reduction of the pension benefits, given the status of their development, and considering the coordination, planning and implementation efforts still required to be completed; it is likely that the timing for achieving the projected benefits will not be as expected by PRASA. Arcadis, therefore, finds these projections optimistic and recommends that PRASA re-evaluate the status and schedule of these initiatives. If the benefits are not realized as projected, to meet its Forecast, PRASA would likely have to reduce the amount of CIP investments planned and/or modify the projected rate increases.

Physical Losses Reduction Initiative

As previously discussed, physical losses are the largest component of NRW in PRASA's water balance. This initiative includes a series of efforts to reduce physical losses and thus NRW. PRASA expects to obtain cost savings in the amount of \$37.2M from FY2019 to FY2024.

PRASA expects to obtain these savings through the continuation of:

- the water leak detection program
- water pressure management and optimization

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- tank overflow avoidance
- data quality improvement
- efficiently addressing reported leaks reducing the number of days required to repair leaks

These cost savings consider that PRASA will save chemical and electricity costs from a reduction in water losses and hence, in production. Given the challenge to measure water losses across the infrastructure, potential saving estimates will be further refined and confirmed by FY2020. Underground asset condition needs further investigation to determine the extent of potential impacts from this initiative, but PRASA's long term goals include reducing water production in the System approximately 10% by 2024, annual cost savings in electricity and chemical costs in the range of \$5M to \$15M and reducing or eliminating the need for water rationing.

The scope of this initiative will be redefined after more visibility is gained on the system condition and after reducing the estimation (for production and consumption). To do so, PRASA is focusing on:

- Increasing measurement of water production
- Stabilizing water pressures by pressure zones and improve tank level monitoring
- Metro region leaks pre-location exercises and DMA's for night flow analysis
- Defining the correlation between water production and variable costs

Other Expenses Reduction

PRASA expects to obtain cost savings in the amount of \$35.2M from FY2019 to FY2024 by the implementation of the Voluntary Pre-Retirement Program, as created by Act 211-15.

Pension / Labor Reform and Christmas Bonus

The Oversight Board has included in the 2019 PRASA Fiscal Plan the elimination of the Christmas bonus benefit starting in FY2019 to achieve cost savings estimated of \$19.0M through FY2024 (\$3.2M per year). However, following the Central Government's public policy, PRASA will consider local laws, such as Act 26-2017, to have supremacy over any other stipulation. As such, PRASA expects to pay the Christmas bonus to its employees throughout the forecast period.

Similarly, the Oversight Board has requested to include in the 2019 PRASA Fiscal Plan a reduction in the pension payments made on a Pay-Go basis. The requirement is to reduce pension contributions by 10% from FY2021 onwards in line with the Central Government's revised new Fiscal Plan for Puerto Rico to achieve a \$38.3M cost savings through FY2024. However, PRASA has indicated that in line with the Central Government's and PRASA's public policy, to the extent possible pension payments will not be reduced. Nonetheless, PRASA has indicated that efforts will be made to identify savings from other Operating Expense categories to account for the rejected initiatives and achieve the bottom line total Operating Expenses as budgeted and required by the Oversight Board.

Uniform Healthcare

The Oversight Board has requested PRASA to include in its Fiscal Plan standardizing healthcare provided to the employees, consistent with the Central Government Fiscal Plan. The initiative consists in providing government employees \$125 worth of benefits per month, or \$1,500 per year for all employees without catastrophic or chronic conditions. Cost savings for the uniform healthcare initiative is projected in the amount of \$4.0M in FY2019 and \$3.4M in the amended FY2020 Annual Budget. For

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

the remainder of the forecast period, cost savings are projected in the amount of \$7.4M. However, following the Central Government's public policy, PRASA is evaluating options to reduce the healthcare cost minimizing the impact on the benefits and costs to its employees.

8. Capitalized Expenses (Exhibit 1, Line 19) – PRASA's external consultant, PJ Sun LLC, completed the most recent review of PRASA's capitalization rate in April 2017. The recommendations included in the updated report, as provided by PRASA, reduce PRASA's capitalization rate from 4.7% to 3.7%. FY2019 preliminary results for Capitalized Expenses amount to \$7.1M. PRASA has included in its FY2020 Annual Budget \$27.6M for Capitalized Expenses. For FY2021 to FY2024, PRASA is projecting an increase from \$28.2M to \$29.2M.

Arcadis assumes that the estimation for expense capitalization used by PRASA is reasonable given that, in previous years, it has been accepted by PRASA's outside, independent auditors in the preparation of its financial statements. Arcadis has not reviewed this estimation in detail and, as such, is not providing an opinion on the reasonableness of the recommended capitalization percentage. However, it should be considered that to the extent that PRASA's financial situation places additional burden and budget constraints at the operational level, the actual amount of R&R and maintenance and repair expenditures that can be capitalized could be reduced (as in recent years), thereby reducing the amount of capitalized expenses. Finally, PRASA should consider re-validating its capitalization rate in FY2020.

9. Hurricanes' Impact on Operational Expenses (Exhibit 1, line 21) – In the 2019 PRASA Fiscal Plan, PRASA estimated a total hurricane impact to operational expenses in the amount of \$228M. The projection of the total incremental expenses due to the hurricanes impact reflects the best estimate of PRASA based on information submitted to FEMA. The major components included as part of this immediate incremental expenses estimate include overtime payroll for employees working during the emergency; maintenance, diesel refueling and logistics for emergency power generators; the insurance deductible; investment on auxiliary backup generators (not included in CIP); water distribution services (i.e. oasis); security measures; among others. This amount is subject to the final estimated extent of the hurricanes' damages, which PRASA is still refining. The total estimated incremental expenses for FY2018 through FY2020 amount to \$228M (\$205M reimbursement). For FY2019 and FY2020, PRASA is forecasting to receive FEMA funding reimbursement at a 90% recovery rate of the total estimated incremental expenses. After deducting the \$70.7M funds already received during FY2018, this equates to approximately \$134.6M.

Arcadis reviewed the MAT, as amended, to determine the adequacy of the allocation of both insurance proceeds and FEMA reimbursements/grants to be obtained as a result of the impact of the September 2017 Hurricanes, and Arcadis requested PRASA legal opinion on this matter. As provided by PRASA, FEMA funds shall not be treated as Operating or Authority Revenues. FEMA does not provide grants to substitute Operating Revenues. Rather, FEMA funds are directed to disaster-related expenses to be used exclusively to cover costs of the eligible emergency and permanent work approved by FEMA. To the extent FEMA funds are received by PRASA as mentioned, such funds shall not be subject to the gross pledge set forth under the MAT as these funds cannot be used to pay bondholders. FEMA funds shall therefore be deposited to the credit of the Current Expense Fund after they are used to reimburse PRASA for Current Expenses. FEMA grants received for the repair,

replacement, or reconstruction of the damaged or destroyed property have been applied to the Capital Improvement Fund as discussed in more detail below.

In FY2019, PRASA is projecting a net impact on operational expenses due to the hurricanes and net of FEMA reimbursements of \$25.4M. In its FY2020 Annual Budget, PRASA is projecting a net deposit of \$65.7M to the credit of the Current Expense Fund. However, Arcadis finds that the total \$205M FEMA reimbursement budgeted to be received in FY2018 through FY2020 may be optimistic. In FY2018 and FY2019, PRASA received a combined \$132.6M from FEMA for emergency related work. However, so far in FY2020 PRASA has only received \$4.9M year-to-date (as of March 5, 2020), well short of the FY2020 Annual Budget amount of approximately \$71.1M.

8.5 Debt Service

8.5.1 Master Agreement of Trust

The MAT contains specific DSC requirements that must be met by PRASA including, but not limited to, a Rate Covenant. As stated in the Rate Covenant defined in the 2012 MAT (as amended), PRASA has covenanted to establish and collect rates, fees and charges so that it meets the following four independent requirements²⁰ (which will be calculated annually no later than six months after the end of each fiscal year based on Operating Revenues and Authority Revenues set forth in PRASA's most recent audited financial statements):

- Operating Revenues shall be sufficient to be at least equal to 250% of annual debt service with respect to Senior Indebtedness for the current fiscal year;
- Operating Revenues shall be sufficient to be at least equal to 200% of annual debt service with respect to Senior Indebtedness and Senior Subordinate Indebtedness for the current fiscal year;
- Operating Revenues shall be sufficient to be at least equal to 150% of annual debt service with respect to all Bonds and Other System Indebtedness for the current fiscal year; and
- Authority Revenues, shall be sufficient to be at least equal to:
 - Annual debt service on Indebtedness
 - Current expenses
 - the amounts, if any, necessary to be deposited in any Senior Debt Service Reserve Account, Senior Subordinate Debt Service Reserve Account or Subordinate Debt Service Reserve Account to restore the amount on deposit therein to the amount of the applicable Debt Service Reserve Requirement (provided that each such Accounts will be deemed to be funded at the applicable Debt Service Reserve Requirement for so long as the deposits required by the MAT are being made);
 - the amount, if any, necessary to be deposited in the Operating Reserve Fund to maintain the balance therein at the Operating Reserve Fund Requirement; and

²⁰ Capitalized terms as defined in the MAT, as amended.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- o the amount, if any, necessary to be deposited in the Capital Improvement Fund and the Rate Stabilization Account of the Surplus Fund in accordance with the Annual Budget for the current fiscal year.

Should PRASA decide to issue additional debt while any of the debt issued under the MAT (as amended) is outstanding, the additional bonds test (ABT) requirements of the MAT would also have to be met. The ABT is a measure of whether DSC will still be met after the proposed, additional bonds are issued. The ABT requirements which PRASA must meet include the following:

- Senior Bonds ABT
 - o Operating Revenues are at least equal to 2.5x Senior Bonds maximum annual debt service
 - o Operating Revenues are at least equal to 1.5x maximum annual debt service on all System Indebtedness.
- Senior Subordinated Bonds ABT
 - o Operating Revenues are at least equal to 2.0x combined Senior Bonds and Senior Subordinate Bonds maximum annual debt service
 - o Operating Revenues are at least equal to 1.5x maximum annual debt service on all System Indebtedness.
- Subordinated Bonds ABT
 - o Operating Revenues are at least equal to 1.5x maximum annual debt service on all System Indebtedness

A summary of PRASA's MAT DSC and ABT requirements is presented in **Table 8-23**.

Table 8-23. Summary of 2012 MAT DSC and ABT Requirements, as amended

Lien Level	Debt Secured	DSC for Additional Bonds Tests (MADS) ¹	DSC for Covenant Test	In Default if DSC not Achieved?
Senior	2008, 2012 & 2019 SRF & RD Loans	2.5/1.5	2.5	Yes
Senior Subordinate	Not currently applicable	2.0/1.5	2.0	Yes
Subordinate	Not currently applicable	1.5	1.5	Yes
Below Subordinate	Commonwealth Guaranteed Indebtedness	N/A	1.0	No
Below Subordinate	Commonwealth Supported Obligations	N/A	1.0	No

¹Two tests apply to future debt. The first test is Operating Revenues divided by existing and proposed debt service (at the existing lien level); the second test is Operating Revenues divided by existing and proposed debt service (regardless of lien level) plus specified Reserve Fund deposits.

In accordance with the MAT, the flow of funds shall be as follows:

- Senior, Senior Subordinate and Subordinate debt (and any debt that is secured on a parity therewith) takes priority over current Operating Expenses.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Commonwealth Guaranteed Indebtedness (CGI) and Commonwealth Supported Obligations (CSO) would continue to be funded/paid only after funding of current operating expenses and other funds with priority over CGI and CSO.
- All revenues shall be deposited by PRASA in the first instance to the Operating Revenue Fund to make the required deposits set forth below. The Trustee transfers the moneys on deposit in the Operating Revenue Fund to the following funds in the following order or priority:
 - Senior Bond Fund – to fund principal and interest payments on Senior Indebtedness;
 - Senior Debt Service Reserve Fund – to fund deficiencies in the reserve fund upon the issuance of additional Senior Bonds or withdrawals or valuation losses;
 - Senior Subordinate Bond Fund – to fund principal and interest payments on Senior Subordinate Indebtedness;
 - Senior Subordinate Debt Service Reserve Fund – to fund deficiencies in the reserve fund upon the issuance of additional Senior Subordinate Bonds or withdrawals or valuation losses;
 - Subordinate Bond Fund – to fund principal and interest payments on Subordinate Indebtedness;
 - Subordinate Debt Service Reserve Fund – to fund deficiencies in the reserve fund upon the issuance of additional Subordinate Bonds or withdrawals or valuation losses;
 - Current Expense Fund (a new fund under the MAT) – to fund current operating expenses of PRASA;
 - Operating Reserve Fund – to fund Operating Reserve Requirement and to pay reimbursement obligations on Operating Reserve Facilities;
 - Capital Improvement Fund – to fund the Capital Improvement Fund Requirement;
 - Commonwealth Payments Fund – to fund principal and interest payments on CGI and CSO; and
 - Surplus Fund – to fund the Rate Stabilization Fund and, thereafter, for any lawful purpose.

8.5.2 Debt Service Coverage

A summary of PRASA's existing debt service obligations and coverages for FY2019 through FY2024 are presented in Exhibit 1 and summarized in Tables 8-21 through 8-24. PRASA's debt service includes: Senior Bonds (the 2008 Series A and B Senior Lien Revenue Bonds, Revenue Refunding Bonds 2008 Series A and B, and the 2012 Series A and B Senior Lien Revenue Bonds), as well as the USDA RD and USEPA SRF loan debts, among others.

FY2019 debt service obligations totaled \$276.5M, of which \$230.8M were Senior lien obligations. As shown, PRASA did not make payments for CSO debt. Total budgeted debt service payments as per current amortization schedules (currently under restructuring) were approximately \$327.7M for FY2019.

Commonwealth Guaranteed Indebtedness (CGI) includes those of PRASA's existing obligations which are guaranteed by the Commonwealth of Puerto Rico. Until June 2019, these obligations included the 2008 Revenue Refunding Commonwealth Guaranteed Bonds, the USDA RD Bonds, and the SRF Loans. On June 30, 2016, PRASA entered into forbearance agreements with both (i) USDA and (ii) the Puerto Rico

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Infrastructure Financing Agency (PRIFA), the Environmental Quality Board (EQB) and the Department of Health (DOH) (all three for the SRFs), which were later extended in various occasions until July 2019 when an agreement was reached between all parties.

Upon execution of the Seventh Supplemental Agreement of Trust dated as of July 26, 2019, the following amendments were made regarding the CGI:

- (a) Amendment to Section 1.02 of the MAT, Definition of “Commonwealth Guaranteed Indebtedness” was amended to read as follows: *“Commonwealth Guaranteed Indebtedness” shall mean any obligations of the Authority that are designated as Commonwealth Guaranteed Indebtedness by the Authority and Authority’s Puerto Rico Aqueduct and Sewer Authority Revenue Refunding Bonds, Series 2088 but shall not include any loans from the United States Department of Agriculture, Rural Development, Rural Utilities Service or obligations of the Authority to the Puerto Rico Infrastructure Financing Authority evidencing revolving loans pursuant to the Puerto Rico Water Pollution control and Drinking Water Treatment Revolving Funds or any loans granted by the Commonwealth Revolving Funds under the provisions of the Federal Clean Water Act of 1972, as amended and the Federal Safe Drinking Water Act of 1996, as amended.*
- (b) Amendment to Section 2.20 of the MAT (new paragraph regarding Trustee notifications to each Fiduciary for, and Holder of (as applicable), Other System Indebtedness), amendment to Section 8.10 of the MAT regarding Waivers of Events of Default.
- (c) Amendment to Section 2.20 of the MAT (new paragraph regarding Trustee notifications to each Fiduciary for, and Holder of (as applicable), Other System Indebtedness).
- (d) Amendment to Section 8.10 of the MAT regarding Waivers of Events of Default.

In addition to the CGI, the Puerto Rico Public Finance Corporation (PFC) has an outstanding note, the proceeds of which were used to finance the construction of the North Coast Superaqueduct System (the “PFC Superaqueduct Note”), which is considered a Commonwealth Supported Obligation (CSO) under the MAT, subordinate to the payment of Senior, Senior Subordinate and Subordinate Indebtedness and to CGI debt. The PFC Superaqueduct Note is contractually payable “solely” from Commonwealth budgetary appropriations. Until 2006, the Commonwealth (directly or indirectly through budgetary appropriations) had made all the debt service payments on the CGI and CSO, including the PFC Superaqueduct Note. In 2006, in order to help alleviate its budget constraints, the Commonwealth requested that PRASA, as part of its actions to restore its operations to financial self-sufficiency, recommence, in respect of the CGI and begin, in respect of the PFC Superaqueduct Note, to make debt service payments on said obligations during fiscal years where sufficient funds are available. The PFC Superaqueduct Note remains, nevertheless, a limited obligation of PRASA, payable solely from appropriations made by the Government. As stipulated in the MAT, if PRASA is unable to make payments on the PFC debt, the obligation is not cumulative and therefore does not carry forward to future periods.

Renegotiated terms of PRASA’s SRF and RD debt obligations, reclassified as Senior Level Debt per the Seventh Supplemental Agreement of Trust dated as of July 26, 2019, are summarized in **Table 8-24**.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Table 8-24. Renegotiated Terms for SRF and RD Debt

Debt Category	SRF	RD
Outstanding Debt Balances including future loans of \$26M for SRF and accrued interests for RD	\$595,777,017.21	\$402,931,464.55
Term	30 years	40 years
Rate	0% until year 10 and 1.0% thereafter	2.0%
Payment Terms	Bi-annual principal only payment of \$5M in Years 1-10; bi-annual principal and interest payments of \$13.7M in Years 11-30	Bi-annual principal and interest payments of \$5M in Years 1-10; increasing to \$8.5M in Years 11-40
Maturity Date	7/1/2049	7/1/2059
Debt Level	Senior	Senior

A summary of PRASA's debt service obligations and projections for FY2019 and the forecast period are presented in **Tables 8-25** and **8-26**, respectively.

Table 8-25. FY2019 Debt Service Obligations and Preliminary Results (\$, Thousands)

Debt Category	FY2019 Obligations ¹	FY2019 Preliminary Results ²
Senior Debt	\$230,790	\$230,790
Senior Subordinated Debt	-	-
Subordinated Debt	-	-
Commonwealth Guaranteed Indebtedness (CGI)	87,916	45,674
Commonwealth Supported Obligations (CSO)	8,999	-
Total	\$327,705	\$276,464

¹ Considers the full debt service obligations due in FY2019 per amortization schedule.

² Considers forbearance agreements for SRF and RD debt and no payment of CSO (PFC Superaqueduct related debt, payable from Commonwealth appropriations). As provided in the MAT, the obligation to make CSO payments is not cumulative and therefore does not carry forward to future periods, and failure to make the payments or required deposits related to this debt is not an event of default under the MAT.

Table 8-26. FY2020-FY2024 Debt Service Obligations (\$, Thousands)

Debt Category ¹	FY2020 Projection	FY2021 Projection	FY2022 Projection	FY2023 Projection	FY2024 Projection
Senior Debt	\$250,791	\$250,790	\$250,789	\$250,788	\$250,787
Senior Subordinated Debt	-	-	-	-	-
Subordinated Debt	-	-	-	-	-

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

Debt Category ¹	FY2020 Projection	FY2021 Projection	FY2022 Projection	FY2023 Projection	FY2024 Projection
Commonwealth Guaranteed Indebtedness (CGI)	20,920	25,956	27,935	28,360	31,962
Commonwealth Supported Obligations (CSO)	-	-	-	-	-
Total Debt	\$271,711	\$276,746	\$278,724	\$279,148	\$282,749

¹ Considers the July 2019 renegotiated agreements for SRF and RD debt service relief as included in PRASA's Governing Board-approved amended FY2020 Annual Budget. Assume no payment of CSO or PFC Superaqueduct related debt, payable from Commonwealth appropriations. As provided in the MAT the obligation to make CSO payments is not cumulative and therefore does not carry forward to future periods, and failure to make the payments or required deposits related to this debt is not an event of default under the MAT.

The DSC results presented in **Table 8-27** for the forecast period have been calculated using the Rate Covenant requirements per the MAT, as amended, and debt service obligations.

Table 8-27. FY2019 - FY2024 Debt Service Coverage

Debt Service Level	DSC Requirement	FY2019 Preliminary DSC	FY2020 DSC	FY2021 DSC	FY2022 DSC	FY2023 DSC	FY2024 DSC
Senior Debt ¹	2.50	4.55	4.10	4.42	4.54	4.58	4.72
Senior Subordinated Debt ¹	2.00	4.55	4.10	4.42	4.54	4.58	4.72
Subordinated Debt ¹	1.50	4.55	4.10	4.42	4.54	4.58	4.72
All Obligations ²	1.00	0.98	1.00	0.97	1.00	1.00	1.00

¹ DSC calculated with respect to Operating Revenues.

² DSC calculated with respect to Authority Revenues.

As shown in **Table 8-27**, FY2019 preliminary DSC results consider the forbearance agreements payment obligations and that PRASA will not pay the CSO debt; while the Forecast DSC results consider the renegotiated debt obligations, changes in the debt level of the SRF and RD debt, and that PRASA will not pay CSO debt. PRASA's Operating Revenues and Authority Revenues are projected to be sufficient to meet Senior Lien debt service payments during the forecast period. While PRASA does not project to meet All Obligations in FY2019 or FY2021, Authority Revenues shall be sufficient to meet DSC on All Obligations in FY2020 and FY2022 through FY2024. Final DSC for FY2019 will be recalculated after the issuance of the FY2019 Audited Financial Statement to determine if PRASA was able to comply with all its obligations.

8.6 Reserve and Funds Deposit Requirements

8.6.1 Debt Service Reserve Funds

In accordance with the MAT as amended, Reserve Funds for Senior Debt, Senior Subordinate, and Subordinate Debt must be maintained in a reserve account at least equal to:

- (i) The amount set forth in the Supplemental Agreement authorizing the issuance of a particular Series of Bonds, or
- (ii) If not otherwise specified in a Supplemental Agreement authorizing the issuance of a particular Series of Bonds, the lesser of:
 - Maximum Annual Debt Service on the Outstanding Bonds secured by such Account, payable in any fiscal year for the related Bonds
 - Ten percent (10%) of the proceeds of the Outstanding Bonds secured by such Account calculated in accordance the Code
 - 125% of the average Annual Debt Service for the payment of the principal of and interest on the Outstanding Bonds secured by such Account

Debt service costs include the required contributions to the debt service reserves which were originally created and funded with 2008 bond proceeds. Should future bond issuances include required reserves, PRASA plans to contribute the additional funds in each of these reserves with part of the bond issuance proceeds, as necessary.

8.6.2 Operating Reserve Fund

The Sixth Supplemental Agreement to the MAT was executed on April 19, 2016. Before the Sixth Supplemental Agreement, the MAT required that an Operating Reserve Fund be established in the amount of \$150M until March 1, 2013 and thereafter:

- (i) If there is a line of credit on deposit in the reserve fund, the reserve shall mean for the term of line of credit an amount equal to at least ninety (90) days of current expenses determined on the first day of the fiscal year in which such line of credit is delivered or renewed as set forth in the annual budget for such fiscal year; or
- (ii) If the reserve fund is funded from revenues, the reserve shall mean an amount equal to not less than ninety (90) days of current expenses determined annually based on the current expenses relating to the fiscal year of such calculation as set forth in the annual budget for such fiscal year.

The Sixth Supplemental Agreement to the MAT, amended Section 5.10 (a) and (c) of the Operating Reserve Fund to read as follows:

- (a) *In each month, the Trustee shall deposit to the Operating Reserve Fund (i) beginning on the first Business Day of the month and after making the deposits required by Section 5.02 (b) (i) through (vii), an amount of the Authority Revenues equal to 1/60 of the amount, if any, necessary to restore the amount on deposit therein to the Operating Reserve Requirement and to pay interest on any reimbursement obligations due with respect to an Operating Reserve Facility. Earnings on moneys held in the Operating Reserve Fund shall be retained therein.*

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- (b) In lieu of or in addition to cash or investments, at any time, the Authority may cause to be deposited to the credit of the Operating Reserve Fund, an Operating Reserve Facility, in the stated amount equal to all or a portion of the application Operating Reserve Requirement. Any withdrawals from the Operating Reserve Fund made in accordance with the above paragraph (b), shall be made first from any cash or investments on deposit therein and then to the extent no such cash or investments are available, from a draw on any Operating Reserve Facility.*

PRASA had a loan agreement (the GDB Loan Agreement) with the GDB under which the GDB provided a revolving line of credit to PRASA in the amount of \$180M (previously \$150M) that satisfied the balance that PRASA is required to maintain in the Operating Reserve Fund under the MAT. Under the GDB Loan Agreement, this line of credit is payable from moneys on deposit in the Operating Reserve Fund (after making deposits to the Current Expenses Fund) or proceeds from additional indebtedness issued under the MAT. The maturity of such line of credit was extended to June 30, 2018, contingent upon PRASA's successful completion of a 2015 Senior Bond issuance. Given that bonds were not issued on or before August 31, 2015, the facility matured on June 30, 2016. Therefore, PRASA is required to fund the Operating Reserve Fund at its requirement level from Operating Revenues in accordance with the flow of funds (as defined in the MAT) or obtain a new line of credit to satisfy the Operating Reserve Fund Requirement.

Therefore, in accordance with the Sixth Supplemental Agreement to the MAT, PRASA deposited \$36.2M in the Operating Reserve Fund during FY2019 (funding approximately 1/5 of the Operating Reserve Fund requirement). This deposit will continue recurrently for two additional years, until PRASA achieves the reserve fund of three months of current expenses. Deposits for the forecast period are projected to be in accordance with the MAT, as amended. As of June 30, 2019, the Operating Reserve Fund balance stood at \$107.1M (inclusive of the \$36.2M deposit made in FY2019). By the start of FY2022, PRASA is forecasting to have a total deposit balance in its Operating Reserve Fund of \$182.6M, meeting its requirement to maintain funds equal to three months of current expenses. In future years, PRASA is projecting to make smaller deposits to align the balance with the increases in Operating Expenses, seeking to always maintain three months of current expenses in deposit.

8.6.3 Capital Improvement Fund

In accordance with the MAT, a Capital Improvement Fund must be established and funded for each fiscal year in an amount equal to the greater of:

- (i) The amount set forth in the annual budget for such fiscal year, or
- (ii) The amount recommended by the Consulting Engineer.

Equal monthly deposits over the fiscal year must be deposited to the Fund to make the balance of the Fund equal to the annual requirement. In addition, the following must be credited to the Fund:

- (i) The proceeds of any condemnation awards,
- (ii) The proceeds of insurance (other than use and occupancy insurance),
- (iii) The proceeds of sales of property constituting a part of the Systems, and

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- (iv) The proceeds of any termination or similar payment received by PRASA under any interest rate swap or similar hedge agreement.

PRASA deposited \$73.5M from Operating Revenues in the Capital Improvement Fund during FY2019 to finance a portion of its projected CIP (R&R and hurricanes-related emergency projects already being executed). This deposit is net from the FEMA/Insurance proceeds that PRASA expects to receive for the identified projects to restore the system and netted from Special Charge and other restricted funds (\$42.5M for FY2019). PRASA is assuming to re-activate its CIP in FY2020.

In its FY2020, PRASA projected to make a deposit in the Capital Improvement Fund of \$84.3M from Operating Revenues, net from FEMA/Insurance proceeds, Special Charge funds, and the PRASA FY2019 Fiscal New Federal Funds initiative estimated at \$38.3M. From FY2021 onwards, PRASA projects to make deposits in the Capital Improvement Fund in the average amount of \$143.7M per year from Operating Revenues and the expected additional federal funds (SRF and RD) of \$86.5 on average per year over the forecast period. If PRASA is not able to secure the new federal funds, it will be required to reduce its projected CIP expenditures and/or increase the proposed rate adjustments to successfully meet its obligations.

Arcadis believes the assumptions taken for the Forecast period Capital Improvement Fund deposit are optimistic given the status of the CIP re-activation process, the on-going procurement process for the CIP program management consultants and the CIP start and ramp-up process which may potentially take longer than assumed to complete the program's actual execution.

8.6.4 Construction Fund

In accordance with the MAT, a Construction Fund must be established and funded with the following deposits:

- (i) the amounts required to be deposited under the resolution of the Board authorizing the issuance of particular Series of Bonds or the applicable Supplemental Agreement and,
- (ii) any moneys of the Authority that may properly be deposited to the credit of said Fund, or the proceeds of any grants received from any source, to be used for the purpose of paying the Cost of Improvements.

PRASA has not included any deposits into the Construction Fund for the Forecast period.

8.6.5 Commonwealth Payments Fund

Since July 2016 through July 2019 PRASA had entered into forbearance agreements for its SRF and RD debt (previously classified as CGI debt). In July 2019, PRASA completed the restructuring of its SRF and RD debt reclassifying such obligations to Senior Indebtedness.

In addition, no funds were deposited in the CSO Account during recent years, and accordingly, no funds were transferred by PRASA to the trustee of the PFC Bonds for the payment of debt service that was due on the PFC Bonds. Nevertheless, as per Section 5.02(c) of the MAT, any deficiency in the amounts required to be deposited into the Commonwealth Payments Fund to pay for the Commonwealth Guaranteed Indebtedness or the Commonwealth Supported Obligations shall not be cumulative and shall be deemed to be eliminated upon interest or principal payment date.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

In its FY2020 Annual Budget, PRASA projects to make a \$20.9M deposit to the Commonwealth Payment Fund. Also, as part of the 2019 PRASA's Fiscal Plan debt service reduction initiatives, PRASA has eliminated the outstanding annual \$9M debt service payments related to the CSO which is reflected in the deposits budgeted to be made during the forecast period. For the rest of the forecast period, PRASA projects to make an annual average deposit of \$29.3M in this Fund.

8.6.6 Surplus Fund and Rate Stabilization Account

After all deposits required by the MAT (as amended) have been accordingly made, any remaining moneys shall be deposited to the credit of the Surplus Fund which includes the Rate Stabilization Account. No deposits were made in FY2019; however, as a result of the debt relief achieved through the SRF and RD debt restructuring, PRASA is projecting to make deposits throughout the forecast period, including a \$20.8M deposit in FY2020, a minimal deposit in FY2022 (approximately \$22,000), and a \$14.6M deposit in FY2023.

As established by the MAT, "Operating Revenues shall mean all moneys received by or on behalf of the Authority, including... (v) amounts, if any, paid from the Rate Stabilization Account into the Operating Revenue Fund in any Fiscal Year minus the amounts, if any, paid from the Operating Revenue Fund into the Rate Stabilization Account during the same Fiscal Year...". Therefore, PRASA has the ability to use the Rate Stabilization Account balance as a cash infusion to supplement operating revenues, if needed. In FY2021 and FY2024, PRASA is projected to transfer \$20.8M and \$4.7M, respectively, from the Rate Stabilization Account to the Operating Revenue Fund.

8.7 Conclusions

PRASA's Forecast (see Exhibit 1) reflects the financial projections included in the Fiscal Plan certified by the Oversight Board on June 25, 2019 as amended by PRASA's Governing Board to incorporate the benefit of the federal debt restructuring completed on July 26, 2019. Despite PRASA's projected additional revenues, cost savings, new federal funds, and proposed rate increases, the Forecast reflects a total deficit of \$54.6M. PRASA plans to bridge this gap by identifying and securing additional revenue sources or financing, implementing higher rate increases, implementing additional controls in Operating Expenses, modifications to projected deposits to the Capital Improvement Fund, or through a combination of these actions.

While Operating Revenues are projected to be sufficient to meet Senior Lien debt service payments and meet Rate Covenant DSC requirements for Senior Lien Debt, Authority Revenues are not sufficient in every year of the forecast period to meet All Obligations per the MAT, which include the payment of the CGI and CSO debt service obligations in full. Therefore, PRASA is currently not projecting to meet its Rate Covenant requirement of 1.0x coverage of its current obligations throughout the Forecast. PRASA may need to reduce its projected CIP investments, increase projected annual rate adjustments, or implement additional operational cost controls to meet its obligations. Furthermore, PRASA must consider the overall sustainability and affordability of its rates given the overall economic situation affecting Puerto Rico and recent trends affecting customer consumption profiles.

The following events could have material negative effects on PRASA's Forecast, which may negatively impact PRASA's financial situation going forward:

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

- Lower revenues or savings achieved, or timeliness of the 2019 PRASA Fiscal Plan initiatives.
- Higher impact from Hurricanes Irma and María on revenue, expenses or damages on PRASA infrastructure (continuing under revision and refinement by PRASA).
- Lower funding than expected from insurance, FEMA proceeds, SRF or RD federal funds.
- Higher overtime expenses than currently planned as a result of further delays in filling vacant positions.
- Higher energy costs as a result of higher PREPA electric costs (per kWh) and/or lower savings achieved through its Comprehensive Energy Management Program.
- Higher expense costs as a result of not eliminating the Christmas bonus or reducing the pension costs without identifying other sources of saving to compensate for not implementing these initiatives proposed by the Oversight Board.
- Higher annual inflation rates.
- Higher capital costs due to lower supply of professional and construction workforce, and higher materials and parts costs.

The probability of PRASA meeting its Forecast is conditioned on the following key assumptions:

1. **PRASA's ability to maintain its Service Revenues, billings, and collections in a continuing challenging economic environment** – Continued uncertainty and strain on the economy, population shifts, and changing consumption patterns could continue to cause further declines in PRASA's billings (reflected in lower Service Revenues than budgeted) and collections (reflected in higher Adjustment for uncollectibles).
2. **PRASA's ability to implement the necessary annual rate increases** – PRASA is projecting to implement annual modest rate increases that will generate about \$690M between FY2019 and FY2024. The actual amount of the rate increases to be implemented by PRASA will depend on their financial results, planned CIP investments, customer base and consumption trends, among others.
3. **PRASA's ability to continue to successfully implement the 2019 PRASA Fiscal Plan initiatives** – PRASA's Forecast includes additional revenue enhancing and cost reduction initiatives. Any changes to the funding, framework and execution of these initiatives may significantly alter PRASA's projected financial results. Although PRASA has made a commitment to implement the initiatives described in this Report (except for the ones proposed by the Oversight Board and noted throughout the Report). Also, there is a possibility that the projected results and, more specifically, the timing of those results may not be achieved.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

EXHIBIT 1

PRASA FINANCIAL FORECAST PRO FORMA ^a (\$, Thousands)	FY2019 PRELIMINARY ^b	FY2020 ANNUAL BUDGET	FY2021 PROJECTION	FY2022 PROJECTION	FY2023 PROJECTION	FY2024 PROJECTION
OPERATING REVENUES						
1. Service Revenues (Base Fee and Service Charges, Net of Subsidies) ^c	\$995,357	\$1,036,499	\$1,062,752	\$1,090,199	\$1,109,547	\$1,120,030
2. Transfer from / (to) Rate Stabilization Account	0	(20,753)	20,753	(22)	(14,553)	\$4,675
3. Other Income (Miscellaneous/Special Assessments)	2,000	500	800	800	1,100	1,100
4. Fiscal Plan - Revenue Enhancing Initiatives ^d	2,832	12,009	23,973	48,676	53,035	57,190
5. Insurance Reimbursement from Revenue Loss	50,000	0	0	0	0	0
6. Total Operating Revenues [Sum Lines 1-5]	\$1,050,189	\$1,028,255	\$1,108,278	\$1,139,654	\$1,149,129	\$1,182,995
ADDITIONAL REVENUES						
7. Transfer from Budgetary Reserve Fund	0	0	0	0	0	0
8. General Fund Grants/Appropriations/Contributions	0	0	0	0	0	0
9. Reimbursements to the Authority Revenues	0	-	0	0	0	0
10. Total Other Sources of Revenue [Sum Lines 7-9]	\$0	\$0	\$0	\$0	\$0	\$0
11. Total Authority Revenues [Line 6 + Line 10]	\$1,050,189	\$1,028,255	\$1,108,278	\$1,139,654	\$1,149,129	\$1,182,995
OPERATING EXPENSES						
12. Payroll and Benefits	\$321,011	\$326,606	\$330,832	\$334,425	\$337,020	\$338,090
13. Electric Power	136,005	152,523	163,299	168,517	166,140	169,447
14. Maintenance and Repair	50,438	57,418	55,601	56,420	57,244	58,085
15. Chemicals	33,903	33,339	34,872	35,386	35,903	36,430
16. Insurance	19,100	19,284	19,560	19,848	20,137	20,433
17. Other Expenses	150,730	156,914	159,156	161,500	163,858	166,264
18. Fiscal Plan - Cost Saving Initiatives ^e	(11,271)	(12,913)	(26,597)	(29,400)	(31,465)	(32,903)
19. Capitalized Operating Expenses	(7,112)	(27,605)	(28,243)	(28,716)	(28,871)	(29,184)
20. Total Operating Expenses [Sum Lines 12-19]	\$692,804	\$705,566	\$708,480	\$717,979	\$719,966	\$726,661
ADDITIONAL EXPENSES						
21. Hurricane Impact on OPEX ^f	25,393	(65,740)	0	0	0	0
22. Total Additional Expenses [Line 21]	\$25,393	(\$65,740)	\$0	\$0	\$0	\$0
23. Total Operating Expenses [Line 20 + Line 22]	\$718,198	\$639,826	\$708,480	\$717,979	\$719,966	\$726,661
DEPOSITS						
24. Deposit to the Senior Bond Fund ^g	\$230,790	\$250,791	\$250,790	\$250,789	\$250,788	\$250,787
25. Deposit to the Senior Debt Service Reserve Fund	0	0	0	0	0	0
26. Deposit to the Senior Subordinate Bond Fund	0	0	0	0	0	0
27. Deposit to the Senior Subordinate Debt Service Reserve Fund	0	0	0	0	0	0
28. Deposit to the Subordinate Bond Fund	0	0	0	0	0	0
29. Deposit to the Subordinate Debt Service Reserve Fund	0	0	0	0	0	0
30. Deposit to the Current Expense Fund	0	0	0	0	0	0
31. Deposit to the Operating Reserve Fund	36,197	32,384	39,974	3,076	1,013	2,033
32. Deposit to the Capital Improvement Fund (Net of Projected New Federal Funds)	42,472	84,334	114,578	139,875	149,002	171,552
33. Deposit to the Construction Fund	0	0	0	0	0	0
34. Deposit to the Commonwealth Payments Fund ^h	45,674	20,920	25,956	27,935	28,360	31,962
35. Deposit to the Surplus Fund	0	0	0	0	0	0
36. Total Deposits, excluding existing deposits available in the Current Expense Fund [Sum Lines 24-29 and 31-35]	\$355,133	\$388,429	\$431,298	\$421,675	\$429,163	\$456,334
37. Net Authority Revenues After Obligations and Deposits [Line 11-Line 23-Line 36]^h	(\$23,141)	\$0	(\$31,499)	\$0	\$0	\$0
DEBT SERVICE PAYMENTS DUE						
38. Senior (S)	\$230,790	\$250,791	\$250,790	\$250,789	\$250,788	\$250,787
39. DS Coverage Required = 2.50	4.55	4.10	4.42	4.54	4.58	4.72
40. Senior Subordinated (SSUB)	0	0	0	0	0	0
41. DS Coverage Required = 2.00	4.55	4.10	4.42	4.54	4.58	4.72
42. Subordinated (SUB)	0	0	0	0	0	0
43. DS Coverage Required = 1.50	4.55	4.10	4.42	4.54	4.58	4.72
44. Commonwealth Guaranteed Indebtedness (CGI)	45,674	20,920	25,956	27,935	28,360	31,962
45. Commonwealth Supported Obligations (CSO)	0	0	0	0	0	0
46. Debt Not Covered Under the MAT	0	0	0	0	0	0
47. Total Debt Service Including Debt Not Covered Under the MAT, Net of Existing Deposits	\$276,464	\$271,711	\$276,746	\$278,724	\$279,148	\$282,749
48. DS Coverage on All Obligations (Coverage Required = 1.00)	0.98	1.00	0.97	1.00	1.00	1.00

^aNumbers may not add up due to rounding.

^bBased on projected results as presented in PRASA's June 25th, 2019 Revised Fiscal Plan.

^cIncludes additional revenues from rate increases and electronic bill discount, net additional billings from on-going initiatives, and the adjustment for billings not collected (net of collections from prior years).

^dProjected additional revenues from initiatives included in Fiscal Plan: P3 Project, Government Collections, New Disconnection Fee, and Adjustment Policy Revision.

^eProjected expense reductions from initiatives included in Fiscal Plan: Physical Losses Reduction, Universal Healthcare Plan, and Other Expense Reductions. Also includes Pension Reduction and Christmas Bonus Elimination which PRASA does not expect to implement but will work to identify equivalent savings to comply with the proposed total expenses.

^fIncludes amount to be deposited from FEMA funding reimbursement. FEMA funds shall be deposited to the credit of the Current Expense Fund as they are used to reimburse PRASA for Current Expenses.

^gAs adjusted to reflect the benefit of the federal debt restructuring.

^hDeficits to be addressed by PRASA either through additional controls of Operating Expenses, modification to projected deposits to the Capital Improvement Fund, additional rate increases, or through a combination of these actions.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Considerations and Assumptions

In preparation of this Report and the conclusions contained herein, Arcadis has relied on certain assumptions and information provided by PRASA with respect to the conditions which may exist or events which may occur in the future. Arcadis believes the information and assumptions are reasonable but has not independently verified information provided by PRASA and others. To the extent that actual future conditions differ from those assumed herein or provided by others, the actual results will vary from those forecasts.

Arcadis has made several considerations and assumptions (as provided throughout this Report); some of the most notable are as follows:

1. Arcadis has made no determination as to the validity and enforceability of any contracts, agreements, existing laws, rules, or regulations applicable to PRASA and its operations. However, for purposes of this report, Arcadis has assumed that all such contracts, agreements, laws, rules, and regulations will be fully enforceable in accordance with their terms.
2. PRASA will continue the current policies of employing qualified and competent personnel; properly operating and maintaining the System in accordance with generally accepted industry practices; and of operating the System in a prudent and sound businesslike manner.
3. The proposed CIP reflects the general needs of the System, the CIP will be largely implemented as planned and reflected in this report, and PRASA will make modifications to the CIP investment forecast if the overall System condition is negatively affected by the investment levels projected in future years.

Set forth below are the most relevant opinions which Arcadis has reached regarding the review of PRASA's System, CIP, and financial projections as per the 2019 PRASA Fiscal Plan.

1. PRASA has reached below the optimum staffing level stipulated by the Executive Management Team but its staffing mix is not yet optimal. For example, PRASA continues to face challenges in filling critical operational staff needs in its Operations Department (i.e., plant operators, electromechanical staff, System maintenance staff and meter readers), which results in overtime hours, delayed repairs, or understaffed/deficient services. PRASA shall further assess its staff mix and implement a more targeted training and workforce development program to allow internal staff re-assignments thereby decreasing existing staffing needs. Also, PRASA may need to reevaluate their compensation package to critical positions in need, such as plant operators and electromechanical, in order to compete with the market and retain personnel (PRASA has indicated that they have begun the process of reevaluating existing compensation packages).
2. PRASA continues to assess administrative and operational performance, and to implement organizational and policy changes, focusing on customer service, System performance, and budget controls. KPI and metrics being measured, along with stronger management oversight continue to contribute to operational and organizational improvements, although KPI results are below established goals.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

3. Arcadis visited a total of 173 facilities throughout PRASA's five Operational Regions between February and August of 2019, to conduct a condition assessment of water and wastewater facilities. In overall, facilities were found to be in the adequate range although the physical condition continues to deteriorate as capital improvements and R&R actions are limited due to the fiscal situation and budget limitations.
 - Overall, the WTPs are in adequate condition and, to the extent that the physical structures and operational/ process controls are maintained or improved, they are expected to continue to serve their intended purpose of providing potable water supply in compliance with applicable regulations. Facility ratings decreased in equipment/maintenance, operations/process control and staff/training criteria compared to the 2017 inspections. The greatest concern currently is the physical condition of the facilities, which continues to deteriorate as capital and R&R improvements are delayed. Also, even though the WTPs are performing better with respect to compliance with limits of the SDWA and effluent discharge parameters, PRASA must continue to implement corrective measures to mitigate the production of disinfection by-products. Moreover, PRASA should address the shortcomings identified during inspections to improve the physical condition of its facilities, achieve/maintain continuous and consistent compliance, and optimize O&M expenses.
 - The WWTPs generally range from poor to adequate condition with compliance and equipment/maintenance as the categories of primary concern. There were nine facilities rated as poor compared to one in 2017 and from the remaining facilities rated as adequate. The greatest concern currently is the physical condition of the facilities, which continues to deteriorate as capital and R&R improvements are delayed. Also, despite some of the NPDES parameters having interim limits, the results showed that there were still many exceedances. Therefore, improvements are necessary not only to meet current interim limits but also future permanent, and more stringent limits. PRASA should verify the flood zone levels at all WWTPs to identify vulnerabilities of assets in these facilities and determine if the potential flood risks merit mitigation actions.
 - No significant changes were noted in the overall evaluation of ancillary facilities with most scoring on the lower end of adequate rating. Approximately 13% of the visited wastewater pump stations (WWPSs) have recorded overflows during the evaluation period. Prompt identification and actions enabled by remote monitoring should help PRASA mitigate overflows in the System, and adding pre-treatment (screens, comminutors) and preventive maintenance to facilities would help lessen overflows. Most of the deficiencies identified for ancillary facilities can be addressed through PRASA's R&R program and may not require major capital improvements. Finally, future regulatory requirements may require either the implementation of significant capital improvements to include and achieve additional treatment capabilities at well facilities, or the closure of certain wells.
4. The number of water leaks and sanitary overflows continue to be high when compared to U.S. benchmarks. However, PRASA has continued to improve its response time and attention/repair effectiveness, excluding the latter years because of the impacts and the after effect of the 2017 Hurricanes. PRASA continues to work on and improve its leak detection and monitoring practices and continues to aggressively address leak occurrences. Currently, PRASA is remotely monitoring levels of a number of tanks in the distribution system to avoid tank overflows and improve the water

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

distribution balance and continues conducting periodic water audits which are used to implement the necessary controls and develop action items to address NRW. Also, PRASA is implementing the 2019 PRASA Fiscal Plan WRO initiatives, which shall help reduce physical water losses. Additionally, PRASA is implementing sanitary sewer evaluations and repair plans to reduce levels of I/I that must be treated in their WWTPs. However, the progress of this initiative has been affected as well by the ongoing fiscal situation.

5. PRASA is redefining their NRW goals and metrics to phase out calculations that still use estimation methods, moving towards use of real measurements. Furthermore, the provision of meters or other mechanisms to measure the water discarded as part of the programmed drainages will further improve accounting for the volume of NRW in the System. Additionally, the Physical Losses Reduction initiatives along with the PRASA's P3 project will further support PRASA's efforts to reduce NRW. Lastly, significant capital investments and R&R funded budgets are required to accelerate the NRW program and address leak occurrences in both a corrective and preventive manner.
6. Except for buried infrastructure improvement needs, PRASA's six-year CIP along with the O&M initiatives are in alignment with the System needs and adequately addresses all mandated requirements of existing consent decrees and agreements with Regulatory Agencies. The CIP also includes funding for minor repair projects and PRASA's R&R program, as well as funding for recovery efforts and for System resilience/strengthening. Most of the investment included for the CIP is related to Emergency/Permanent Work projects. However, as noted in previous reports, given PRASA's high rate of leaks and overflows and continuing aging infrastructure, additional funds and a reactivation and acceleration of the R&R program are required to reduce/minimize these incidences. Hence, PRASA may need to further re-prioritize its funding and capital projects to address these critical System issues, as well as to address future regulations and other regulatory requirements of which impacts are not yet known. Finally, PRASA's six-year CIP includes funding for maintenance improvements, as well as for other necessary infrastructure projects (i.e., fleet and building renovation, and technological improvements) essential to maintaining and preserving the utility assets.
7. The insurance program covering PRASA's exposures to risks of accidental property and liability losses arising from on-going operations provides reasonable coverage. Also, the Owner Controlled Insurance Program (OCIP) covering PRASA's exposures to risks of accidental property and liability losses arising from construction activities provides reasonable coverage. PRASA should address the following key recommendations:
 - Conduct a PML Study considering new CAT Modellings and parameters. Specially after the lessons learned in the aftermath of the September 2017 Hurricanes.
 - PRASA should consider establishing a fund to cover possible financial losses from any future catastrophic or any non-catastrophic, peril that might affect infrastructure and operations and, therefore, impose an unexpected financial burden.
 - Consideration to Cyber Security Coverage, which is excluded under all current PRASA's Insurance Programs. Also, complete a self-assessment to determine potential areas of weakness

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

as compared to international standards and to determine the potential frequency and severity of a breach.

- Consideration to Terrorism Coverage, which is excluded under all current PRASA's Insurance Programs.
 - PRASA should consider including Fungi and/or Bacteria coverage, which is excluded under General liability and umbrella coverage and other programs.
 - PRASA should consider including a "Claims Preparation Expense" additional coverage sublimit in the OCIP Builder's Risk policy to provide for the necessary and reasonable fees or expenses incurred by the insured's customary auditors, accountants, architects, or engineers that may assist the insured proving a claim.
 - PRASA should consider requesting an endorsement to include a "Partial Occupancy Provision" to grant permission for partial occupancy of project areas in the OCIP Builder's Risk Policy. Therefore, coverage will not cease or expire due to the partial occupation of any project area or due to the project's substantial completion.
 - PRASA should consider changing the "Completed Operations" coverage extension to ten years to cover the full statutory limit (Statute of Limitations Law) in the OCIP Commercial General Liability Policy. Currently is for five years from the termination date of the policy or its renewal(s). Should also consider same action for the OCIP Commercial Umbrella Liability Policy.
8. PRASA's Forecast (Exhibit 1) reflects the financial plan certified by the Oversight Board: the FY2019 PRASA Fiscal Plan. Despite PRASA's projected additional revenues, cost savings, new federal funds, and proposed rate increases, the Forecast reflects a total deficit of \$54.6M. PRASA plans to bridge this gap by identifying and securing additional revenue sources or financing, implementing higher rate increases, implementing additional controls in Operating Expenses, modifications to projected deposits to the Capital Improvement Fund, or through a combination of these actions.
- PRASA must continue the implementation and monitoring of Operational Initiatives so that adjustments, if needed, are made on a timely basis to both the program's operational elements and budget projections. Given the status of these initiatives, and considering the coordination, planning and implementation efforts still required to be completed; it is possible that the timing for achieving the projected benefits will not be as expected by PRASA. PRASA should re-evaluate the status and schedule of these initiatives and adjust the Forecast accordingly and/or identify actions to accelerate development and implementation.
9. While Operating Revenues are projected to be sufficient to meet Senior Lien debt service payments and meet Rate Covenant DSC requirements for Senior Lien Debt, Authority Revenues are not sufficient in every year of the forecast period to meet All Obligations per the MAT. Therefore, PRASA is currently not projecting to meet its Rate Covenant requirement of 1.0x coverage of its current obligations throughout the Forecast. PRASA may need to obtain new financing, refinance a portion of its current debt, reduce its projected CIP investments, increase projected annual rate adjustments, or implement additional operational cost controls to meet its obligations. Furthermore, PRASA must consider the overall sustainability and affordability of its rates given the overall economic situation affecting Puerto Rico and recent trends affecting customer consumption profiles.

FISCAL YEAR 2019 CONSULTING ENGINEER'S REPORT FOR THE PUERTO RICO AQUEDUCT AND SEWER AUTHORITY

The probability of PRASA meeting its Forecast is conditioned on the following key assumptions:

- **PRASA's ability to maintain its Service Revenues, billings, and collections in a continuing challenging economic environment** – Continued uncertainty and strain on the economy, population shifts, and changing consumption patterns could continue to cause further declines in PRASA's billings (reflected in lower Service Revenues than budgeted) and collections (reflected in higher Adjustment for uncollectibles).
- **PRASA's ability to implement the necessary annual rate increases** – PRASA is projecting to implement annual modest rate increases that will generate about \$690M between FY2019 and FY2024. The actual amount of the rate increases to be implemented by PRASA will depend on their financial results, planned CIP investments, customer base and consumption trends, among others.
- **PRASA's ability to continue to successfully implement the 2019 PRASA Fiscal Plan initiatives** – PRASA's Forecast includes additional revenue enhancing and cost reduction initiatives. Any changes to the funding, framework and execution of these initiatives may significantly alter PRASA's projected financial results. Although PRASA has made a commitment to implement the initiatives described in this Report (except for the ones proposed by the Oversight Board and noted throughout the Report). Also, there is a possibility that the projected results and, more specifically, the timing of those results may not be achieved.

Arcadis Caribe, P.S.C.

48 Carr 165 OFC 401

Guaynabo, Puerto Rico 00968

Tel 787 777 4000

Fax 787 792 8931

www.arcadis.com

A decorative graphic consisting of three thin orange lines. One line is horizontal, extending across the width of the page. Two other lines are diagonal, starting from the bottom left and extending towards the top right, crossing the horizontal line.