

*Environmental Impact Assessment  
Terms of Reference:*

# East-West Arterial Extension

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SECTION 2 (WOODLAND DRIVE –  
LOOKOUT ROAD)

SECTION 3 (LOOKOUT ROAD – FRANK  
SOUND ROAD)



# Project Stakeholders and Presenters

## National Road Authority (*Project Owner*):

- Denis Thibeault *Assistant Director of Transportation and Planning Unit*



## Whitman, Requardt & Associates, LLP (*Project Consultant*):

- Lindsey Ulizio, PE *Senior Project Engineer*
- Kimberly Glinkin, AICP/ENV-SP *Senior Environmental Planner/ Noise Analysis*
- Dody Frawley *Senior Project Environmental Scientist*



## TYLin (*Project Consultant*):

- Sara Gutekunst *Senior Environmental Scientist*

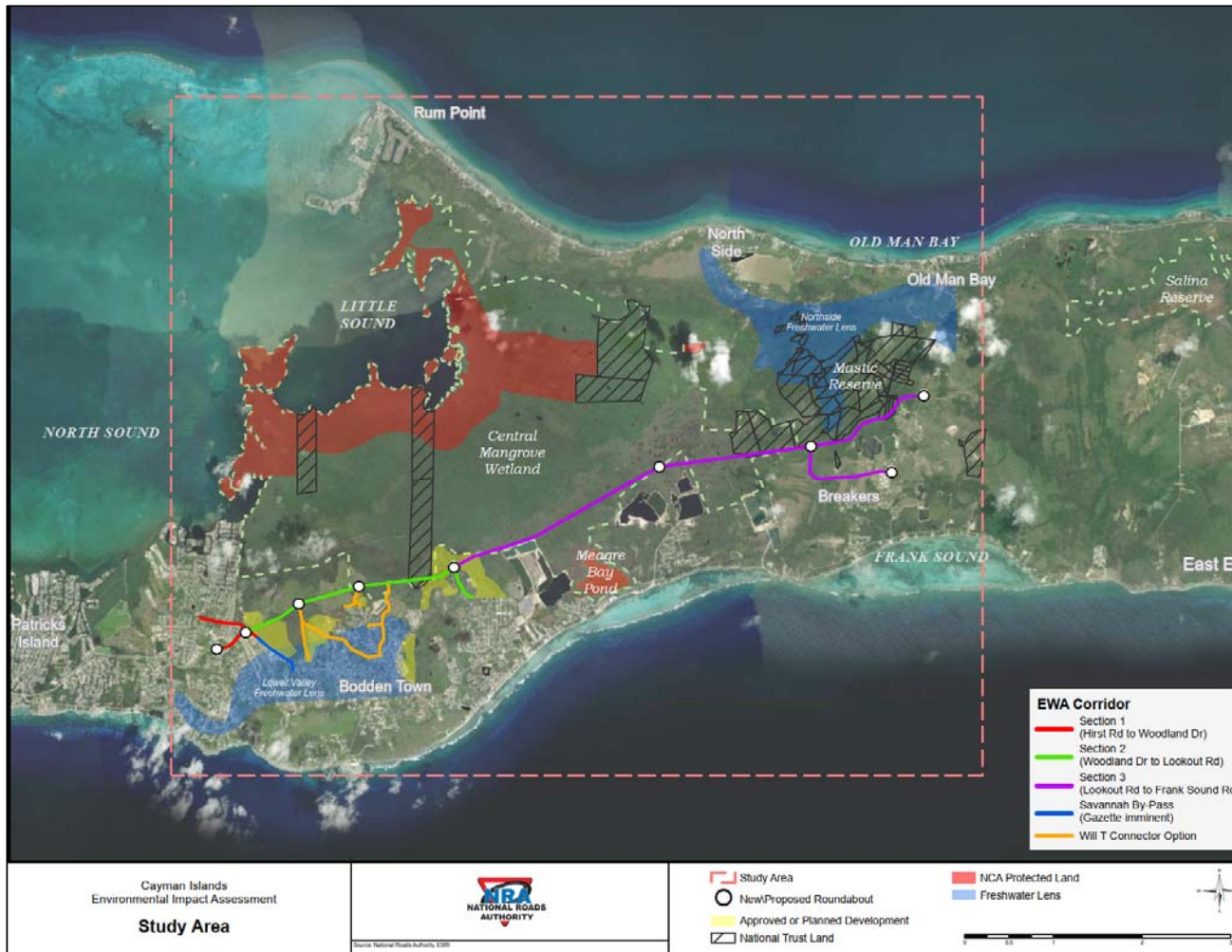


Environmental Assessment Board Members

# Project Overview

10 mile long (16 km), multi-lane highway and roundabouts

- Section 1 (*under construction*)
  - Hirst Road to Woodland Drive
- Section 2
  - Woodland Drive to Lookout Road
- Section 3
  - Lookout Road to Frank Sound Road



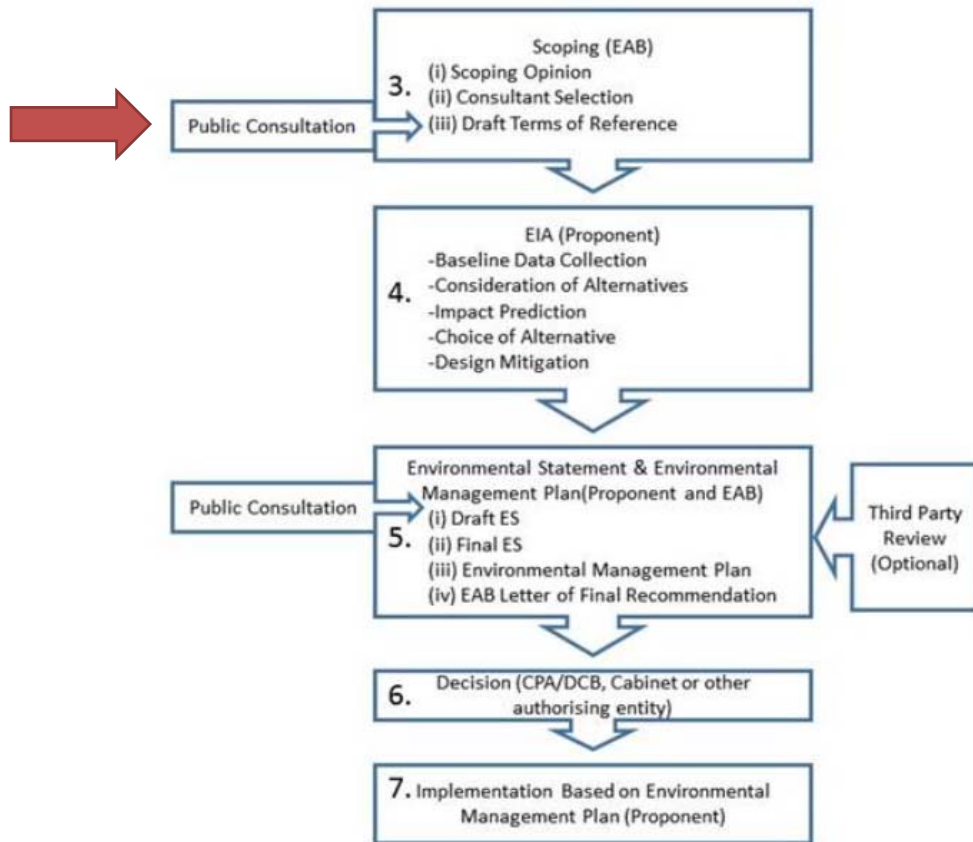
# Purpose and Need

## Purpose:

- Provide a disaster-resilient transportation network to connect the east and west districts
- Create a central alternative route to Bodden Town Road
- Ease traffic congestion along Bodden Town Road

## Need:

- Effects of climatic events and sea-level rise on Bodden Town Road
- Lack of alternatives to Bodden Town Road/Shamrock Road connecting the Eastern and Western districts
- Frequency of congestion along Bodden Town Road and Shamrock Road



# Environmental Impact Assessment Process

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# Terms of Reference

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Addresses the applicable environmental laws and regulations

Establishes the assessment methodologies

Guides the overall activities required for the environmental studies

Evaluates the following applicable resources:

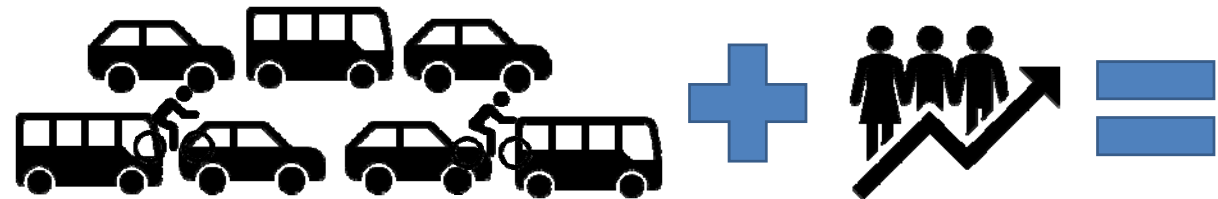
- Socio-Economic Considerations;
- Hydrology and Drainage (including climate resiliency)
- Geo-Environmental
- Terrestrial Ecology
- Cultural and Natural Heritage Trust-Protected Areas
- Greenhouse Gas Emissions
- Noise and Vibration

# Highway Design and Traffic Analysis Engineering

**Lindsey Ulizio, PE**  
*Senior Project Engineer*



# Roadway Alignment Alternatives & Analysis



Eastern Districts  $\longleftrightarrow$  Central & Western Districts

*Limited Options...*





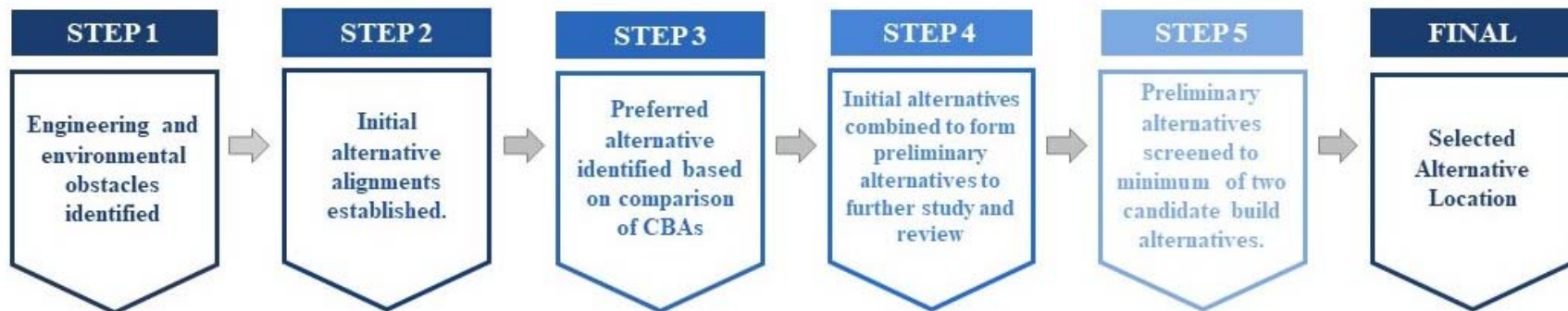
# The Focus of the Roadway Analysis



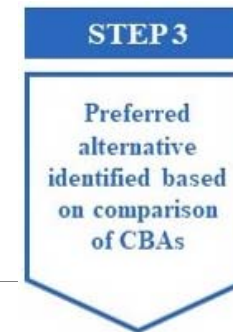
- ✓ Provide a disaster-resilient alternative route
- ✓ Meet the existing and projected multimodal travel needs through improved traffic conditions
- ✓ Preserve the unique environment of Grand Cayman
- ✓ Provide an enriched quality of life through improved mobility and accessibility for residents and visitors alike

# Alternatives Evaluation

1. “Do Nothing” Alternative – only includes previously established committed projects, such as the EW Arterial section between Hirst Road and Agricola Drive
2. EW Arterial Expansion Alternative – includes all the “Do Nothing” alternative as well as the EW Arterial extension to Frank Sound Road
3. Shamrock Road/Bodden Town Road Alternative – includes all committed projects in the “Do Nothing” alternative as well as any necessary design, safety, and/or operational improvements needed to meet the Purpose and Need



# Alternatives Evaluation: Step 3



## Sustainability Measures

- **Cost Effectiveness** – in terms of short- and long-term life cycle costs
- **Environmental and Natural Resource Conservation** – level to which environmental resources (e.g., wildlife, water quality, air quality, virgin materials, etc.) are being conserved, protected, or enhanced
- **Ease of Implementation** – based on NRA contractual and policy procedures or existing operating conditions and circumstances
- **Community Context Sensitivity** – level to which promotes, maintains, and/or enhances the local/regional community or driving public by improving safety, quality of life, and sense of place

## Performance Metrics

- **Travel time (TT)** and reliability for employment opportunities, equity, and overall quality of life as well as enhancement to local tourism sector
- **TT** to key destinations and outlying tourist attractions
- **Travel Time Index (TTI)**, which is used to measure the severity of recurring congestion
- **Intersection Operations and Maximum Queues**
- **Vehicle Miles Travelled (VMT)**, which is used to compare both operational and air quality factors
- **Fuel Usage and Emissions** based on %VMT
- **Land Use Accessibility** to improve quality of life through increased opportunities to efficiently and safely reach occupational, recreational, and shopping areas/facilities

STEP 4

Initial alternatives combined to form preliminary alternatives to further study and review

# Alternatives Evaluation: Step 4

## Possible Engineering and Environmental Factors in Screening Process

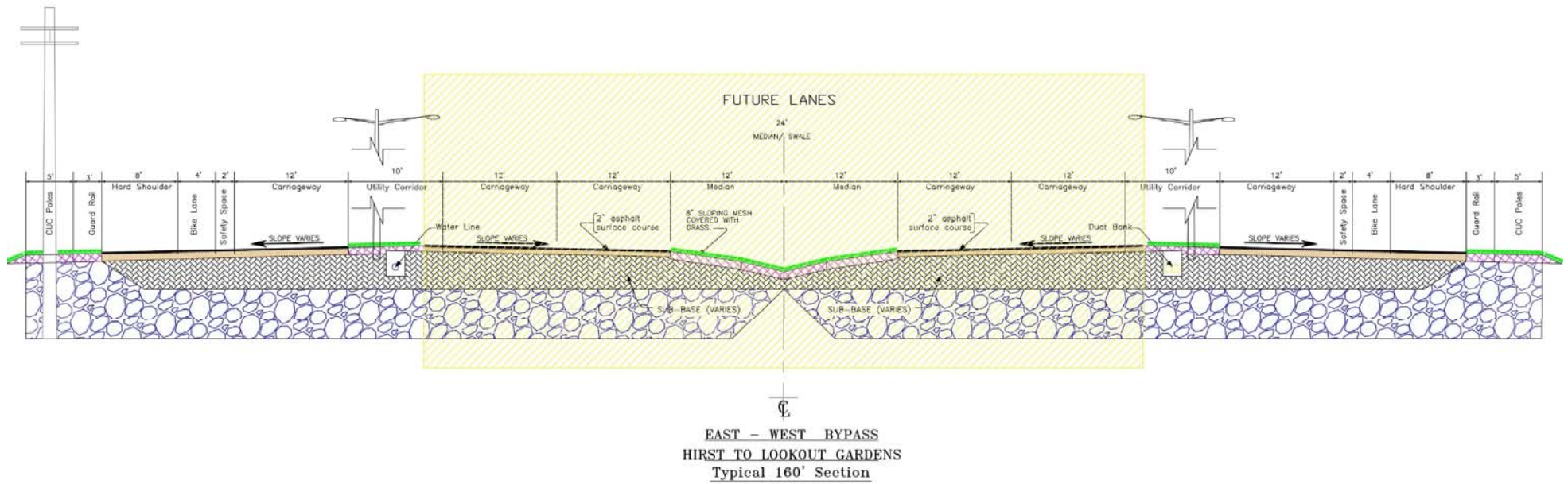
- Ability to minimize the removal of unsuitable materials
- Decrease the potential of flooding adjacent lands by considering bridges, culverts, or cross drains
- Reduce the aggregate volume needed to construct the new road
- Address areas that have a need for pedestrian crossings or wildlife passage
- Reduce direct and indirect impacts to protected areas



# Summary of Anticipated Impacts

Alternatives	No Build	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Etc.
Socio-Economic Impacts:						
Hydrology & Drainage Impacts:						
Geo-Environmental Impacts:						
Terrestrial Ecology Impacts:						
Cultural & Natural Heritage Impacts:						
Greenhouse Gas Impacts:						
Noise & Vibration Impacts:						
Traffic Impacts:						

# Typical Section Example



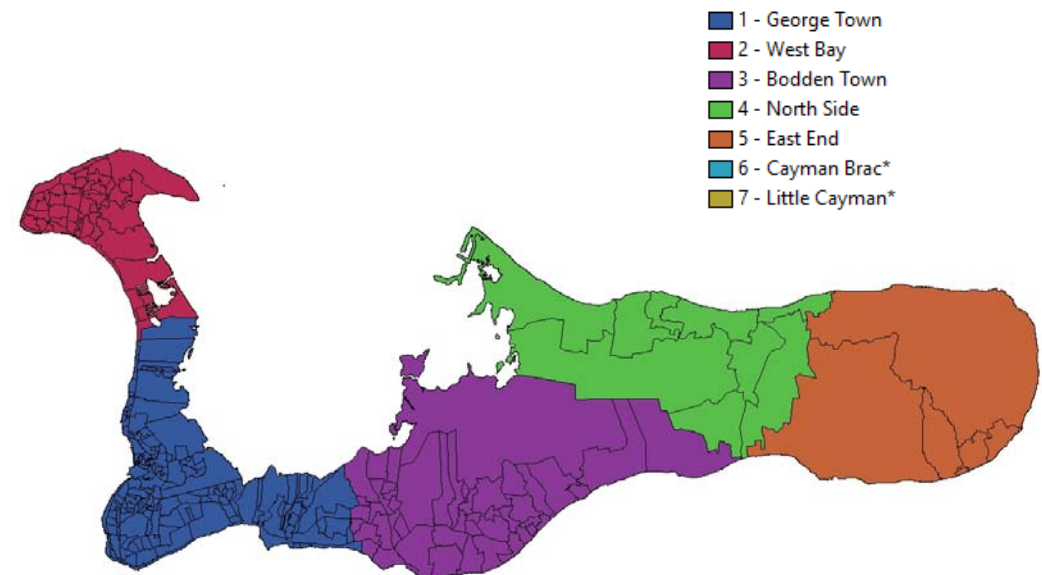
# Roundabout Configuration Example

1. Existing Conditions:  
Unsignalized **T-intersection**
2. Considered Design: **Bowtie-Shaped Roundabout** to minimize Right-of-Way impacts
3. Revised Design: **2 x 1 Hybrid Roundabout** with pedestrian/cyclist crossings and bus pull-offs



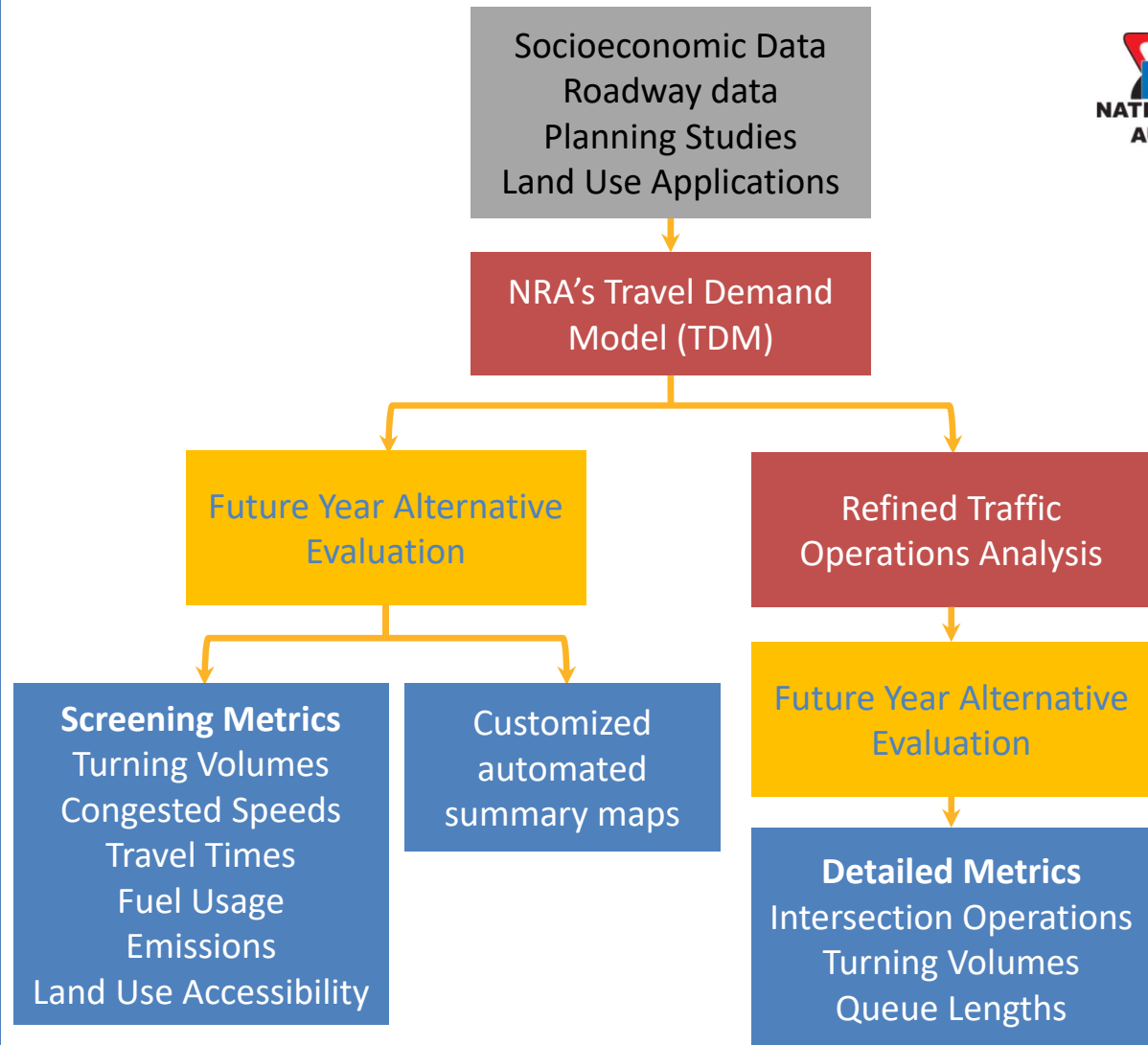
# Traffic Analysis

- Feeds into the Highway Design to determine the optimal solution(s) to meet the Purpose and Need
- Holistic perspective of project mobility benefits and impacts to be determined and evaluated for each alternative
- Alternatives to be evaluated for Years 2026, 2036, and 2046
- Use most recent Census and socio-economic data for each District to forecast future year traffic volumes
- Evaluate three primary alternatives with any necessary refinements, which may include:
  - Determining number of lanes at each roundabout,
  - Turn bay lengths at intersections,
  - Number of through lanes, and
  - Intersection configurations at each intersection





# Overall Multimodal Transportation Model Flow





# Study Area and Socio-Economics

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**Kimberly Glinkin, AICP/ENV-SP**

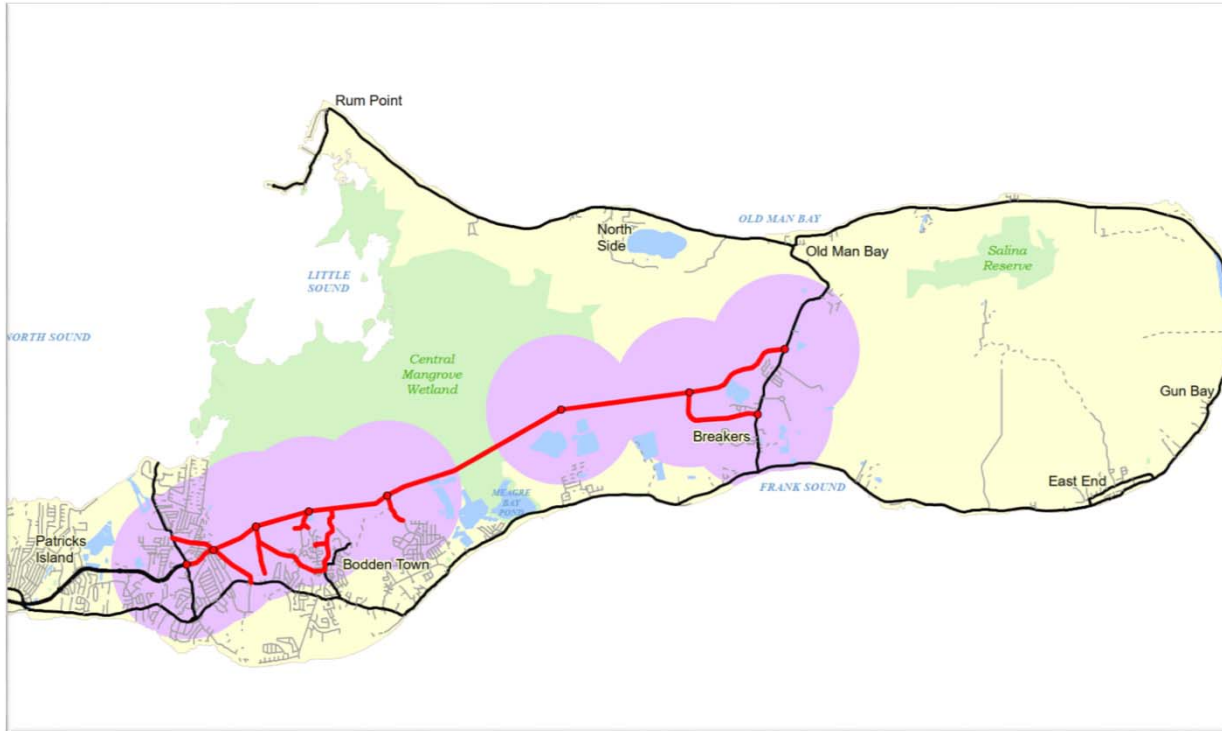
*Senior Environmental Planner/ Noise  
Analysis*



# Study Area



- Direct Impacts
  - Project footprint
  - Other direct impacts are set back (light, noise, etc.)
- Indirect and Cumulative Effects
  - Foreseeable effects that could occur later in time or further in distance
  - Combined effects with past actions and projects/developments that are planned to occur
- Study Area (*red dashed line on map*)
  - Includes direct, indirect, and cumulative effects



## Induced Growth (Indirect Impact)

- New development due to the proposed roadway
- Primarily anticipated within 1 mile (1.6 km) of new access points (*purple circles on the map*)
- Effects of the new developments will be qualitatively assessed (including impacts to traffic and natural resources)

# Assessment of Effects to Resources

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Direct or Indirect

Certain or  
Potential

Secondary or  
Induced

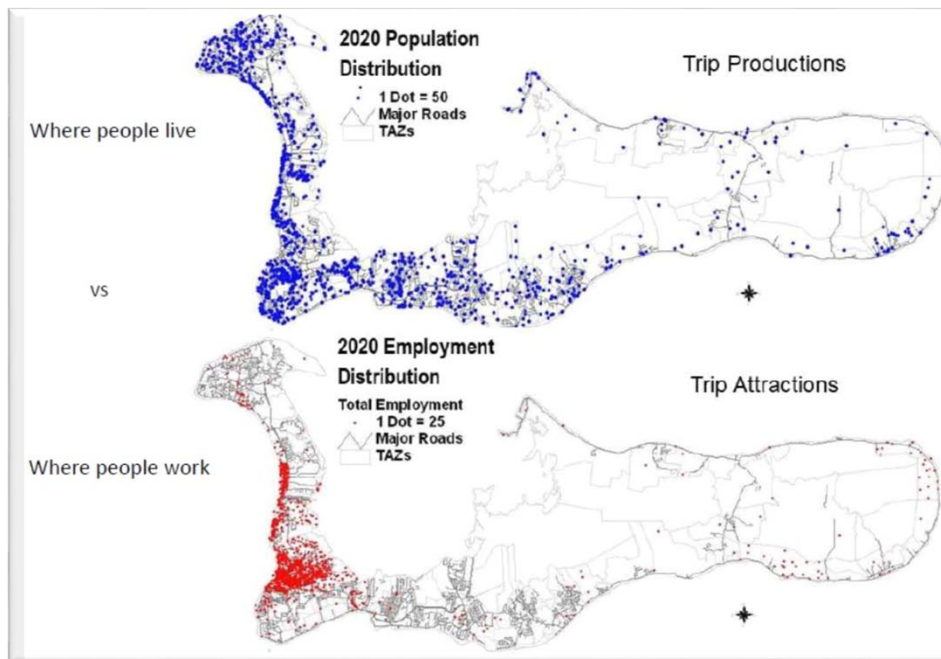
Short, medium, or  
long term,

Permanent or  
Temporary

Positive or  
Negative  
(beneficial or  
adverse)

		Importance/Sensitivity of Resource			
		High	Medium	Low	Negligible
Magnitude of Change	High	Very Substantial	Substantial	Moderate	None
	Medium	Substantial	Substantial	Moderate	None
	Low	Moderate	Moderate	Slight	None
	Negligible	None	None	None	None

# Significance Evaluation



## Socio-Economics

- Objective characteristics (e.g., income or education)
- Subjective characteristics (e.g., people's sense of placement).
- Evaluates residents, businesses, short-term renters, and marginalised/vulnerable groups
- Study area includes all of Grand Cayman Island

# Socio- Economics Evaluation Process



1. Data is used to create a baseline of current conditions
2. Relevant planning documents, data, and laws are reviewed
3. New planned developments/projects and/or planned changes to laws or planning documents are evaluated
4. Potential benefits and impacts of the project in comparison to a No-build scenario are then qualitatively described. Including:
  - Aesthetics “Quality of Life”
  - Access & Mobility
  - Income & Economics
  - Housing
5. Measures to minimize or mitigation these effect would then be discussed





# Noise, Vibration, and Greenhouse Gas Emissions

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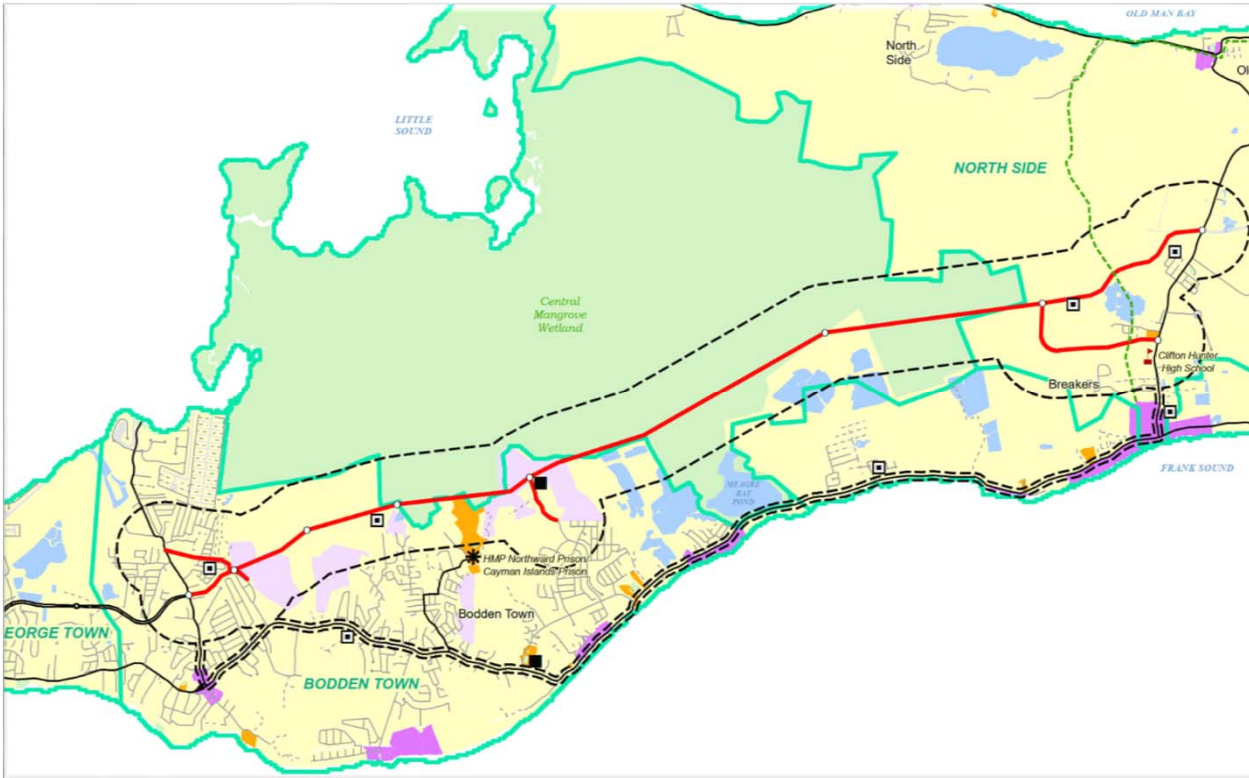
**Kimberly Glinkin, AICP/ENV-SP**

*Senior Environmental Planner/ Noise  
Analysis*

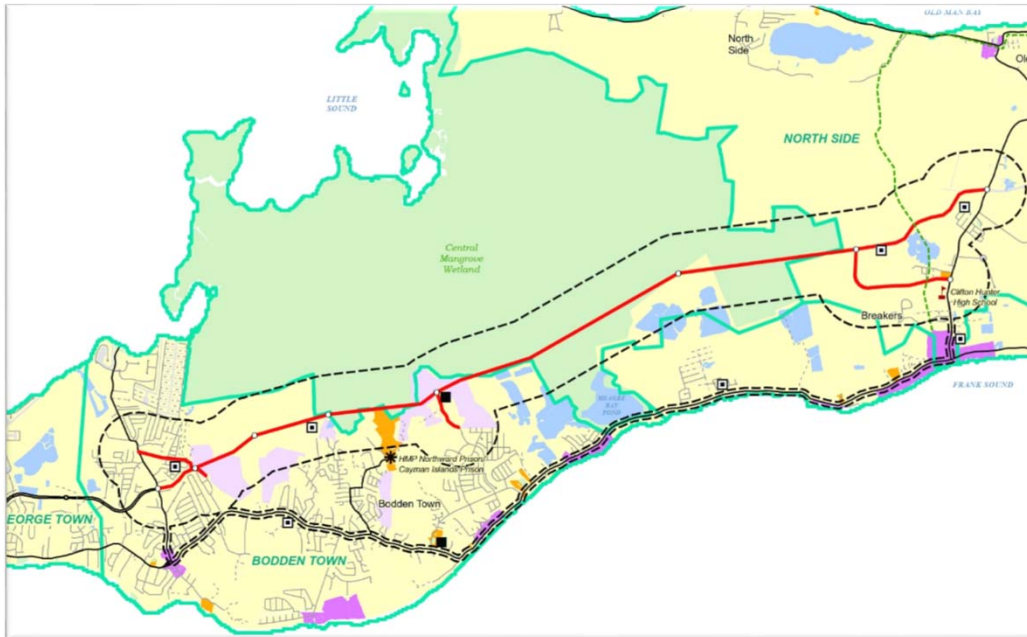


# Noise

- Assessed for its affect on adjacent sensitive land uses (such as residences and community facilities)
  - Operation – focused on the area within 2,000 ft (600m) of the new roadway
  - Construction – focused on the area within 165 ft (50m) of the existing roadways



# Noise Assessment Methodology



- Noise monitoring of existing conditions
  - 2 long-term monitoring sessions (24-hours)
  - 7 short-term monitoring sessions (20-minutes)
- Develop a 3-D model to predict future sound levels
- Identify where sound levels are above applicable standards (based on UK and Cayman standards)
- Determine whether changes to the project could occur to reduce those sound levels
- Share future sound levels with the local jurisdiction with zoning control

# Vibration

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- Construction vibration may at times reach levels of perception and annoyance
  - No building interruption or damage anticipated
- Qualitative assessment of vibration would include identifying the sensitivity and magnitude of the vibration effects by evaluating the following:
  - Expected construction schedule
  - Construction activity
  - Distance to potentially sensitive resources



# Greenhouse Gas (GHG) Emissions



The GHG analysis will include the following emission sources:

- Construction equipment tailpipe emissions;
- Material/delivery vehicle tailpipe emissions;
- Peat removal carbon sequestration losses;
- Release of peat-stored carbon; and,
- Road material (concrete, asphalt etc.)

Potential mitigation measures to control or reduce GHG emissions are:

- Lowering asphalt production temperature and increasing recycling rates;
- Using cement clinker substitutes in concrete;
- Using scrap-based steel;
- Installing engine retrofit devices;
- Restricting vehicle idling;
- Using robust materials that require less maintenance, repair, and refurbishment;
- Choosing materials that can be reused or recycled instead of landfilled;
- Reducing amount of vegetation removed; and,
- Revising road design to reduce the need for removal of peat overburden.



**Dody Frawley**

*Senior Project Environmental Scientist*



# Hydrology, Drainage, and Geo- Environmental

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# Hydrology and Drainage: Baseline Condition

## Hydrology and drainage:

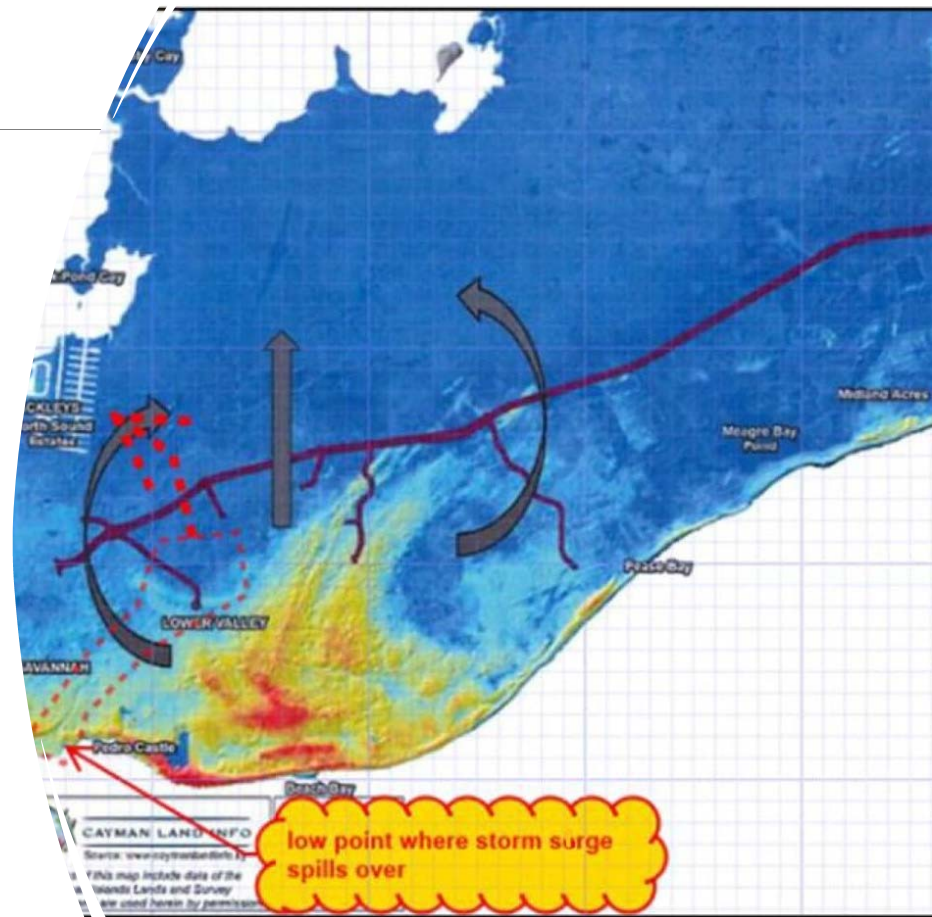
- topography
- geology
- climate
- tropical storms and hurricanes
- freshwater lenses
- large mangroves population

Flat and low-lying topography- vulnerable to winds and flooding caused by hurricanes and tropical storms

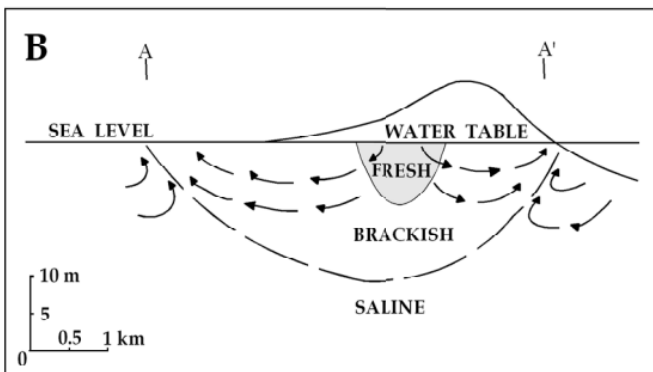
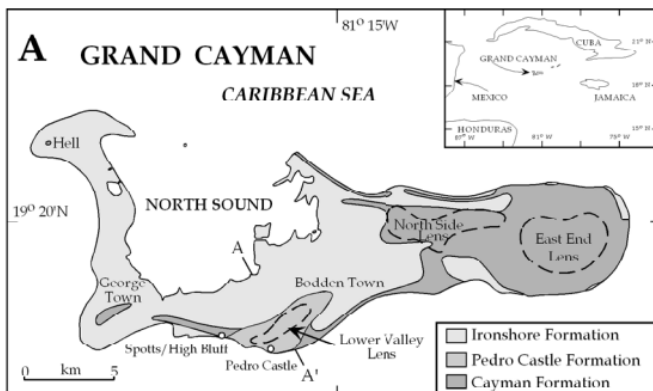
## Flooding:

- Limited- Areas with sufficient elevation and porous limestone outcroppings
- Frequent flooding- Developed and undeveloped areas with low elevation and/or soil, peat or cap rock with low permeability

Central Mangrove Wetland- important role in hydrologic cycle



# Geo-Environmental: Baseline Condition



## Freshwater Lenses:

- 3 largest freshwater Lenses- Lower Valley Lens, North Side Lens, East End Lens
- 3 Zones- freshwater, brackish, saline
- Recharge- mainly during large rainstorms
- Source of potable water

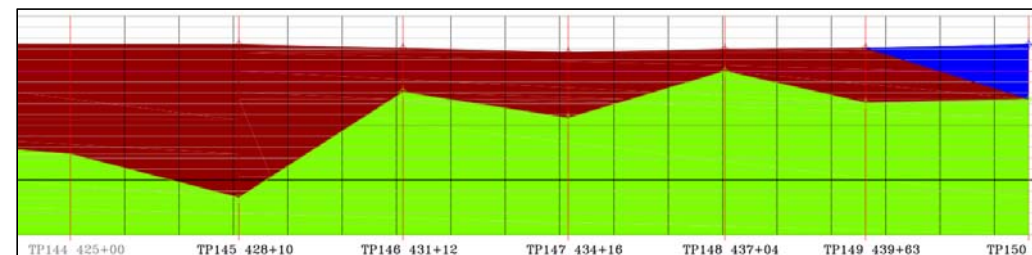
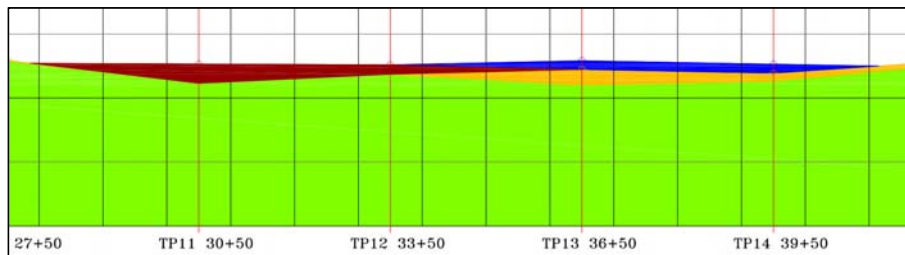




# Geo-Environmental: Baseline Condition

## Peat:

- Underlies most of the mangrove swamps & covers bedrock
- Mainly composed of organic remains from mangroves
- Climate change- sequester greenhouse gases
- Trial pit data (2008 – Section 2 and 2014 – Section 3)



# Potential Impacts & Mitigation Measures

Potential Impact	Mitigation Measures
<p><b>During Construction:</b></p> <ul style="list-style-type: none"><li>• Soil compaction</li><li>• Soil erosion</li><li>• Temporary dewatering for excavation of roadway foundations</li><li>• Footprint- disturb sensitive natural resources (mangroves, freshwater lenses)</li></ul>	<p><b>Erosion and Sediment Pollution Control:</b></p> <ul style="list-style-type: none"><li>• Use of low-impact construction vehicles and/or mats</li><li>• Proper siting of temporary stockpiles and access roads</li><li>• Use best practice pollution prevention techniques</li></ul>



# Potential Impacts & Mitigation Measures

## Potential Impact

### Damming effect:

- North of the proposed EWA Extension- Restrict hydrology to the Central Mangrove Wetland
- South of the proposed EWA Extension- Inundation of the mangroves and adjacent developed areas
- Alter hydrology, water flow, water levels, surface drainage, salinity levels, nutrient balance, oxygen concentration or temperature
- Damage to existing drainage infrastructure and subsequent flooding of neighbouring properties or infrastructure

## Mitigation Measures

### Maintain Water Flow:

- Elevated roadway
- Aggregate roadway embankment
- Box culverts



# Potential Impacts & Mitigation Measures



Potential Impact	Mitigation Measures
<p><b>Loss of mangroves:</b></p> <ul style="list-style-type: none"> <li>• Reduce transpiration</li> <li>• Increase speed of stormwater run-off</li> <li>• Reduce protection from tropical storms and hurricanes</li> <li>• Loss of water filtering</li> <li>• Soil erosion</li> </ul>	<p><b>Minimize Mangrove Take:</b></p> <ul style="list-style-type: none"> <li>• Proposed roadway alignment design</li> </ul>
<p><b>Loss of peat:</b></p> <ul style="list-style-type: none"> <li>• May potentially be removed, covered over, compacted, and contaminated</li> <li>• Contribute to the release of greenhouse gasses</li> </ul>	<p><b>Minimize Peat Impact:</b></p> <ul style="list-style-type: none"> <li>• Proposed roadway alignment design</li> <li>• Salvage and reuse mangrove peat</li> <li>• Fill by elevating roadway and employing other design options</li> </ul>

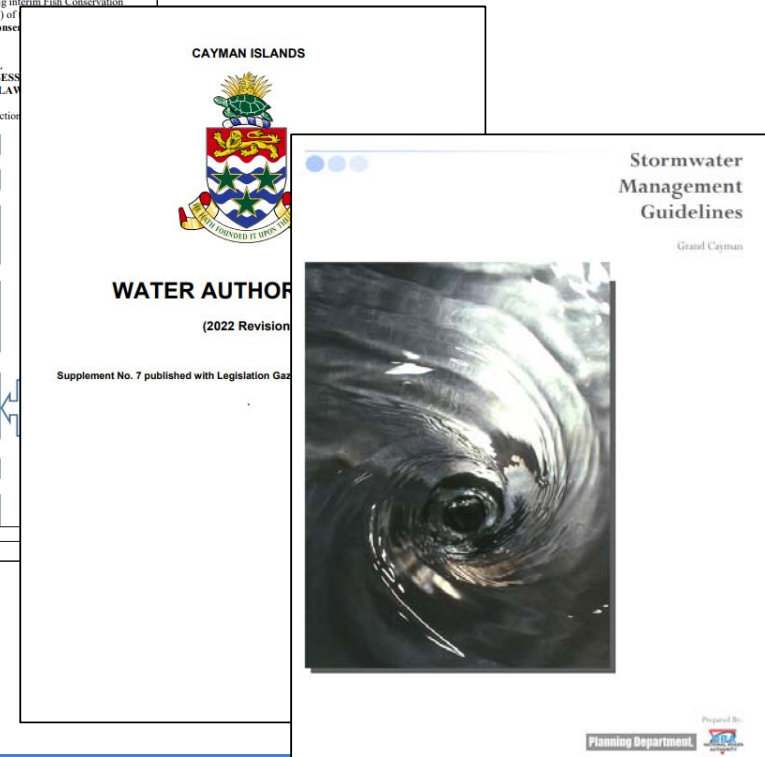
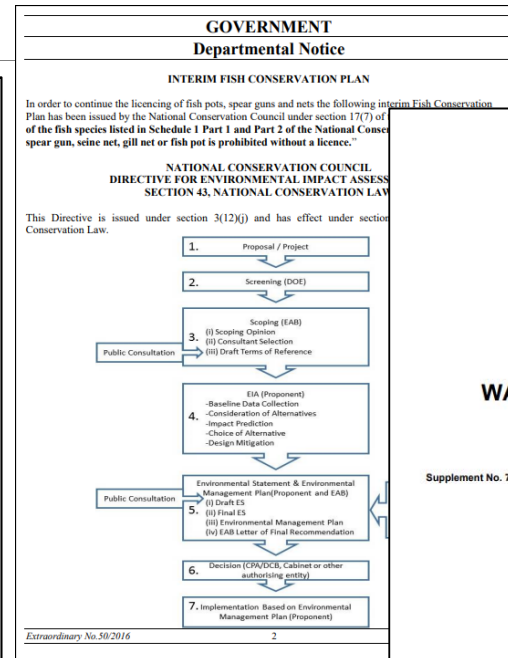
# Potential Impacts & Mitigation Measures

Potential Impact	Mitigation Measures
<p><b>Stormwater and Drainage Patterns:</b></p> <ul style="list-style-type: none"> <li>• Increase stormwater run-off volume &amp; velocity from roadway pavement</li> <li>• Impact groundwater and surface water flows, drainage patterns, &amp; recharge- freshwater lenses, potable water supply</li> <li>• Impact the ecology of Central Mangrove Wetlands, Mastic Reserve, &amp; Meagre Bay Pond</li> </ul> <p><b>Contamination from Roadway:</b></p> <ul style="list-style-type: none"> <li>• Released directly (e.g., spillages) or indirectly (via surface water runoff)</li> <li>• Pollute groundwater/freshwater lenses</li> <li>• Pollute sensitive habitats (mangroves)</li> </ul>	<p><b>Stormwater Management Plan/ Drainage Infrastructure Design:</b></p> <ul style="list-style-type: none"> <li>• Adequate capacity to handle stormwater run-off</li> <li>• Appropriate locations to discharge stormwater</li> <li>• Maintain hydrological regimes</li> <li>• Avoid or minimize impacts on developed areas and natural resources</li> <li>• Roadway accessible during intense rainfall events</li> <li>• Climate change &amp; sea level rise</li> </ul>



# Applicable Standards

- The Environmental, Health and Safety Guidelines, General EHS Guidelines: Environment (International Finance Corporation (IFC), 2007) Wastewater and Ambient Water Quality
- Stormwater Management (Cayman Islands Planning Department and NRA) Guidelines Levels (2008)
- Florida Department of Transportation (FDOT) Drainage Manual (January 2023) and associated FDOT Handbooks and Florida Administrative Code Rule Chapter 62-777 Contaminant Clean-up Target Levels
- Directive for EIAs (2016) issued in accordance with The National Conservation Law (2013);
- EIA Directive (2016) issued in accordance with the National Conservation Act (2013)
- United States Department of Agriculture Natural Resources Conservation Service (NRCS) National Engineering Handbook, 2021
- Water Authority Act (2022 Revision) which states in Section 19 that groundwater vests in the name of the Crown and appoints the Water Authority Cayman (WAC) as the custodian of groundwater in the name of, and on behalf of, the Crown;
- Cayman Islands Development and Planning Regulations (2022), specifically Regulation 18. Mangrove Buffer zones and Regulation 19. Land above water lenses
- Consultation with the Department of Environment (DoE), Water Authority Cayman (WAC) and Department of Environmental Health (DEH) to determine the applicable standards that should be adopted for this part of the assessment
- International standards such as the UK's and Canada's Environmental Quality Standards

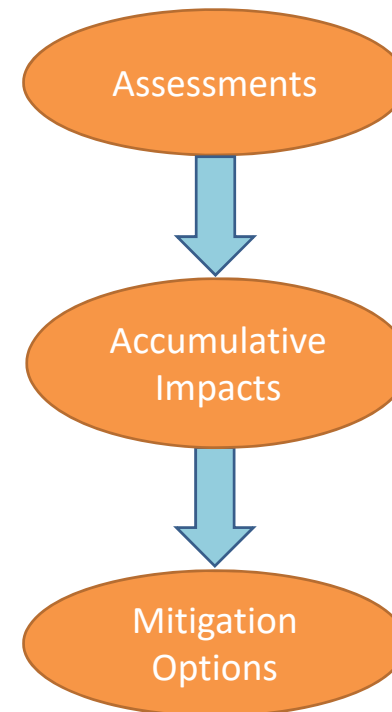


# Assessment Methodology

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## Assessments:

- Desktop and field
- Review applicable regulations
- Hydrologic and Hydraulic Analysis
- Freshwater Lens Study
- Flood Risk Assessment
- Mangrove Peat Assessment
- Cut and Fill Estimation
- Assessment of Risk Significance
- Impact of sea-level rise and climate change





**Jeffry H. Marcus, Ph.D.**

*Environmental Sciences Group Leader*

**Sara Gutekunst**

*Senior Environmental Scientist*

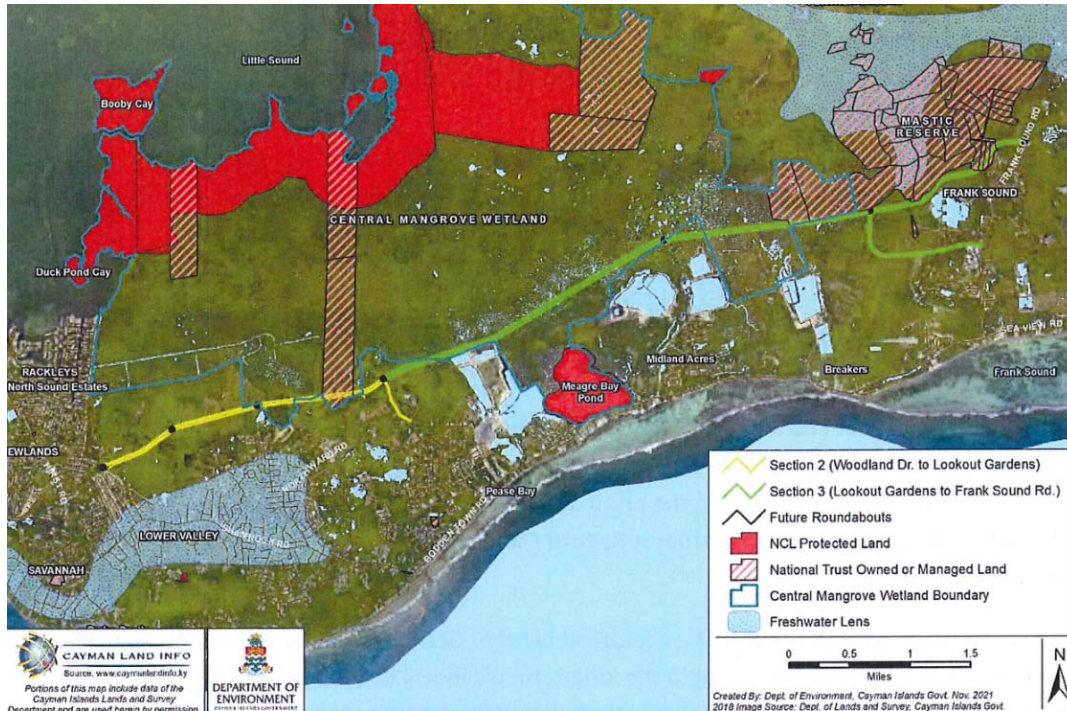
**TYLin**

# Terrestrial Ecology & Cultural and Natural Heritage Sites

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# Gazetted Corridor in Relation to Environmentally Sensitive Areas



- Sections 2 and 3 border the southern boundary of the Central Mangrove Wetland and Mastic Reserve
- Sections of National Trust Land are contiguous in some areas
- Areas in red are protected National Conservation Lands

# Central Mangrove Wetland

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- Total 8,655 acres
- Mangroves play a vital role in the Grand Cayman Ecosystem
  - Protect coastlines against storm surge and wave erosion
  - Provide habitat for many species of birds and animals
  - Store carbon from atmosphere
  - Generate needed nutrients to North Sound
  - Produce peat



# Mangroves – Great Habitat for Fauna

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Mangroves provide great habitat to birds, reptiles, fish, and invertebrates including:

- West Indian Whistling Duck
- Grand Cayman Parrots
- Snowy Egrets
- Blue Iguana
- Crabs and other crustaceans
- Crocodiles
- Hickatees





# Mastic Reserve & Trail

Largest area of Dry Forest on Grand Cayman

Higher than mangroves and a unique community of Hammock species

- Black Mastic Tree
- Royal Palms
- Silver Thatched Palms
- Cedar
- Mahogany
- Endemic orchids
- Vitelline Warbler (bird)

#### Establish Baseline Conditions

- Gather data: field surveys and hydraulic and hydrologic modeling information

#### Identify Potential Receptors

- Central Mangrove Wetland;
- Mastic Reserve;
- Migratory birds; and,
- Protected Species (flora and fauna).

#### Desktop and Field Review Assessment

- Use hand-held GPS and drones to collect data, characterize and map ecological features in terms of size, type, and functional value (i.e. UMAM)

#### Perform Significance and Magnitude of Change Evaluation

- Impact assessment of ecological features

#### Mitigation Measures

# Methodology to Evaluate Terrestrial Ecology

# Anticipated Impacts to Wetlands and Mastic Reserve

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- Size
- Function
- Species mortality and disruption
- Habitat impact
- Habitat fragmentation
- Hydrological impacts
- Wildlife-Vehicular strikes

Biodiversity No Net Loss Analysis

Ecological Impact Assessment



# Terrestrial Ecology Mitigation Measures

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- Wildlife crossings
- Hydrological crossings
- Replacing habitat
  - Creation
  - Restoration
  - Enhancement
  - Preservation
- Mangrove restoration has been very successful
  - Scraping down areas that have been filled
  - Filling holes that have been dredged
  - Mangrove planters
  - Reestablishment of tidal connection

# Cultural and Natural Heritage Sites

Resources identified and/or protected under the following regulations:

- National Conservation Act
- National Trust Act
- Public Lands Act

Identified resources to date:

- Central Mangrove Wetland
- Mastic Reserve
- Mastic Trail





# Examples of Potential Mitigation Measures

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Replacement of  
property

Replanting/  
establishment of  
habitat

Creation of  
hydrological  
components

Landscaping

Viewshed  
enhancements/  
visual screening

Regional ecological  
restoration

Land contouring

Consideration of  
wildlife crossings to  
avoid habitat  
fragmentation

# Where can you find the draft Terms of Reference for the East West Arterial Extension?

**National Conservation Council**  
[www.conservation.ky](http://www.conservation.ky)

Navigate to the EIA's Heading, then pick EIA Reports

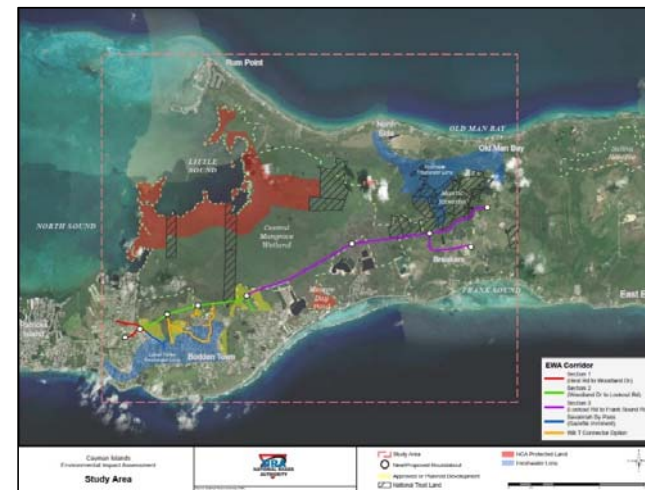
<https://conservation.ky/download/75/eia/2041/draft-nra-ewa-extension-terms-of-reference-public.pdf>

and,

**National Roads Authority**  
[www.caymanroads.com](http://www.caymanroads.com)

Under the Project's Heading, click "Draft Terms of Terms Document for the Environmental Impact Assess of the East –West Arterial"

<https://www.caymanroads.com/upload/files/4/63d815bc47149.pdf>



## How to leave a public comment:

1. Submit a written comment to NRA and DoE staff present this evening
2. Email the Environmental Assessment Board at [DOE@gov.ky](mailto:DOE@gov.ky)
3. Mail a comment to:
  - Department of Environment  
PO Box 10202, KY1-1002  
Grand Cayman, Cayman Islands
4. Hand deliver a comment to:
  - Environmental Centre  
580 North Sound Road  
George Town, Grand Cayman

# Comments

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