

20 Year Domestic Water Demand Forecast for T&T

Ministry of Public Utilities
Economic Policy and Planning Division – Water Sector

Presented by

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Background, Aim,
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BACKGROUND

WHAT?

Water Demand is the volume of water requested by users to satisfy their needs.

A Water Demand Forecast can be defined as the analysis of estimating the future water demand.

A good forecast can help to plan future operations

WHY?



- Last forecast done almost 20 years ago
- Changes in household plumbing and technology
- Increasing population



- Government capital investments are made without a sound approach



WATER DEMAND FORECAST FOR T&T

AIM

To develop a water demand forecast model for the next twenty (20) year in Trinidad and Tobago

Objectives

- To build a model to forecast water demand
- To forecast and explore changes in water demand across T&T with population using unmodified and modified demand scenarios
- To assess the population growth rates and the vulnerable population in each community



Purpose

- Capital investment and master planning in water supply and wastewater projects
- To understand peak demand factors
- Prioritising of vulnerable areas



ASSUMPTIONS



1. There will be no extreme political, social or environmental events that will the populations studied and water demand.
2. Internal shifts in the settlement of people across the country over time would be negligible, therefore the growth rate remains the same for each community across the forecasting period.
3. The increase in water demand due to dry conditions associated with climate change is negligible during the forecasting period.
4. Non-revenue is not considered in the model and will be reflected on the supply side of the water balance



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METHODOLOGY

The “Unit Water Demand” approach was used for this model

- Easy to Understand
- Can be used with limited data

Population

Resident

Migrant

Visitor



Consumption

Unmodified (BAU)

WHO Average

Controlled
(Policy Initiatives)



Water Demand

Unmodified

WHO Average

Controlled

Vulnerability

“Most Vulnerable Communities”

POPULATIONS



Resident

The usual residents of
Trinidad and Tobago

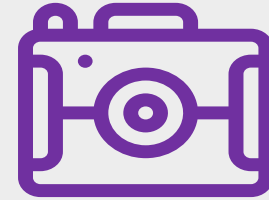
Non-Transient



Migrant

Changes country of
residence irrespective
of reason or legal
status

Transient



Visitor

Travels to a main
destination outside
their home country for
any purpose other than
to be employed

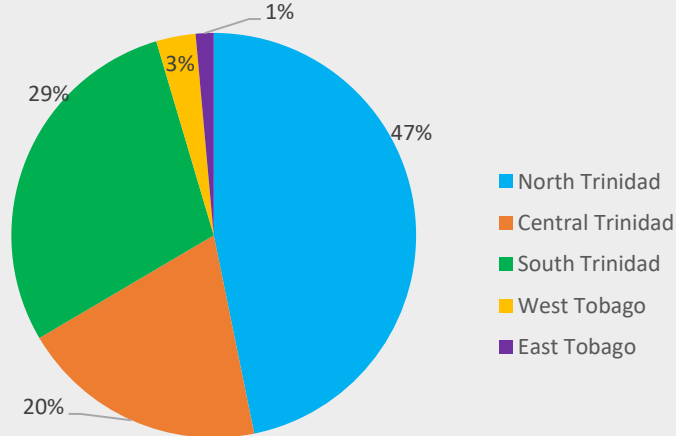
Transient



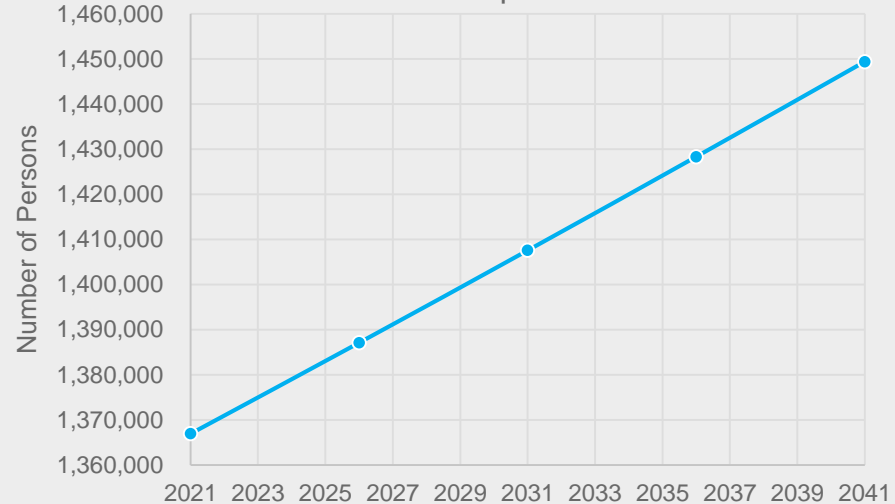
RESIDENT POPULATION

- Data retrieved from the CSO (2011 Census and mid-year Estimates)
- **Approach:** Exponential Growth or Geometric Method: $P_{t+n} = P_t (1 + r)^n$
- **Assumption:** Growth rate remains constant for each community

Trinidad and Tobago Population Disaggregated by Region



Resident Population Forecast



Population: Trinidad- 95 %; Tobago - 5 %



MIGRANT POPULATION

Approach: Bayesian Forecast Method
(Timeseries Data + Expert Judgement)

Assumptions about the future

- Largely dependent on Venezuela's Economic Recovery
- Peak in 2026
- Reach pre-COVID levels by 2031
- Reach normal levels by 2036
- No further external shocks during the forecasting period.

Timeseries Data

- Retrieved from the UNHCR (2000-2021)

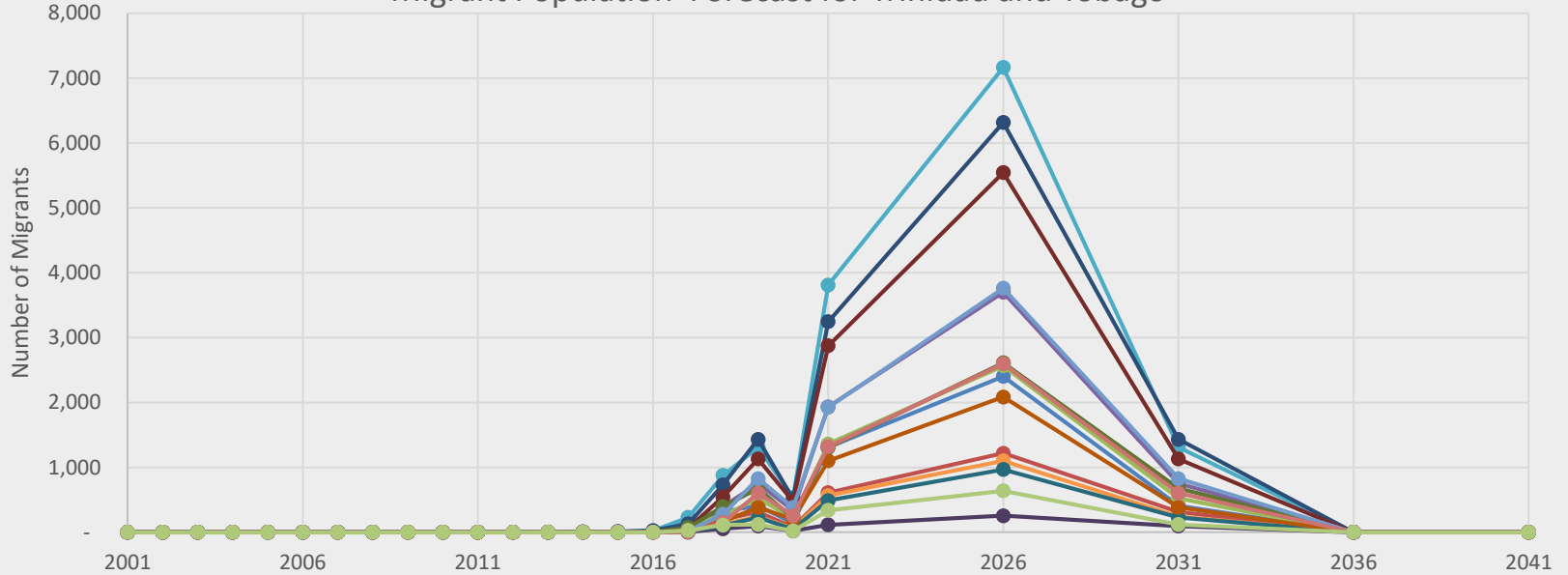
Expert Judgement :The Venezuelan Situation

- Base Scenario : Migrants will continue to leave Venezuela at least until 2025 (IMF, 2022)
- Migration “push factors” are expected to weaken in the following years due to economic recovery (IMF, 2022)
- Venezuela's Economy may recover by the year 2033 (IDB, 2020)



MIGRANT POPULATION

Migrant Population Forecast for Trinidad and Tobago



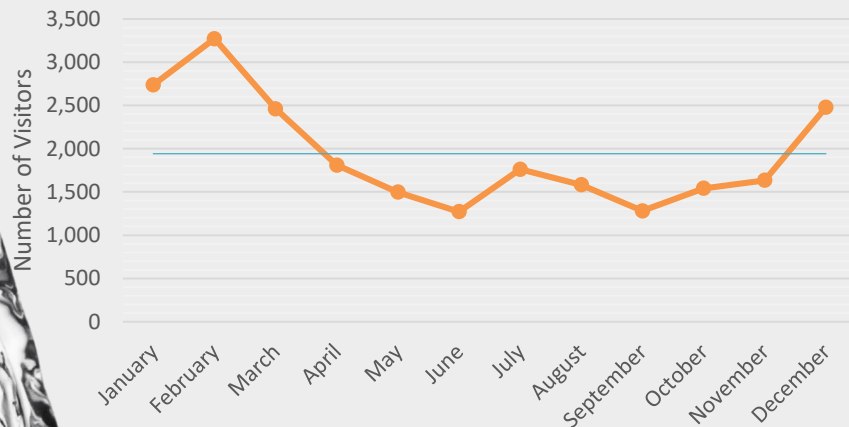
- CITY OF PORT OF SPAIN
- SAN JUAN/LAVENTILLE REGION
- BOROUGH OF CHAGUANAS
- BOROUGH OF POINT FORTIN
- PENAL/DEBE
- BOROUGH OF ARIMA
- TUNAPUNA/PIARCO REGION
- COUVA/TABAQUITE/TALPARO
- MAYARO/RIO CLARO
- SIPARIA
- DIEGO MARTIN REGION
- SANGRE GRANDE
- CITY OF SAN FERNANDO
- PRINCES TOWN
- TOBAGO



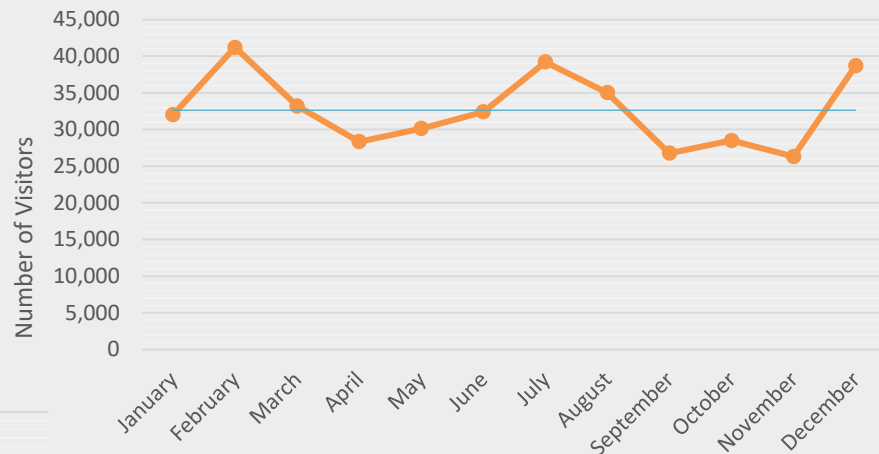
VISITOR POPULATION

- Data retrieved from the MNS – Immigration Division
- **Approach:** Average Visitors remains constant over the forecasting period

Tobago Average Visitor Population



Trinidad Average Visitor Population



- Trinidad Peak Months: February, June, December
- Tobago Peak Months: December, January, February.
- Trinidad – 94% ; Tobago – 6%

CONSUMPTION

RESIDENT AND MIGRANT

VISITORS

Unmodified

Calculated Average Consumption of the Population

Constant with Time

WHO Average

Likely volume of water consumed by a household optimal access –
44 gallons/person/day

Constant with Time

Controlled

Percentage Reduction in Unmodified Consumption due to Implementation of Policy Initiatives – Domestic Metering

Changes with Time



Unmodified

400 Litres Or
88 gallons
per visitor per day
(Gossling, et al., 2012)

Same for all Scenarios

UNMODIFIED CONSUMPTION

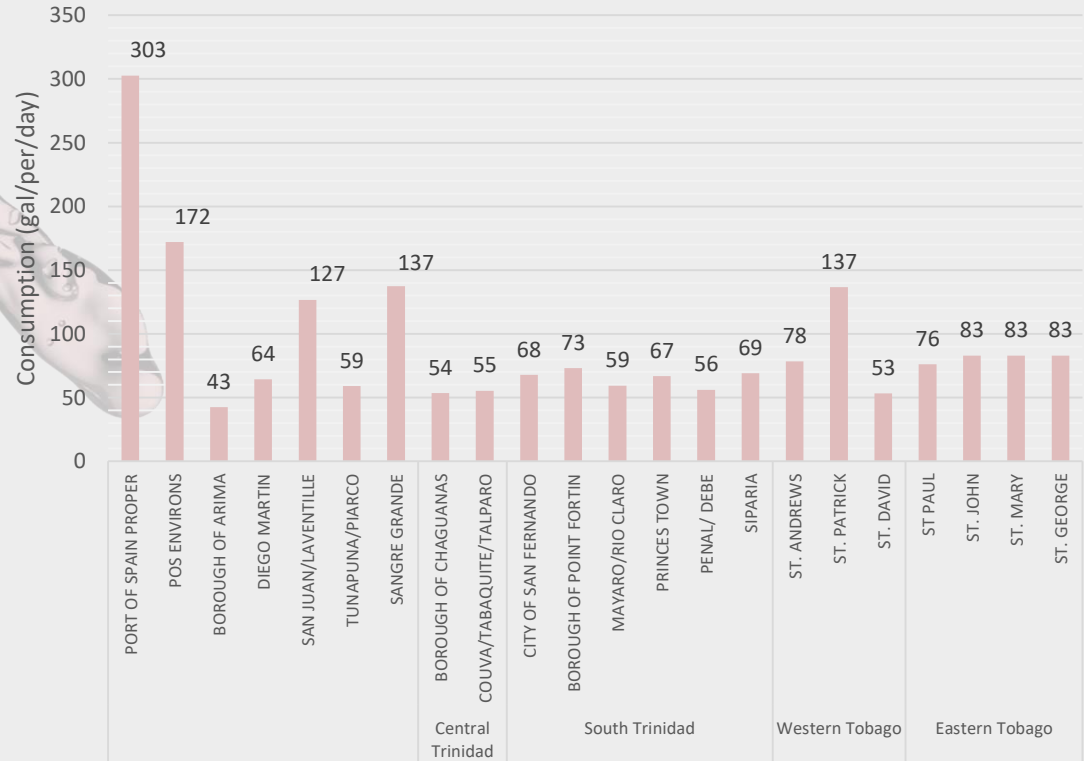
- Data retrieved from the WASA for metered customers (2018-2020)
- Household size retrieved from 2011 Census

Assumption: The consumption of each community is the same in its respective municipality.

Municipality/Parish Consumption

- Average = 91 gal/persons/day
- Variations due to: lack of data on factors which may affect consumption; limited sample size and; poor customer classification

Unmodified Daily Consumption per Capita by Region



CONTROLLED CONSUMPTION

- Main Policy Initiative: Domestic Metering
- Based on: Universal Metering Programme.
- Metering has the potential to reduce consumption by 15% – 22%



*% Reduction in Unmodified Consumption
= % meters installed × 20%*

Assumptions

- 20% reduction in consumption for every installed meter
- 100% coverage by the year 2041
- All customers would be metered by the year 2041
- New customers will be required to install a meter
- Actual programme schedule does not deviate significantly from that outlined in the universal metering programme.

Year	% Customers Metered since 2021 (baseline year)	% Reduction in Unmodified Consumption
2021	0%	0%
2026	16%	3%
2031	59%	12%
2036	94%	19%
2041	100%	20%

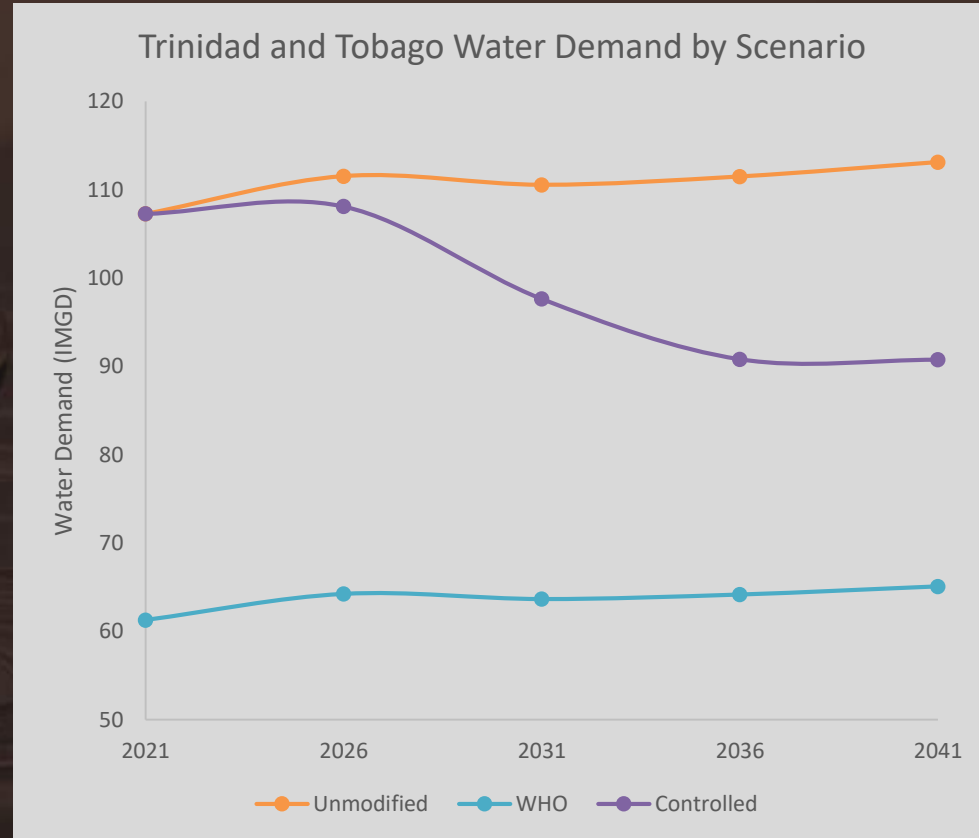
WATER DEMAND FORECAST

Demand Scenario	Consumption/ Unit Water Demand (gallons/person/day)	Population (persons)
Unmodified Water Demand	Resident Unmodified Consumption	Resident Population
	Migrant Unmodified Consumption	Migrant Population
	Visitors Unmodified Consumption	Visitor Population
WHO Average Water Demand	Resident WHO Average Consumption	Resident Population
	Migrant WHO Average Consumption	Migrant Population
	Visitors Unmodified Consumption*	Visitor Population
Controlled Water Demand	Resident Controlled Consumption	Resident Population
	Migrant Controlled Consumption	Migrant Population
	Visitors Unmodified Consumption*	Visitor Population

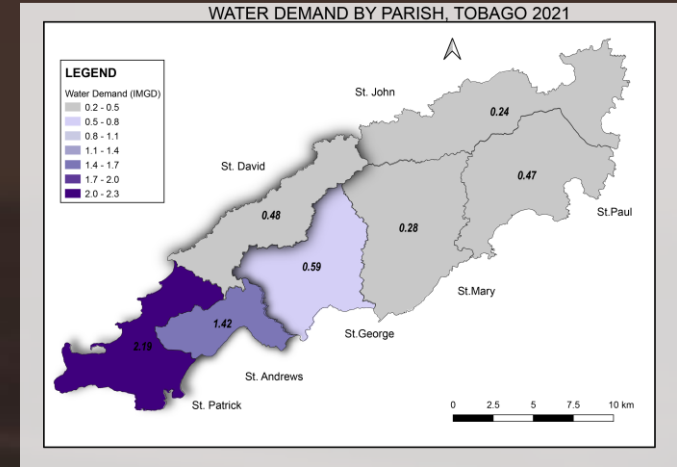
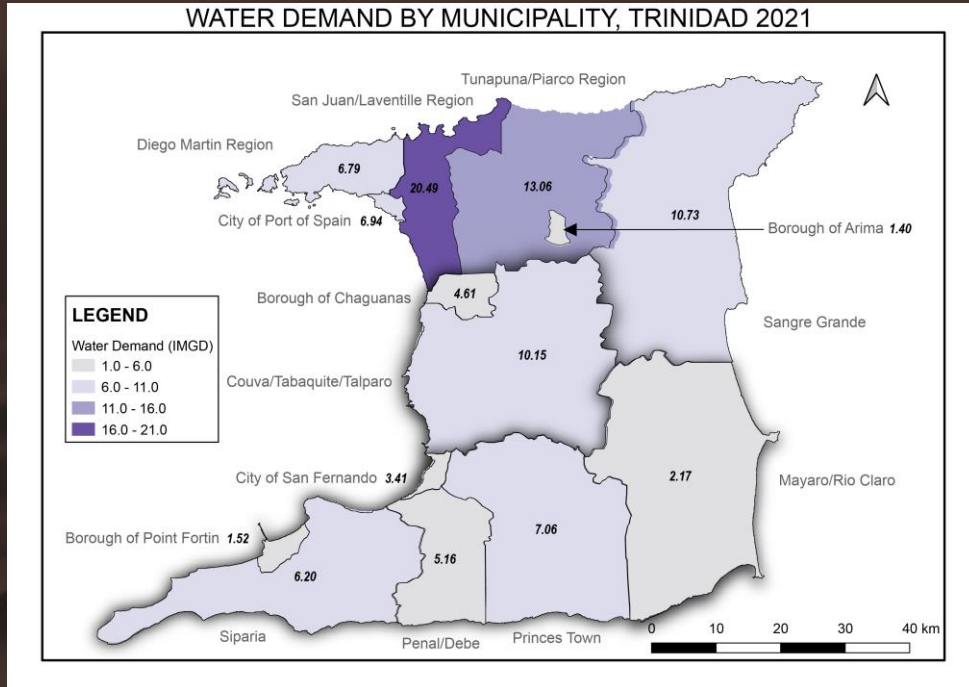
**Scenario does not apply*

WATER DEMAND FORECAST

- Residential Demand (Unmodified) increases at 0.32 IMGD/year and accounts for more than 95% of domestic demand.
- Migrant Demand peaks in 2026 (as expected) and accounts for less than 3% of domestic demand.
- Visitor Demand is constant at 1.32 IMGD and accounts for less than 2% of demand.
- Unmodified water demand is 74% higher than the WHO Average Demand.
- Resident consumption decreases at approx. 1.4 IMGD/year during the bulk of the metering programme.
- Visitors consume 1144 gallons of water over the average length of stay (13 days).



WATER DEMAND FORECAST



North Trinidad has the highest Water Demand accounting for 56% of residential demand and over 50% of Migrant demand.

Overall, Tobago has lowest water demand accounting for 5% Resident, 2% of Migrants (til 2036) and 6% of Vistor's demand (Unmodified)

VULNERABILITY

A Person is considered **Vulnerable** when they have **One or More Unmet Basic Need (UBN)**

These persons must be prioritised, as they tend to bear the highest cost of an inefficient water supply.

Data retrieved from 2011 Census, CSO - (% Community with One or More UBN)

Approach: Communities (for each island) categorized into quintiles based on Number of Vulnerable Persons

$$\text{Number of Vulnerable Persons} = \frac{\% \text{ Community with One or More UBN}}{100} \times \text{Population of Community}$$

TRINIDAD

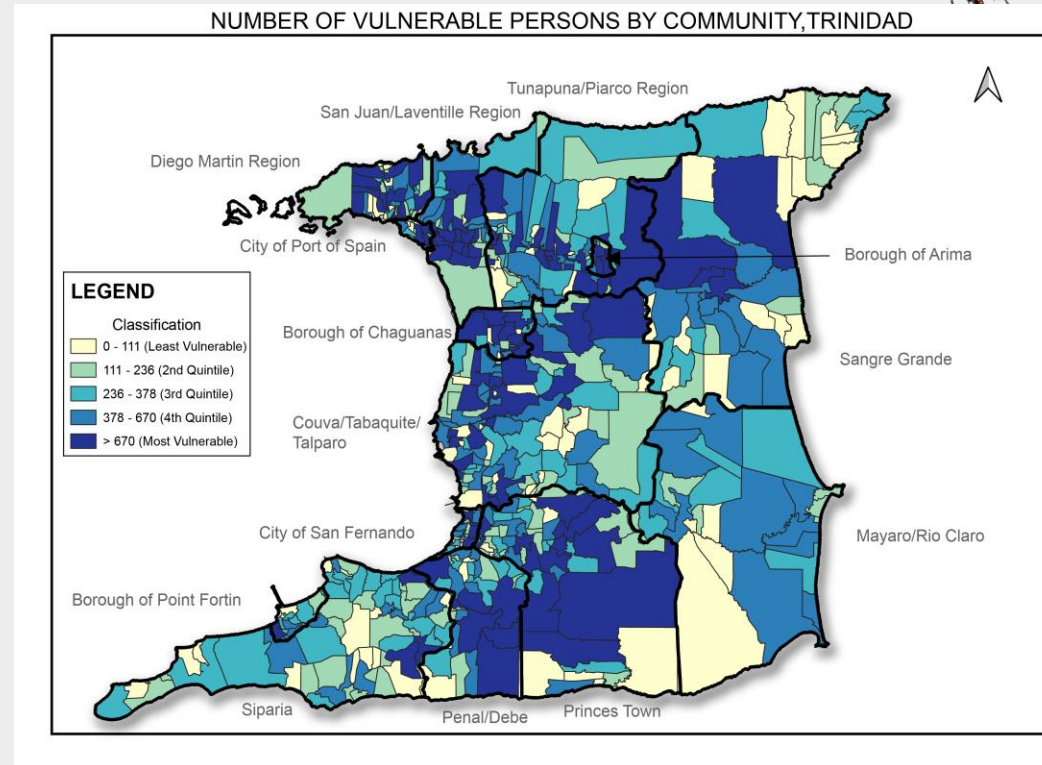
Category	Number of Vulnerable Persons
Least vulnerable	< 111 persons
Second Quintile	> 111 to 236 persons
Third Quintile	> 236 to 378 persons
Fourth Quintile	> 378 to 670 persons
Most vulnerable	> 670 persons

TOBAGO

Category	Number of Vulnerable Persons
Least vulnerable	< 74 persons
Second Quintile	> 74 to 112 persons
Third Quintile	> 112 to 243 persons
Fourth Quintile	> 243 to 356 persons
Most vulnerable	> 356 persons

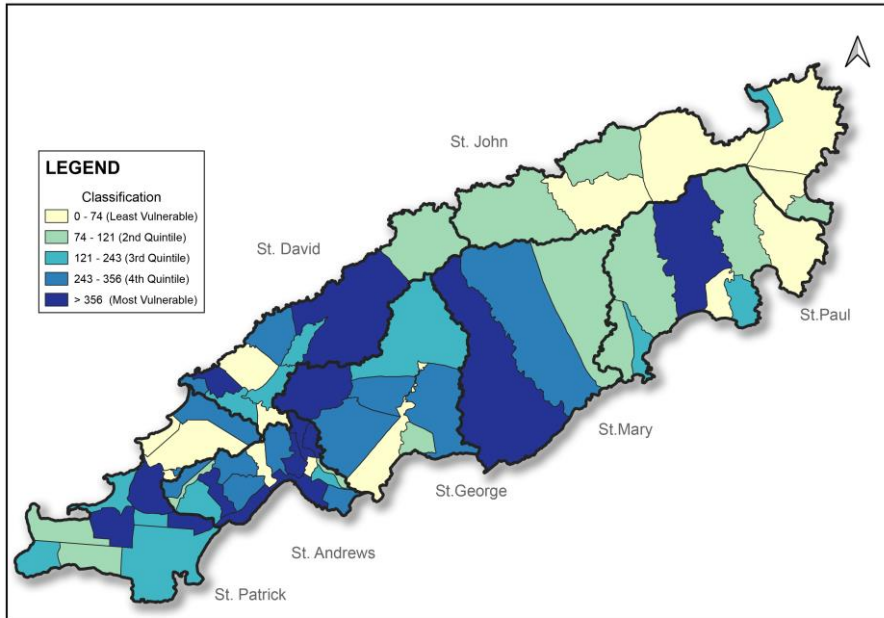
VULNERABILITY - TRINIDAD

- North, Central and South Trinidad accounts for 54%, 22% and 24% of the most vulnerable communities on the island, respectively
- San-Juan/ Laventille has the highest number of “Most Vulnerable” Communities (19)
- Top three (3) Communities with the highest number of Vulnerable Persons
 - Morvant – 4313 persons
 - Enterprise – 4078 persons
 - Valencia – 3563 persons



VULNERABILITY – TOBAGO

NUMBER OF VULNERABLE PERSONS BY COMMUNITY, TOBAGO



- West and East Tobago accounts for 79% and 21% of the most vulnerable communities on the island, respectively
- St Andrew's Parish has the highest number of “Most Vulnerable” Communities (6)
- Top three (3) Communities with the highest number of Vulnerable Persons
 - Roxborough – 648 persons
 - Mason Hall – 630 persons
 - Mt Grace – 585 persons

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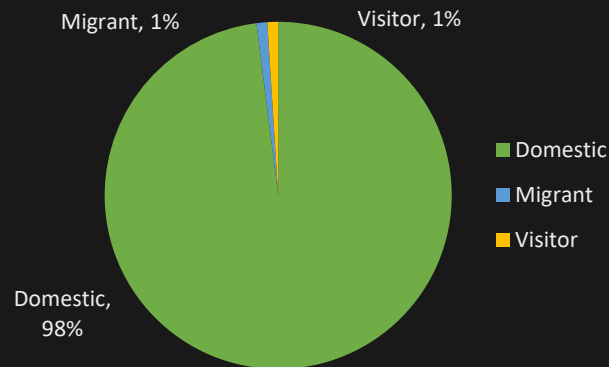
SUMMARY

- Assuming that domestic demand accounts for 74% of the total water demand - Trinidad and Tobago produces enough water to meet demand but struggles due to high NRW.
- Unmodified Water Demand is 74% higher than WHO Average Water Demand
- Water demand is forecasted to decrease with the implementation of meters despite the growing population
- Peak demand months to T&T are in February and December due to Visitors
- North Trinidad has the highest water demand. It is also home to the highest number of most vulnerable communities.

Table showing Water Demand Forecast for Trinidad and Tobago

Trinidad and Tobago Water Demand (IMGD)					
Scenario	2021	2026	2031	2036	2041
Unmodified	107	112	111	112	113
WHO	61.3	64.2	63.6	64.2	65.1
Controlled	107	108	97.7	90.8	90.8

20 Year Average Water Demand Disaggregation by Population



LIMITATIONS/ SOURCES OF ERRORS

- The model uses time-series data and therefore does not consider factors which can affect population growth and water demand.
- Lack recent and relevant population data
- Limited spread of metered customer data across communities
- Unavailable data for visitor consumption and accommodation
- Controlled Water Demand scenario did not account for other policy initiatives outside of metering e.g. Rainwater Harvest and Wastewater Reuse
- Water service data was unavailable for the communities



IMPROVEMENTS

1. Publish the results of this forecast to be further developed by academia.
2. Revise the water demand forecast model every five (5) years or sooner if required with relevant data and implementations to improve the model's accuracy and reliability.
3. Include vulnerability data specific to the lack of access to water.
4. Develop an additional scenario to explore change in water demand due to climate change given that increasing temperatures can increase consumption.



BENEFITS

1. To provide support to the calculation of a 20 year water balance in the absence of wide spread metering.
2. To monitor and predict the impact of capital project and policy initiatives, including those related to NRW.
3. To assist with supply and demand management when used with production and distribution data.



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- 4) Water and Sewerage Authority (WASA)
- 5) United Nations High Commissioner for Refugees (UNHCR)
- 6) Ministry of National Security – Immigration Division
- 7) Ministry of Planning and Development – Central Statistical Office (CSO)
- 8) Ministry of Social Development



A black and white photograph of a water splash, with numerous droplets captured in mid-air, creating a dynamic and refreshing visual. The water is splashing upwards and outwards from a central point, with many individual droplets of varying sizes suspended in the air. The background is a plain, light color, making the water droplets stand out prominently.

Thank You

20 YEAR WATER DEMAND FORECAST FOR T&T