



ASCE Florida Section  
Palm Beach Branch

# The infrastructure of Puerto Rico

According to ASCE's Infrastructure Report Card



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# Agenda

- ASCE's IRC
- 2019 Puerto Rico IRC
  - Dams
    - Dos Bocas Dam
- Future of the Infrastructure in PR
  - ASCE initiatives
  - PR Senate Bill 465
- Municipal, State & Federal Government



# Infrastructure Report Card Overview

## The Key Questions: What, Why, When, Where, How

**What:** The Infrastructure Report Card is an easy-to-read document that contains a vast information on the performance of our nation (or state) infrastructure. The report card is written in a non-technical way, because the targeted audience is the public-policy related people and the general public.










**Why:** The ASCE is a civil engineering organization with an outstanding credibility and respect around the world. As an American organization, part of their duty is to inform the government on the Infrastructure needs, and in 1988 the ASCE delivered to Congress and the President the first report on the infrastructure performance and recommendations to improve.









# Infrastructure Report Card: When

- ASCE's Infrastructure Report Card cycle is every 4 years. The previous report card was in 2017, the present is in 2021 and the next one is 2025. The state report cards usually takes a 1 year to gather data, analyze it, write the draft, correct it, and release it.
- State report cards should follow the 4-year cycle, but it depends on the Section volunteers
- ASCE Puerto Rico Section released its first Infrastructure Report Card in 2019. It is the first document that contains real, validated, non-biased expert analysis of the island infrastructure. The report contains 8 infrastructure chapters and an economic investment report.




# 2021 Infrastructure Grades

	AVIATION	D+
	BRIDGES	C
	DAMS	D
	DRINKING WATER	C-
	ENERGY	C-
	HAZARDOUS WASTE	D+
	INLAND WATERWAYS	D+
	LEVEES	D
	PARKS AND RECREATION	D+

	PORTS	B-
	RAIL	B
	ROADS	D
	SCHOOLS	D+
	SOLID WASTE	C+
	STORM WATER	D
	TRANSIT	D-
	WASTEWATER	D+

America's Cumulative Infrastructure Grade



<b>A</b>	EXCEPTIONAL
<b>B</b>	GOOD
<b>C</b>	MEDIOCRE
<b>D</b>	POOR
<b>F</b>	FAILING

# What the Grades Mean



**MEDIOCRE**  
Requires attention



**EXCEPTIONAL**  
Fit for the future



**POOR**  
At risk



**GOOD**  
Adequate for now



**FAILING/CRITICAL**  
Unfit for purpose

A background collage of various colorful icons representing infrastructure, including bridges, power lines, buses, houses, trees, and water treatment components.

# State Report Card Methodology: The “how”

The State Section gathers a team of volunteers that will gather data on infrastructure chapters and then write the report based on:

1. Capacity
2. Condition
3. Funding
4. Future Need
5. Innovation
6. Public Safety
7. Operation and Maintenance
8. Resilience

Then the draft is reviewed by ASCE’s Government Relations staff and make recommendations. After the draft is corrected, then ASCE Committee on America’s Infrastructure make more recommendations/corrects the report. After that, then the report is ready to publish.



# Trends

1. Maintenance backlogs continue to be an issue, but asset management helps prioritize limited funding.
2. Federal investments have moved the needle, and many state and local governments continue to prioritize infrastructure investments to help us keep pace with our growing needs.
3. There are still infrastructure sectors where data is scarce or unreliable.





# Leadership & Action



# Investment



# Resilience





Smart investment will only be possible with strong leadership, decisive action, and a clear vision for our nation's infrastructure.

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Incentivize asset management and encourage the creation and utilization of infrastructure data sets

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Streamline the project permitting process across infrastructure sectors, while ensuring appropriate safeguards and protections are in place.

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Ensure all investments are spent wisely, prioritizing projects with critical benefits

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Leverage proven and emerging tech to make use of limited available resources.

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Consider life cycle costs when making project decisions.

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Support research and development of innovative materials, technologies, and processes to modernize and extend the life of infrastructure

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Promote sustainability, or the "triple bottom line" in infrastructure decisions



## Achieving an infrastructure system fit for the future requires **increased, long-term, consistent investment.**

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Increase investment from all levels of government and the private sector from 2.5% to 3.5% of U.S. Gross Domestic Product (GDP) by 2025.

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Fully fund authorized programs.

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Infrastructure owners and operators must charge, and Americans must be willing to pay, rates reflecting the true cost of using, maintaining, and improving infrastructure.

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Congress must fix the Highway Trust Fund.

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Close the rural/urban and underserved community resource divide by ensuring adequate investment in these areas through programmatic set asides.

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Use public private partnerships, where appropriate.



SOLUTIONS  
Resilience

Utilize new approaches, materials, and technologies to ensure our infrastructure that can withstand or quickly recover from natural or man-made.

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Enable communities to develop and institute their own resilience pathway for all their infrastructure portfolios

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Incentivize and enforce the use of codes and standards

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Understand that our infrastructure is a system of systems

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Prioritize projects that improve the safety and security of systems and communities, to ensure continued reliability and enhanced resilience.

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Improve land use planning

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Enhance the resilience of various infrastructure sectors by including or enhancing natural or “green” infrastructure

# ASCE – Puerto Rico

- The Section was founded in 1929 and has more than 400 members.
- Our section has an infrastructure commission of international experts and consultants.
- The ASCE PR Section has 2 student chapters Mayagüez University Campus (RUM or UPRM) Polytechnic University of Puerto Rico (PUPR).
- For more information you can visit our website, [www.ascepuertorico.org](http://www.ascepuertorico.org)



American Society of Civil Engineers Puerto Rico Section  
[INFRASTRUCTUREREPORTCARD.ORG/PUERTO-RICO](http://INFRASTRUCTUREREPORTCARD.ORG/PUERTO-RICO)



# 2019 ASCE Puerto Rico Infrastructure Report Card

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- The first time that an entity with international credibility makes a report on Puerto Rico's infrastructure. Comparison: It's like an X-ray
- The report is an agglomeration of information, evaluates 8 infrastructure categories (plus an economic analysis) and issues recommendations endorsed by the ASCE Society's Infrastructure commission.
- It is public information and contains recommendations to mitigate the roots of the problems in the evaluated infrastructure (Dams, Roads, Energy, Solid Waste, etc.)
  - We assume they are simple, but in reality, they can be complex
  - Example: potholes in roads or water rationing

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# Supplemental Documents: Infographic

## Puertos y Aeropuertos\*

**PROBLEMA:**  
Plan Maestro para el Aeropuerto Internacional Luis Muñoz Marín (LMM) y la Autoridad de Puertos no incluye medidas para mitigar el alza del nivel del mar. La condición de los pavimentos de las pistas principales de los aeropuertos comerciales se encuentran en condición regular o mala a base del Índice de Condición de Pavimentos (PCI).  
Aeropuerto LMM 2050:  
Aumento del Nivel del Mar de 3 pies (proyección extrema NOAA)

Pista Norte  
Terminal  
Pista Sur  
Posibles zonas afectadas por desborde de la Laguna Torrecilla

\*Aeropuertos no son parte del 2019 ASCE PR IRC, no fueron calificados\*

**ACCIÓN NECESARIA:**  
Implementar un Plan de Adaptación al Cambio Climático para los aeropuertos.  
Inversión total de \$1,136 millones, \$879 millones provienen de fondos federales para la rehabilitación de los puertos marítimos.  
Implementar el Plan de Mejoras Capitales de Aerostar (SIU) para los años 2019-2036 proyectado en \$436.5 millones de los cuales \$401 millones provienen de diversas fuentes de fondos federales y cargos al pasajero.  
Muelle Panamericano y Aeropuerto Isla Grande en riesgo debido al cambio climático

## Energía

**PROBLEMA:**  
Falta de resiliencia debido a una infraestructura eléctrica anticuada.  
El costo promedio de la electricidad supera los \$0.19 dólares/kWh, el doble de la tarifa de EE.UU. No obstante, la red eléctrica de PR está entre las peores.  
Dependencia a los combustibles fósiles:

**ACCIÓN NECESARIA:**  
Rediseño y reconstrucción del sistema para resistir vientos de 160 mph, de acuerdo a los estándares de la ASCE. Se debe aumentar uso de energía renovable.

## INVERSIÓN TOTAL

Inversión requerida: ASCE recomienda invertir anualmente alrededor de 3% del Producto Interno Bruto (PIB) en infraestructura civil, pero PR ha invertido anualmente alrededor de 2% promedio en los pasados 5 años. El promedio de inversión debe aumentar \$2,000 millones anuales o \$20,000 millones en 50 años.

Brecha de Inversión en Infraestructura\*

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

www.infrastructurereportcard.org/Puerto-Rico  
ascepuertorico@gmail.com  
www.ascepuertorico.org

## Carreteras y Puentes

**PROBLEMA:**  
81% DE LOS PUENTES ESTÁN EN CONDICIONES POBRES O SATISFACTORIAS  
94% DE LOS 3,540 CARRILES-MILLAS DE CARRETERAS EVALUADAS NO ESTÁN EN BUEN ESTADO.  
20% DE LAS FATALIDADES EN CARRETERAS DE PR SON PEATONES

**ACCIÓN NECESARIA:**  
Factores contribuyentes al daño de las carreteras y puentes que atentan contra la seguridad de todos los usuarios:  
1. Controles inadecuados de la sobrecarga de camiones.  
2. Deficiencias de drenaje.  
3. Ausencias en el control de calidad del pavimento de las carreteras municipales.  
ACCIÓN NECESARIA:  
• \$517 millones anuales (hasta el año fiscal 2023) para mejoras capitales en adición al mantenimiento preventivo.  
• Implementar un plan agresivo de inspección, mantenimiento y rehabilitación de puentes y nivel isla cumpliendo con las disposiciones federales y estatales.  
• Acelerar la implementación de iniciativas innovadoras de seguridad conforme al Plan Estratégico de Seguridad Vial del año 2019.  
• Reglamentación estricta del proceso de pesaje de camiones.  
• Implementar un plan de mejoras de drenaje urbano.  
• Incrementar los recursos financieros y técnicos para mejorar el control de calidad en los proyectos de carreteras municipales.

## Desperdicios Sólidos

**PROBLEMA:**  
62% DE VERTEDEROS SON CAMPO ABIERTO, NO CUMPLE CON LAS REGULACIONES FEDERALES Y DEBEN CERRAR INMEDIATAMENTE  
EMISIÓN GASES TÓXICOS (METANO)  
CRIADEROS DE PLAGAS QUE CAUSAN EPIDEMIAS  
PERCOLACIÓN DE PLOMO Y METALES PESADOS A RÍOS  
LIXIVIADOS PUEDEN PERCOLAR AL SISTEMA DE AGUA POTABLE

**ACCIÓN NECESARIA:**  
Para 2030, hace falta capacidad para 30 millones de toneladas de desperdicios sólidos.  
ACCIÓN NECESARIA:  
• A corto plazo y de carácter de emergencia, aumentar y solicitar fondos federales disponibles para en sufragar el proceso de cerrar los vertederos en incumplimiento  
• Implementar un Plan Sistémico para disponer los desperdicios sólidos responsablemente conforme con las reglamentaciones federales.  
• Programar alternativas regionales para poder satisfacer un programa de expansión del sistema de vertederos de la isla (costo podría fluctuar entre \$30 a \$300 millones dependiendo del vertedero).

## Agua Potable y Represas

**PROBLEMA:**  
Alta pérdida de agua potable y sedimentación de embalses. Racionamiento de agua y suspensión de servicio frecuentemente.  
Alta dependencia en energía de AEE.  
Aumento de 2% anual en la factura al consumidor mejoras aparente.

Agua Potable  
59% Agua no contabilizada  
41% Agua que produce Ingreso  
Capacidad de Embalse  
Estimado de \$300 millones en agua no contabilizada  
45% Agua  
55% Sedimentación  
AAA necesita \$400 millones de inversión anual por 5 años

**ACCIÓN NECESARIA:**  
Explorar alternativas costo-eficientes para minimizar y remover la sedimentación en embalses, simultáneamente utilizar recursos de agua subterráneos para reforzar suministro de agua potable  
Disminuir la cantidad de agua no contabilizada. La tasa actual es similar a varios de los 47 Países Menos Desarrollados según ONU/WHO/UN-W GLAAS 2015  
Utilizar métodos alternos de energía eléctrica.

Represa Gualajataca siendo reparada

Acumulación de químicos dañinos producto del vertedero de Moca

# Infrastructure Report Card - Dams

- Puerto Rico has 37 dams.
- 97% of these 37 are high risk. (failure=deaths).
- 81% of these 37 are reported to be in “good shape” or “satisfactory”.
- 35% of these 37 dams have executed/completed emergency plans.
- 11 dams contain 67% of the potable H2O that enters to AAA’s system.
- Storage capacity of these 11 dams has been reduced 23% due to sedimentation.
- Dos Bocas has lost close to 60% of its capacity due to sedimentation (Pre-María).

# Infrastructure Report Card - Dams

- The safety inspection office and its regulatory unit, a division of PREPA, are required (Law 133) to do an inspection every 3 years to identify structural or maintenance problems.
- The reservoirs supply 580 MGD to PREPA, 40 MGD for agriculture and water to produce approximately 1.8% of the electricity produced by PREPA.
- It is possible that some of the older dams were built without seismic mitigation or with earthquake-specific design parameters.
- There is no official or standard guide to carry out inspections required by law (133) and each agency has different criteria.

# Infrastructure Report Card - Dams

- According to the Puerto Rico Dam Safety program, its budget for 2018 was \$ 230,686. Put another way, \$ 6,234 per dam.
- A 20-year annual dredging program costs approx. \$ 15M per dam that provides drinking water.
- There are low-cost, sustainable solutions to operate infrastructure sustainably.
  - Avoid water rationing
  - Reduce the amount of sediment entering the reservoir

# Dos Bocas Dam

- It has a life expectancy of approx. 35 years.
- The Lago Dos Bocas system supplies the Super Aqueduct of the North with around 50 MGD to 600,000 residents.
- The hydroelectric equipment installed in Dos Bocas has the capacity to produce 101.2 MW. It currently produces 35 MW. Of this loss, 31 MW is due to damage from Hurricane María and the remainder to lack of maintenance.

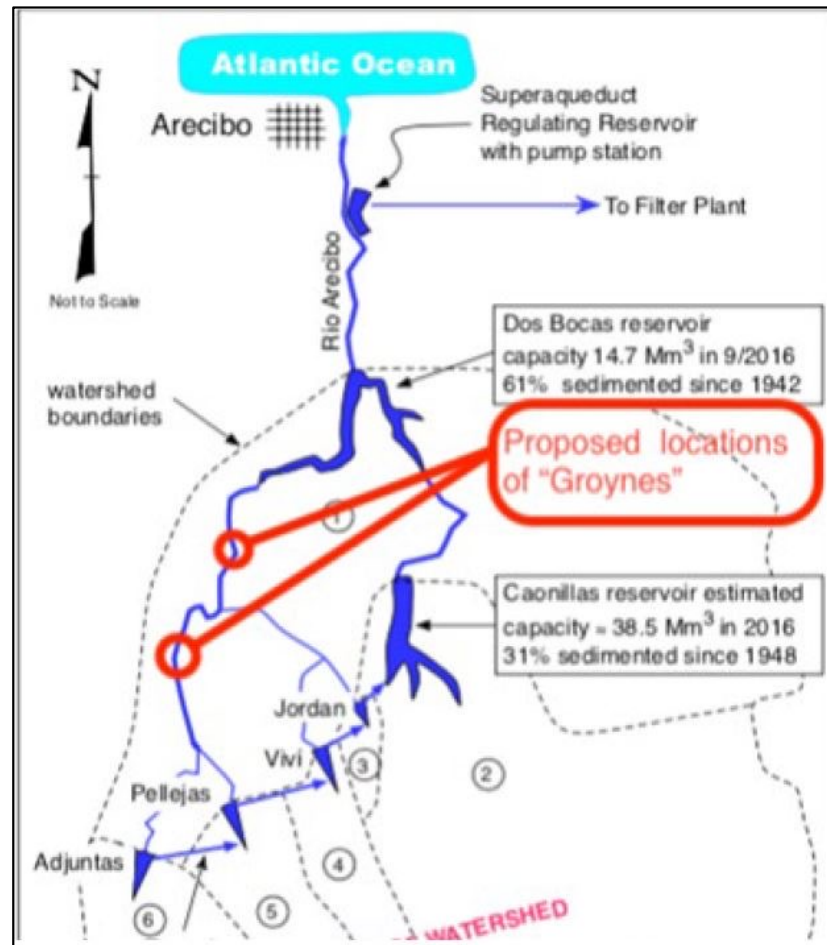


# Dos Bocas



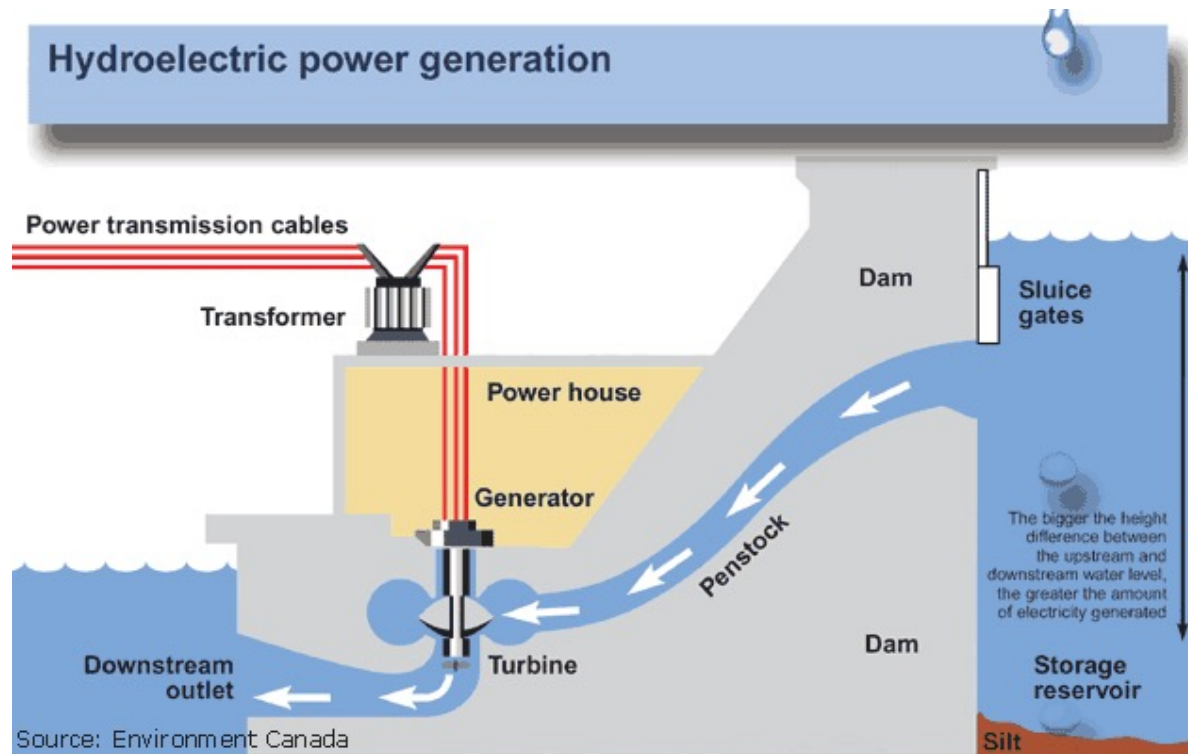
# Dos Bocas

\*Image courtesy of Dr. Greg Morris from GLM Engineers



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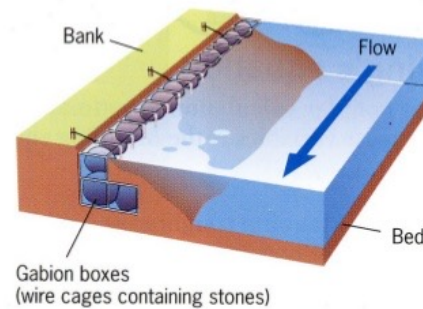
# Como funciona una hidroeléctrica



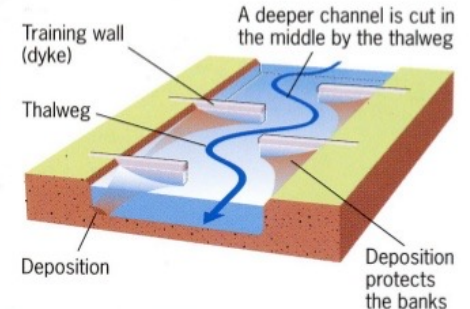
<https://www.usgs.gov/media/images/flow-water-produces-hydroelectricity>

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# Future of the Infrastructure in PR – Initiatives



**Figure 6.3** Gabion boxes (wire cages containing stones) strengthen the banks (Source: Knapp et al, 1989)



**Figure 6.4** Groynes or spurs deflect the thalweg, allowing the deposition of sediment in the lee of the groyne, thus protecting the banks from erosion (Source: Knapp et al, 1989)



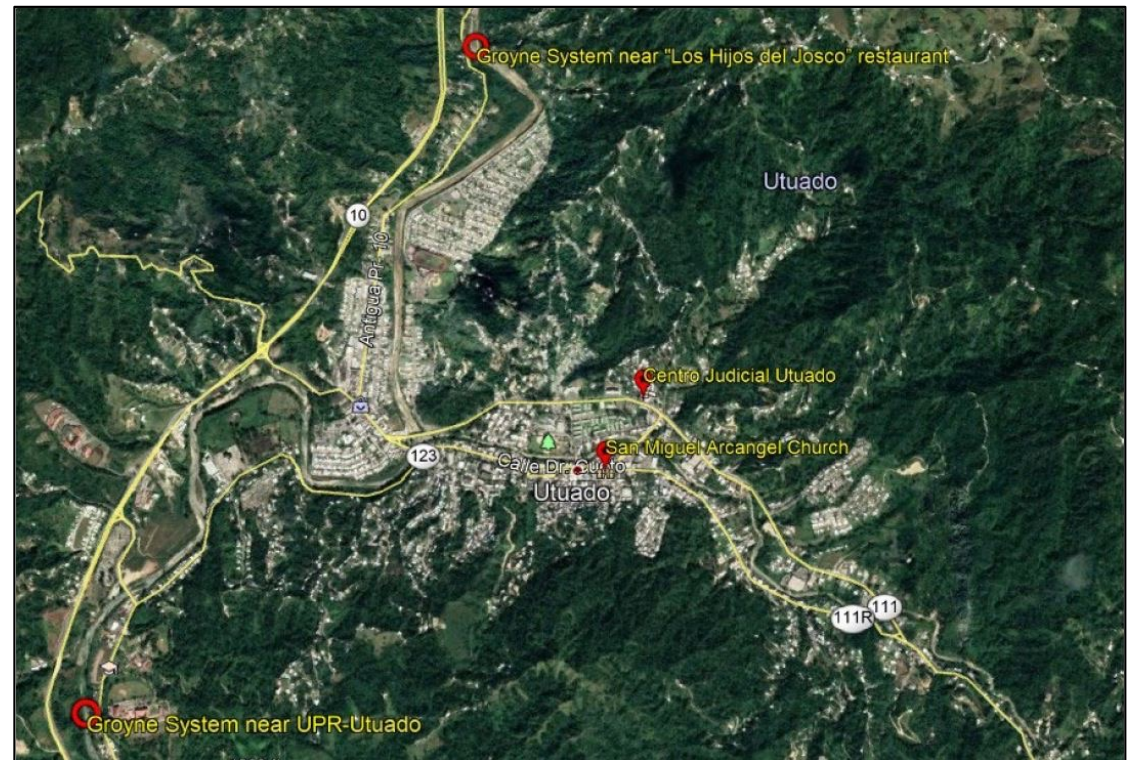
# Future of the Infrastructure in PR – Initiatives





# Future of the Infrastructure in PR – Initiatives

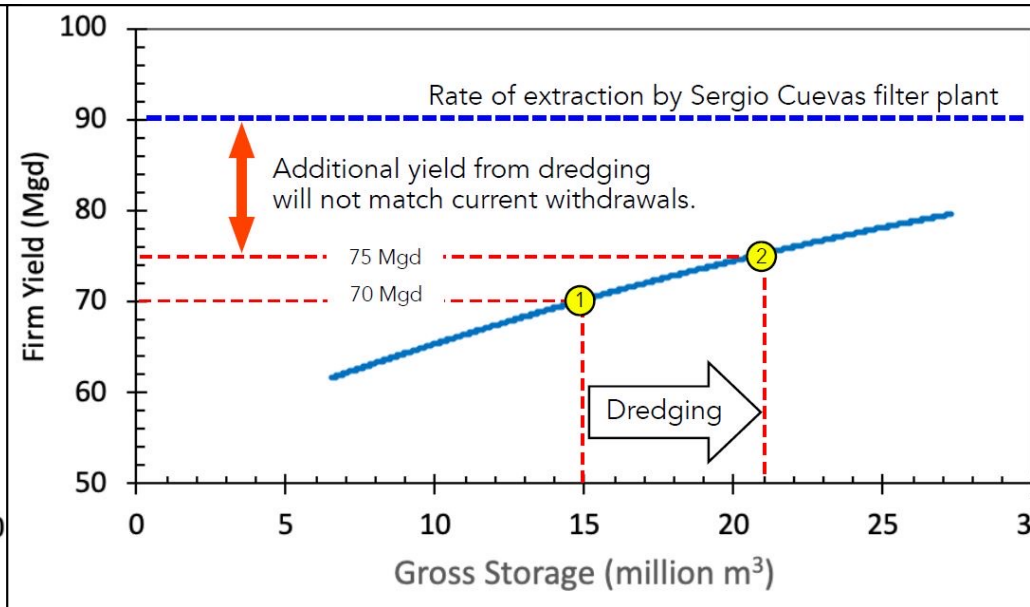
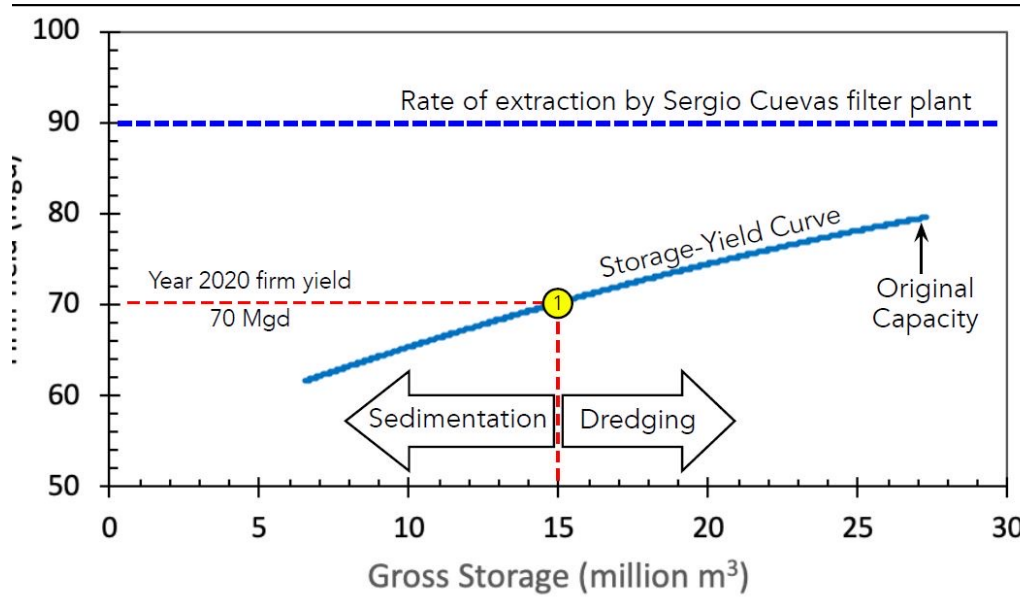
- Hydraulic Barriers
- Landfill coverage



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# Future of the Infrastructure in PR – Initiatives

- Retrofit of Dos Bocas

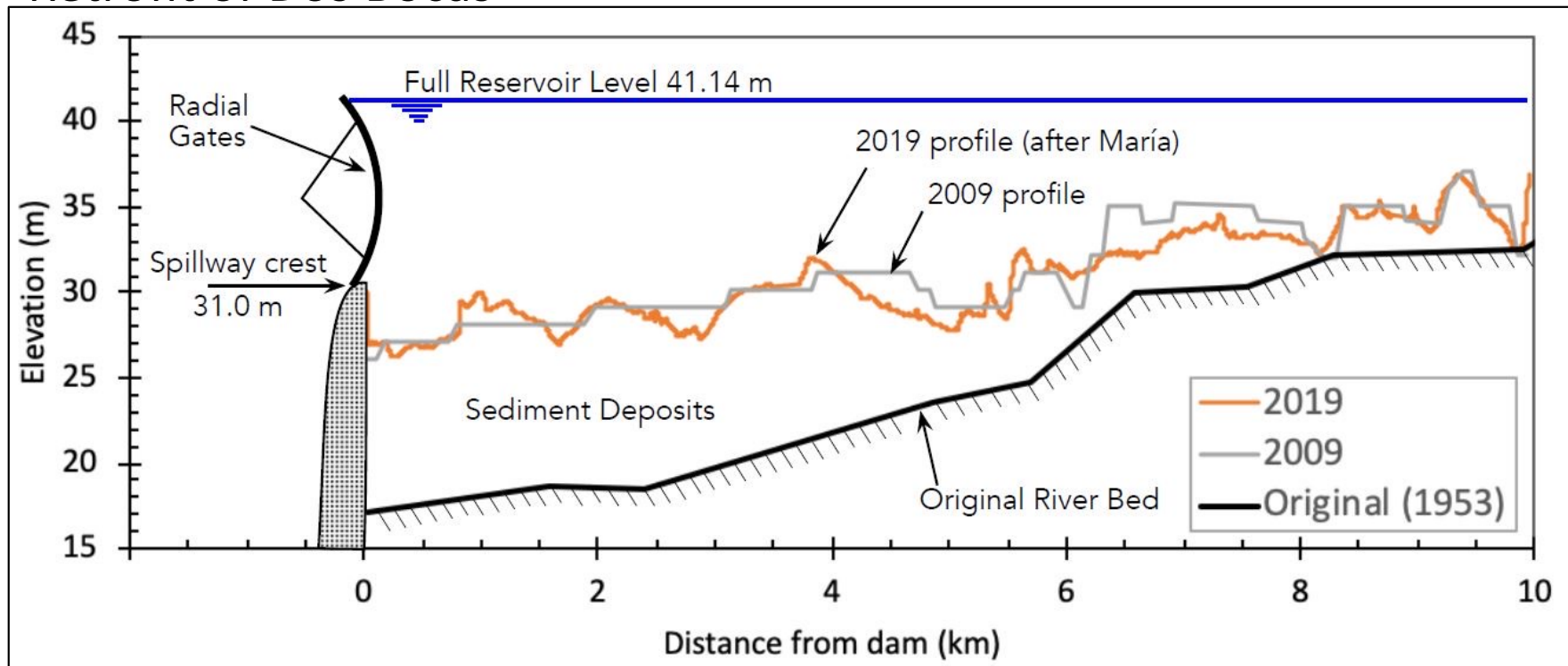


Graphs courtesy of GLM Engineers

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# Future of the Infrastructure in PR – Initiatives

- Retrofit of Dos Bocas





# Future of the Infrastructure in PR – Initiatives

- Retrofit of Dos Bocas



# Future of the Infrastructure in PR – Initiatives – R.C. 465

Legislation is available at  
[www.ascepuertorico.org](http://www.ascepuertorico.org)

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## GOBIERNO DE PUERTO RICO

18<sup>va</sup>. Asamblea  
Legislativa

7<sup>ma</sup>. Sesión  
Ordinaria

## SENADO DE PUERTO RICO

### **R. C. del S. 465**

15 de enero de 2020

Presentado por el señor *Seilhamer Rodríguez*

*Referido a la Comisión de Innovación, Telecomunicaciones, Urbanismo e  
Infraestructura*

### **RESOLUCIÓN CONJUNTA**

Para ordenar al Departamento de Transportación y Obras Públicas, en conjunto con otras agencias, a desarrollar y elaborar el Plan de Infraestructura de Puerto Rico, con el fin de atender y mejorar el estado de la infraestructura en Puerto Rico, con énfasis en las siguientes áreas: puentes, represas, agua potable, energía, puertos, carreteras, desperdicios sólidos y aguas residuales.

### **EXPOSICIÓN DE MOTIVOS**

La Sociedad Americana de Ingenieros Civiles (ASCE, por sus siglas en inglés), Capítulo de Puerto Rico, elaboró recientemente el documento titulado *2019 Report Card for Puerto Rico's Infrastructure*. Esta importante iniciativa consiste en un informe de

# PROMESA, Federal Government, State Government and Municipal Governments

- White House

- ✓ President Biden favored the Puerto Rico IRC and included it in his campaign for the presidency.
- ✓ VP Harris understands the needs of Puerto Rico's electrical system because she has come on visits.
- ✓ THE BIDEN-HARRIS PLAN FOR RECOVERY, RENEWAL AND RESPECT FOR PUERTO RICO

- US Congress

- ✓ She works together with the Resident Commissioner on matters related to the allocation of infrastructure funds for PR.

- Resident Commissioner

- ✓ Collaborated to acquire \$12B to repair electrical system and education.

- Puerto Rico Government

- ✓ ASCE recommends legislation for its codes to be used in rebuilding the electrical system. See case of Bahamas.