ENVIRONMENTAL IMPACT ASSESSMENT

LEGENDARY MARINA RESORT AT BLUEWATER CAY
NEW PROVIDENCE, BAHAMAS

Submitted to:
Department of Environmental Planning and Protection
Ministry of Environment and Natural Resources
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1. EXECUTIVE SUMMARY

The Legendary Marine Bluewater Cay Ltd. (the Developer) proposes to develop the Legendary Marina Resort at Bluewater Cay (the Project). The site is situated in the Yamacraw area on an approx. 20-acre parcel of previously developed land and dredged marina ideally located in a sheltered bay. The objective of this Environmental Impact Assessment (EIA) is to provide an accurate assessment of the potential environmental impacts of the proposed development. For the purposes of this EIA, the assessment of the Project in Yamacraw environment is inclusive of biological, physical, and socio-economic resources, as well as the processes that have the potential to be directly and/or indirectly impacted by the proposed Project.

1.1 Project Details

The proposed development will include a full-service marina located near the Yamacraw constituency in the eastern district of New Providence. The Project Developer proposes to develop a hurricane Category 5 rated boat barn / storage, capable of storing up to 600 boats. This multi-story boat storage building will store vessels up to 53ft LOA (length overall) and is an estimated 189,200 sf. The planned development will also include a boatyard capable of hauling boats up to 100 feet long as well as full marina service and parts center marine store, hotel, marina club with restaurant, bar, pools, retail area, fuel dock, work force housing, oceanfront villas, condominiums and residences, and a Bahamas Customs/Immigration fixed based operation.

The developer has extensive experience and a keen understanding of the development and operation of this type of marina and storage facilities (e.g., The Legendary Marina facility in Destin, Florida).

The proposed development provides a unique opportunity for boaters to keep their vessels in a safe, secure, and dry storage that offers the following benefits:

- Storm Protection – facility designed to withstand category 5 hurricane winds;
- Lower Maintenance – vessels stored in a dry controlled storage will have less maintenance issues;
- Peace of mind. The facility will be monitored 24/7 with closed circuit tv (CCTV) and security guards. The facility will have perimeter fencing and an entrance security gate staffed with security personnel.

The Project will bring many direct and indirect benefits to the adjacent neighborhood, to the Island of New Providence, and more broadly the Bahamian economy.

1.2 Project Development Phases and Timelines

The proposed Project will be developed in four (4) phases:

Phase 1 is the initial phase required to construct assets appropriate to open a functioning marina:

- Commencement: Year 1
- Construction duration: 1.5 years (18 months)

- Scope of Phase 1 work will include all site civil works, infrastructure, seawall, and reconstruction of main peninsula, 50% of wet marina, 50% of boat storage building, 50% parking, guard house and fencing, Administration building, channel and marina basin dredging, coastal protection, marine service bays, fuel docks and fuel storage, and revitalization of mangroves
- PH1 Employment Figures:
    - Construction: 75 persons
    - Operations: 40 persons

Phase 2 will expand on Phase 1 by completing marina assets and reconstructing the southern breakwater (ridge) into larger peninsula:

- Commencement: Year 3
- Construction duration: 2 years
- Description of PH2 Work:
    - Remainder of boat storage building
    - remainder of wet marina
    - Remainder of parking
    - Construct enhanced peninsula (south marina wall & breakwater)
    - Marine services bays
    - Mixed use /Retail building
- PH2 Employment:
    - Construction: 75 persons
    - Operations: 40 persons (for a total of 80 persons)

Phase 3 will bring the hospitality assets online along with associated amenities and staff housing as required:

- Commencement: Year 5
- Construction Duration: 2.5yrs
- Description of PH 3 work:
    - Hotel
    - Restaurant/Bar
    - Pool
    - Lighthouse
    - Staff housing
- PH3 Employment:
    - Construction: 100 persons
    - Operations: 90 persons (170 persons total)

Phase 4 brings development to full resort & beach development.

- Commencement: Year 7
- Construction Duration: 2.5 yrs

- Description of PH4 works:
  - Oceanfront villas, Cottages, condominiums, and short/mid-term lease
  - Beach areas
  - Additional Coastal protection (groynes & beach stabilization) as needed
- PH4 Employment:
  - Construction: 80 persons
  - Operations: 50 persons (220 persons total)

The above dates are tentative pending project approvals, permitting requirements and other unforeseeable delays.

1.3 Socio-Economic Impacts

Legendary Marina Resort at Blue Water Cay intends to be a full-service marina located near Yamacraw Settlement on New Providence Island with an overall capital investment estimated to be $80million. The Project is anticipated to generate direct and in-direct long-term, sustainable benefits to the local economy as well as surrounding island destinations. A summary of some of the key economic impacts that the planned development will generate are as follows:

- Direct employment (during construction and operations phases) as described above.
- Training of personnel / workforce in the service and maintenance of internationally branded outboard engines as well as hospitality-related positions.
- The proposed storage facility will encourage long-term boat storage, boat services and utilization, which in turn will create additional demand on the housing, transportation, entertainment, lodging, and food & beverage industries.
- The food and beverage operations will deliver additional revenue and will provide needed services for the immediate areas including marine supply store.
- Fuel sales will create direct and indirect employment opportunities through delivery services as well as serving other non-member boaters.
- The project would also be an entertainment and recreational facility, which will contain restaurants, bars and shops offering goods for sale to tourists and the public. This includes goods and services from Bahamian artists, musicians, cooks, and other specialists.
- Adding marina amenities and security will increase property values in the surrounding area.
- Providing service and parts availability will keep boat owners from taking their boats to Florida for service. This will bring an existing revenue stream to the Bahamas that is currently going elsewhere.
- The in-direct benefits of the Project would be in the order 3 to 4 times the direct benefits, based on experience with similar projects.

1.4 Environmental Impacts

Both positive and negative environmental and social impacts will result during the construction and operation of the Project. Negative environmental and social impacts include land clearing (possible erosion due to vegetation removal), land reclamation, dredging (removal of the marine benthos), air pollution, noise pollution, as well as increased motor vehicle and boat traffic within the area and reduced public access to the to the Project area. Positive environmental and social impacts include invasive species removal, improvements to solid waste disposal, restoration of impacted mangrove wetlands adjacent to the site and development of a public beach near the southwest corner of the property. The impact on marine habitat will be offset by rocks placed for shore protection revetments, jetties, breakwater and T-groynes. As a result of the development activities associated with land reclamation, breakwater and groynes structures will create habitat (beach) to aid in coastal/marine biodiversity. Legendary Marina Resort at Bluewater Cay is expected to stimulate the economy of New Providence, as well as the wider Bahamian economy by providing job opportunities and contributing to the ever-growing tourism industry. At all phases of development, the Developer will make every effort to achieve an employment ratio of 80% Bahamian to 20% non-Bahamian. The Project's marine service facility will include a training component that will create a demand on BTVI and other vocational schools for qualified individuals seeking to be trained in the service and repairs of internationally branded outboard engines.

1.5 Mitigation and Environmental Management

The use of turbidity containment and erosion control measures will be employed to control the spread of sedimentation during dredging and other coastal construction activities. Prior to reclamation and coastal works, pre-clearance marine surveys will be conducted to remove slow moving organisms from the immediate area of impact. Also, pre-clearance surveys will occur prior to land clearing activities to identify protected plants, wildlife, and avian species. Guests and mariners will be informed of the proper waste management and best environmental practices to encourage a pollution free marina. To prevent further impacts to the surrounding environment, the removal of invasive species and planting of native vegetation in the landscaping footprint of the project will create environmental corridors to encourage an ecological succession throughout the development. Spill Management will primarily focus on spill prevention measures and secondarily focus on clean up and mitigation. Environmental sensitivity/awareness training for construction and operations staff of the Project will promote public awareness and education of native Bahamian species and vital ecosystems.

These mitigation strategies have the potential to lessen and even eradicate environmental impacts due to project activities. Recommendations on best practices and industry standards will be provided in the Environmental Management Plan (EMP) for the project. These mitigation strategies will be employed where possible to lessen the overall environmental impact of the project, allowing the full socio-economic benefits of the project to be realized by residents and stakeholders on the island of New Providence.

1.6 SUMMARY OF ENVIRONMENTAL AND SOCIAL BENEFITS AND MITIGATION MEASURES

1. The existing site has been abandoned for several years and has become a hazardous location to the neighborhood. There are trash dumps on site and stolen boats have been found in Yamacraw Lake. The project will enhance the surrounding environment by bringing a security presence to the area and cleaning up a blighted site.
2. The Developer is also proposing to dredge the very shallow entrance to Yamacraw Lake, which will allow residents to access the lake with their vessels as well as enhance the water circulation and exchange flow with the sea, thus enhancing the water quality of the lake.
3. The planned development will include the construction of a culvert under the entrance road, thereby connecting the mangroves with Yamacraw Lake at the north-west corner of the lake (near the gatehouse). This will re-establish historical drainage patterns that allow the mangrove swamp to the west of the project to flush naturally with tidal activity.
4. To the extent possible, mangroves will be protected, and every effort will be made to replant mangroves that are incidentally removed. The benefits of re-establishing the historical flushing characteristics with the adjacent mangrove swamp will offset incidental removal of existing mangroves.
5. To mitigate the impact to mangroves, the Developer proposes the establishment of a “living shoreline” for mangroves along the northern and/or southern coastlines of the marina entrance. This would provide natural flushing /filtering of pollutants from the marina basin, while providing coastal erosion protection and replace mangrove habitat removed during construction. An option considered is to incorporate the dredge spoil in its design.
6. Engage public schools in the nearby community to develop programs to study mangroves, mangrove revitalization techniques and the importance of revitalizing mangroves in the context of providing healthy ecologies and natural barriers to protect shorelines from erosion.
7. The Developer intends to construct unimpeded public access to a public beach location at the south-west corner of the Project. This access will be outside of the security perimeter of the planned development and will connect to Fox Hill Road. The Developer understands the development of the proposed sandy beach at the current rocky shore and black mangrove habitat will have negative ecological impact. This impact will be mitigated by construction of a living shoreline along the groynes/jetty that separates the beach from the development.

2. INTRODUCTION

Bron Ltd. (BRON) was engaged by Legendary Marine Bluewater Cay Ltd. to provide an Environmental Impact Assessment (EIA) for the proposed marina, residences, and indoor boat storage on the island of New Providence, in Commonwealth of The Bahamas. Environmental baseline studies were conducted by BRON to support the preparation of this EIA in accordance with standards set by the Department of Environmental Planning and Protection (DEPP).

2.1 Environmental Impact Assessment (EIA) Objective

The objective of this EIA is to provide an accurate assessment of the potential environmental impacts of the proposed development of Legendary Marina Resort at Bluewater Cay in the eastern district of New Providence (hereinafter referred to as the "Project"). For the purposes of this EIA, the assessment of the Legendary Marina Resort at Blue Water Cay in Yamacraw environment is inclusive of biological, physical, and socio-economic resources, as well as the processes that have the potential to be directly and/or indirectly impacted by the proposed Project. Mitigation measures for potentially adverse environmental impacts during the construction and operations phases of the Project will be discussed to ensure that the development adheres to the best environmental practices. The evaluation of potential impacts on environmental resources is a critical step in the environmental compliance process in The Bahamas, as well as successful project planning and execution.

An Environmental Management Plan (EMP) will be produced upon the approval of the EIA, to outline mitigation measures for the prevention and/or minimization of environmental impacts during the developmental and operational phases of the Project.

2.2 Scope of the EIA

The scope of this EIA covers the biological and physical footprint of the Project site at Legendary Marina Resort at Blue Water Cay Road within the Yamacraw community and its immediate marine and near-shore environments. Possible impacts associated with the proposed development and mitigation strategies to avoid or lessen such influences within and surrounding the Project area will be evaluated and discussed. The Project aims to offer boat storage and marina, along with other boating facilities, to store and replenish food and beverages to larger boats, provide entertainment and a secure facility. Also, the Project aims to provide quality service for general boat repair and service. Therefore, consideration for the socio-economic environment is inclusive of the residents of the Yamacraw area and surrounding communities.

3. SITE LOCATION

3.1 Geographic Location

Nassau is the capital city of The Bahamas, which is located on the island of New Providence. The Project's site is located along the southeastern coastline within the eastern district of New Providence, The Bahamas at approximately 25° 1'1.03"N and 77°17'48.26"W. The site is accessible via Fox Hill Road south which connects to the Blue Water Cay Road (east of Fox Hill

Road south). The Blue Water Cay Road is the main thoroughfare for the Project site. North of the Project site lies the Yamacraw community. Figure 1 shows the location of the Project site at Legendary Marina Resort at Blue Water Cay in The Bahamas and Figure 2 shows the location of the Project site on New Providence.

Figure 1. Site Location in The Bahamas (Google Earth, 2022).

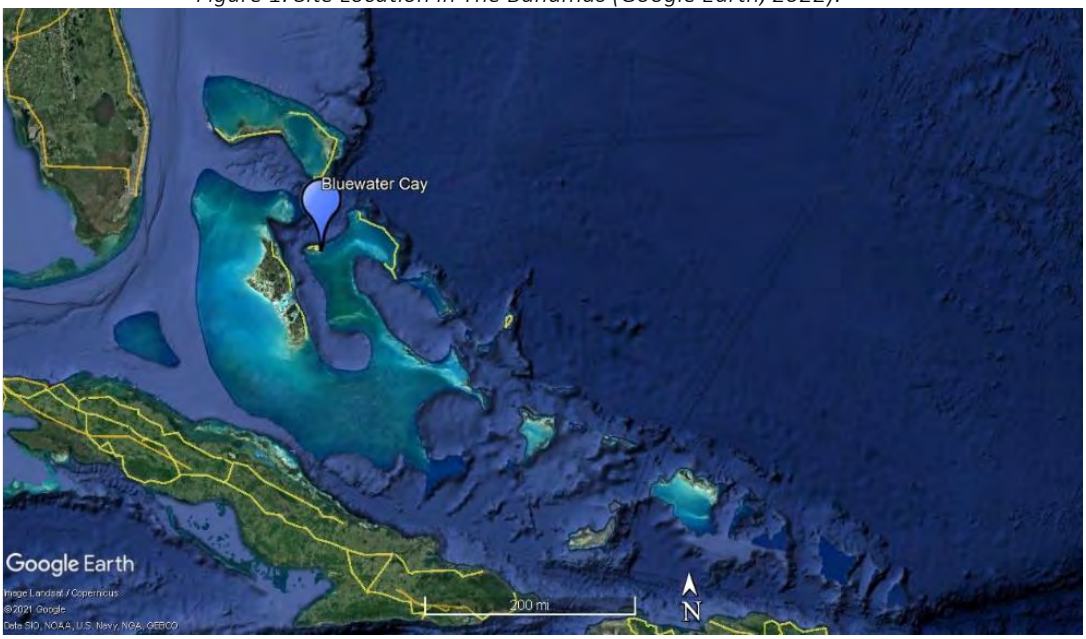


Figure 2. Site Location on New Providence (Google Earth, 2022).

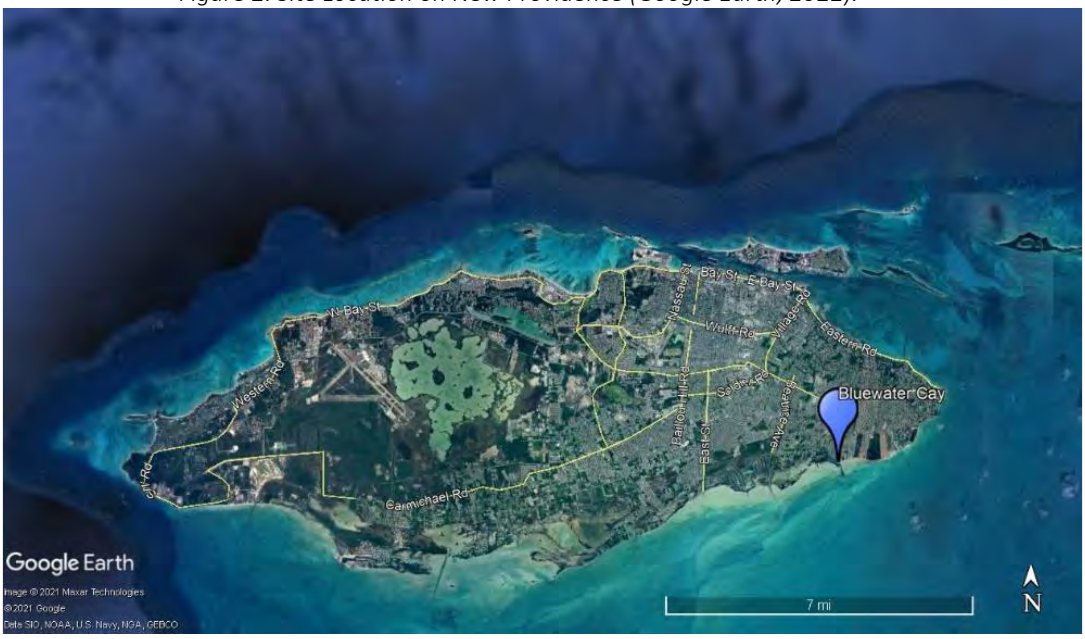
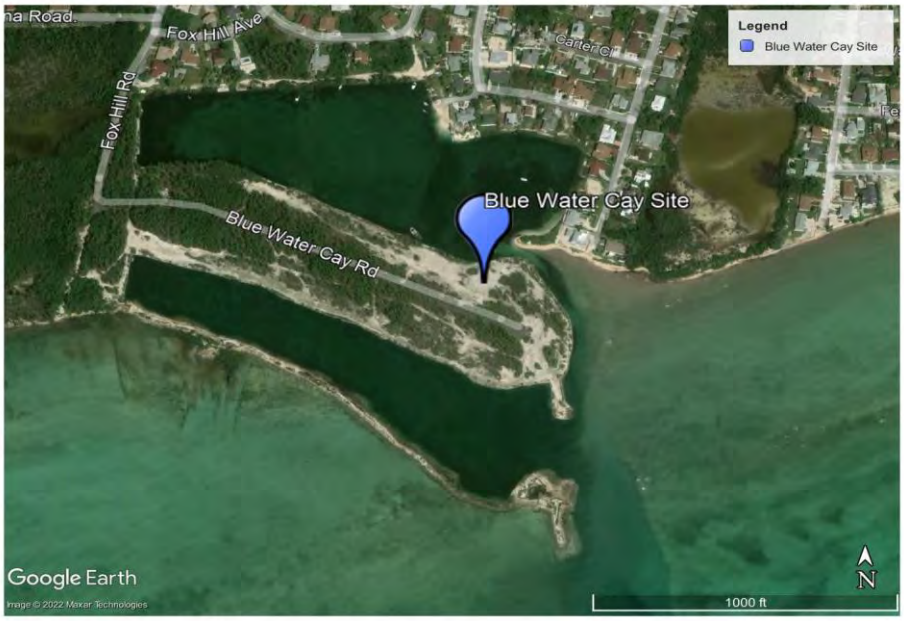


Figure 3. Site location in southeastern New Providence (Google Earth, 2022).



3.2 Site Description

The Project site is situated along the southeastern coastline within an existing dredged area, which is partially surrounded by residential homes to the north-northeast, forming a peninsula. The dredge scar is visible in Google Earth Imagery from 2010 as shown in Figure 4. To the west and east of the Project site are mangrove creeks which were previously connected prior to development in this area. The main entrance road into the property bisects the western creek from the marina basin. Figure 4 also shows the location of two (2) mangrove wetlands immediately to the east and west of the Project site.

Along the northern boundary of the Project site is the southernmost extent of the Yamacraw constituency. Most residents along the waterfront have a small dock for personal boats and utilize the marina basin and access channel to launch vessels from the southern shore of New Providence. Nearby residents are also known to utilize the site for access to fishing spots along the coastline, submerged fish pots, and recreational swimming.

Figure 4. Area of interest outlined in red (Google Earth, 2010).

The Project site is approximately 20 acres of previously disturbed and reclaimed land. The initial stages of the property development commenced 20+ years ago and included the dredging of the marina basin and access channel and construction of the existing peninsulas on the project site. The site had undergone major preparation works via the construction of bulkheads and breakwaters around the reclaimed land, installation of utilities including electrical and plumbing, construction of roads, security gates and a building structure, slip sites for vessels and street lighting. Much of the previously installed infrastructure is in disrepair and requires maintenance/renovation or demolition works. The following figures show the state of the current infrastructure on the site.

Figure 5. Images of existing infrastructure in disrepair (streetlight, sewage, electrical infrastructure).

Figure 6. Vacant building in disrepair.

Figure 7. Partially submerged vessel and slip numbers.

3.3 AREAS OF INFLUENCE

The Yamacraw boating community and their respective residents will be primarily influenced by the Project due to its proximity to the proposed development, including international boating communities.

Marine and terrestrial environments, inclusive of the rocky intertidal zone, sandy bottom, hard bottom, and mangrove habitats within the Legendary Marina Resort at Blue Water Cay area will also be under influence of impacts stemming from the proposed development.

Furthermore, the areas of influence associated with the Project include direct and indirect economic impacts on New Providence, as well as the wider Bahamas. This includes the likelihood of on-site job creation, disbursement of salaries within the New Providence, aid in national security/ boarder control, and the likelihood of the national economic benefit of generated government tax revenue.

4. EXISTING LAND USE AND OWNERSHIP

Currently, the land is owned by the applicant (Legendary Marine Bluewater Cay Ltd.). It has previously disturbed and partially undeveloped state. The terrestrial areas of the site include various plants and wildlife species that encompass the entire site. No ongoing residential, commercial, or industrial operations occur within the boundaries of the parcel. However, there are residential homes north - northeast of the site. There are currently no marinas, resorts, or hotels in this immediate area. However, there are other marina developments along the southern coastline of New Providence (Figure 8). Palm Cay is the nearest of the three (3) existing marinas which is located approximately 1.42 miles east of the Project. The marine environment is used for recreational activities by locals. Boating, swimming, fishing, diving, kayaking, and snorkeling activities are known to occur within the site area.

Figure 8. Project location related to other marinas on the southern coast of New Providence (Google Earth, 2022).

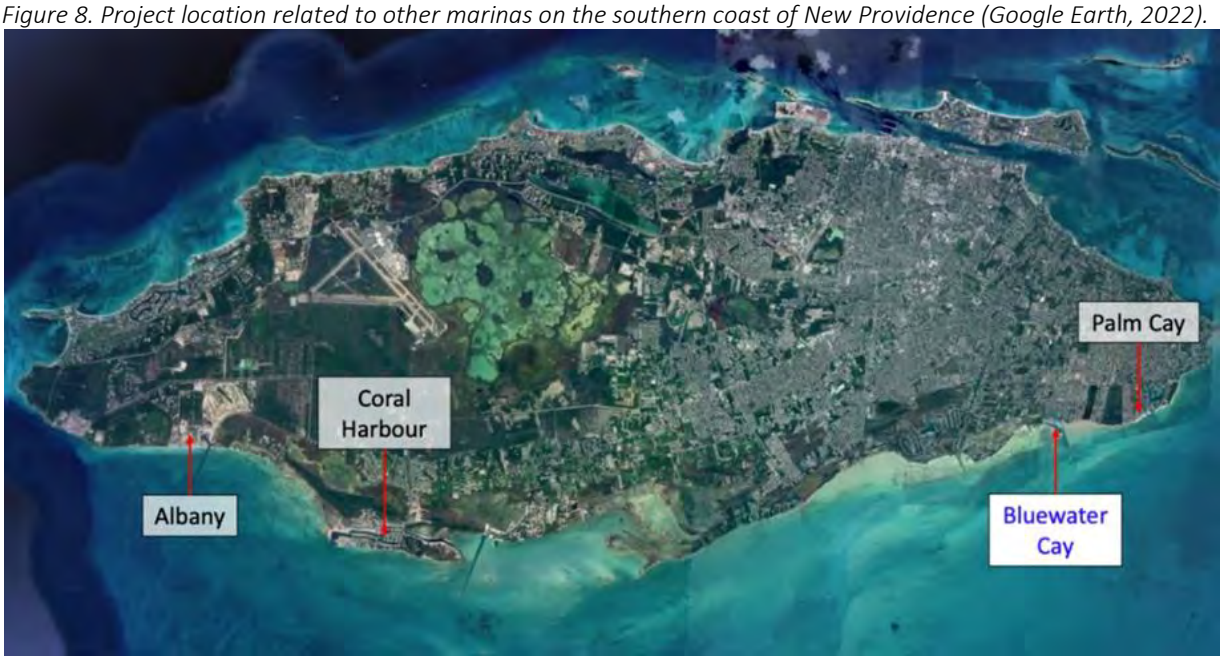
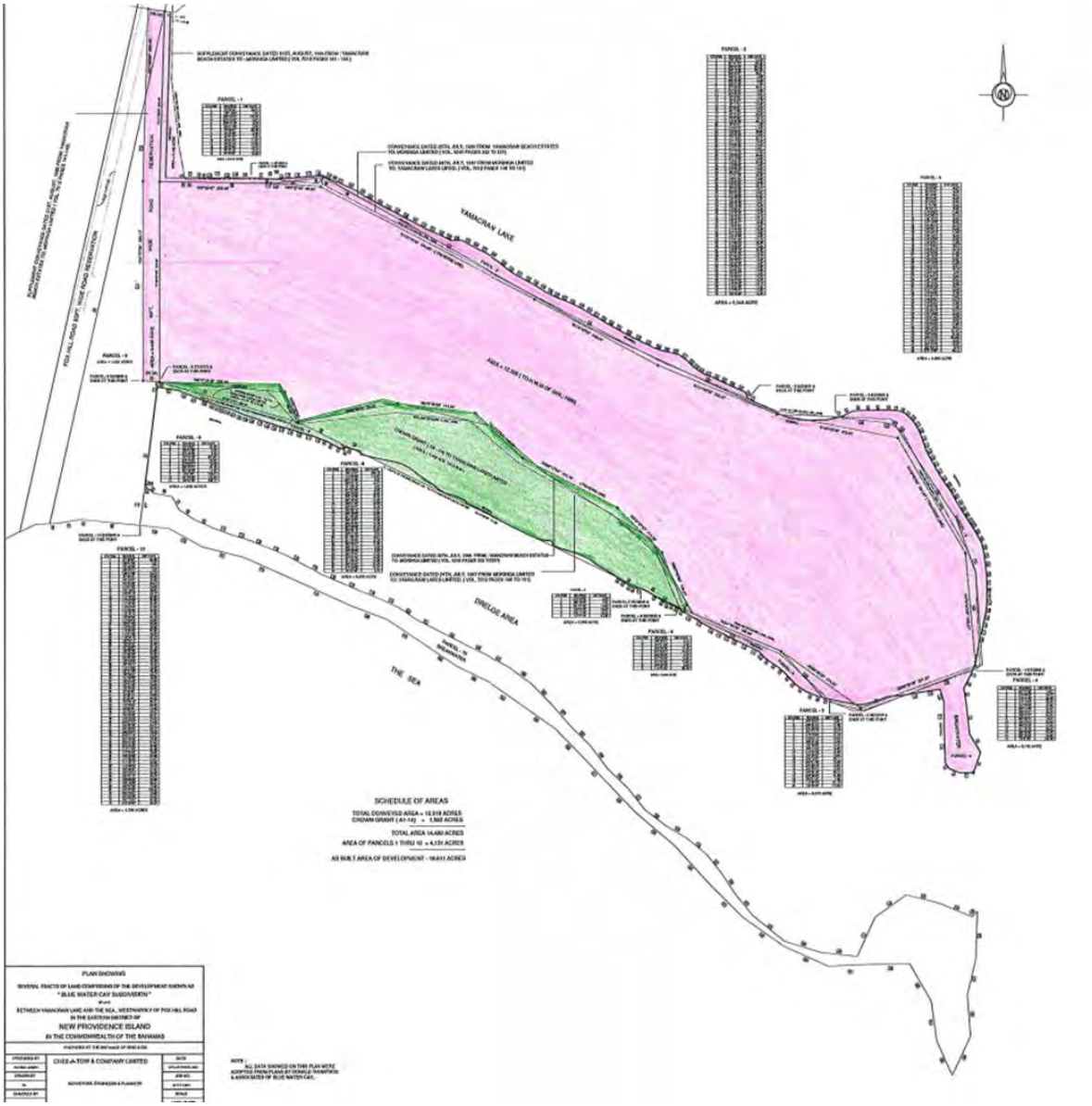


Figure 9. Legendary Marina Resort at Blue Water Cay Topographic Survey Plan (Larger Print in Appendix A).



5. PROJECT DESCRIPTION

5.1 PROJECT DETAILS

The purpose of Legendary Marina Resort at Bluewater Cay is to serve as a mid-point for mariners traveling to and throughout The Bahamas islands. The Project proposes to develop a hurricane Category 5 rated boat barn / storage, capable of storing up to 600 boats. This multi-story boat barn will store vessels up to 53ft LOA (length overall) and is an estimated 189,200 sf. The Project will also include a full-service marine facility including marina basin with up to 100 wet slips and other amenities include the following features (See Figures 10 and 12– Master Plan, Phase 1 and Full Development):

- Mixed Use building (Service-related provisions i.e., recreational rental, bookings for excursions and charters, provision storage, grocery, and retail goods)
- Entry Gate/ Security Facility
- Marina Club / Restaurant
- Pools (3)
- Short/Mid Term Lease (2-storey)
- Work Force Housing (approximately 20-30 condominiums) for yacht staff, transient mechanics, etc.
- Marina Floating Dock with up to 100 wet slips.
- Hotel (4-storey; 120 keys)
- Beachfront Cottages
- Condominium (3-storey)
- Fuel dock (inclusive of underground fuel storage tanks)
- Launch Area
- Administration Building with Bahamas Customs/Immigration Operations
- Maintenance Garage (haul out facility) up to 100 ft. LOA. Additional dry storage for boats too large to be lifted by forklift.
- Lighthouse

Other developments associated with the project include:

a) Shoreline groynes to stop sand infiltration into the basin.
b) Breakwaters to calm the sea state inside the basin from the usual southeastern wave conditions.
c) Entrance navigation channel dredging.
d) Dredging inside the exiting marina basin.
e) Land reclamation to raise the land elevation.
f) Repair the existing retaining wall and/or building new bulkhead wall
g) Shoreline stabilization (sheet pile and revetment).
h) Beach creation/nourishment

Table 1. Summary table of project details.

Unit Type	No. of Bldgs.	Building Area (sq ft)
Cottages A	5	900
Beach Front Cottages A	9	900
Beach Front Cottages B	8	900
Mixed use A	1	10,000
Mixed use B	1	5,000
Boat Barn	1	189,200
Fuel Docks	1	900
Storage Lockers/Maintenance Garage	1	7,200
Administration Building with Customs/ Immigration	1	7,200
Lodging A (Short/Mid Term Lease)	1	21,500
Lodging B (Condominiums)	1	37,950
Pool A	1	2,000
Pool B	1	2,000
Pool C	1	2,000
Restaurant	1	5,600
Bar	1	1,300
Hotel	1	64,000
Entry Gate/ Guardhouse	1	250
Work Force Housing A	1	7,000
Work Force Housing B	1	5,000

5.2 PROJECT SCHEDULE

The Project will be completed in four (4) phases as described below (See Appendix C – Schedule2: Description of Project Phases and Timelines):

- **Phase 1** is the initial phase required to construct assets appropriate to open a functioning marina:

Commencement: Year 1
Construction duration : 1.5 yrs
PH1 Employment Figures:
- Construction: 75 persons
- Operations: 40 persons

Description of Phase 1 Work:
- All site work, infrastructure, seawall reconstruction on main peninsula
- 50% of wet marina
- 50% of boat storage building
- Administration building
- Fuel docks and fuel storage
- Revitalization of mangroves
- Channel and marina basin dredging
- Marine service bays
- Coastal protection
- 50% Parking
- Guard house and fencing

- **Phase 2** will expand on Phase 1 by completing the marina assets and reconstructing the breakwater into a larger peninsula:

Commencement: Year 3
Construction duration: 2yrs
PH2 Employment Figures:
- Construction: 75 persons
- Operations: 40 persons

(80 persons total)

Description of PH2 Work:
- Remainder of boat storage building
- Remainder of wet marina
- Remainder of parking
- Construct enhanced peninsula
- Marine service bays
- Mixed use / Retail building

- **Phase 3** brings the hospitality assets online along with the associated amenities and staff housing as required:

Commencement: Year 5
Construction duration: 2.5yrs
PH3 Employment Figures
- Construction: 100 persons
- Operations: 90 persons

(170 persons total)

Description of PH3 Work:
- Hotel
- Restaurant / Bar
- Lighthouse
- Pool
- Staff housing

- **Phase 4** brings development to the reconstructed and fortified peninsula that was constructed in Phase 2:

Commencement: Year 7

Construction duration: 2.5 yrs
PH4 Employment Figures:

- Operations: 50 persons
- Construction : 80 persons

(220 persons total)

Description of PH4 Work:

- Oceanfront villas
- Cottages
- Additional coastal protection areas as needed
- Short/Mid-term lease
- Condominiums
- Beach areas

Figure 10. Legendary Marina Resort at Bluewater Cay Master Plan - Phase One (Printed larger in Appendix B).

Figure 11. Project development chart

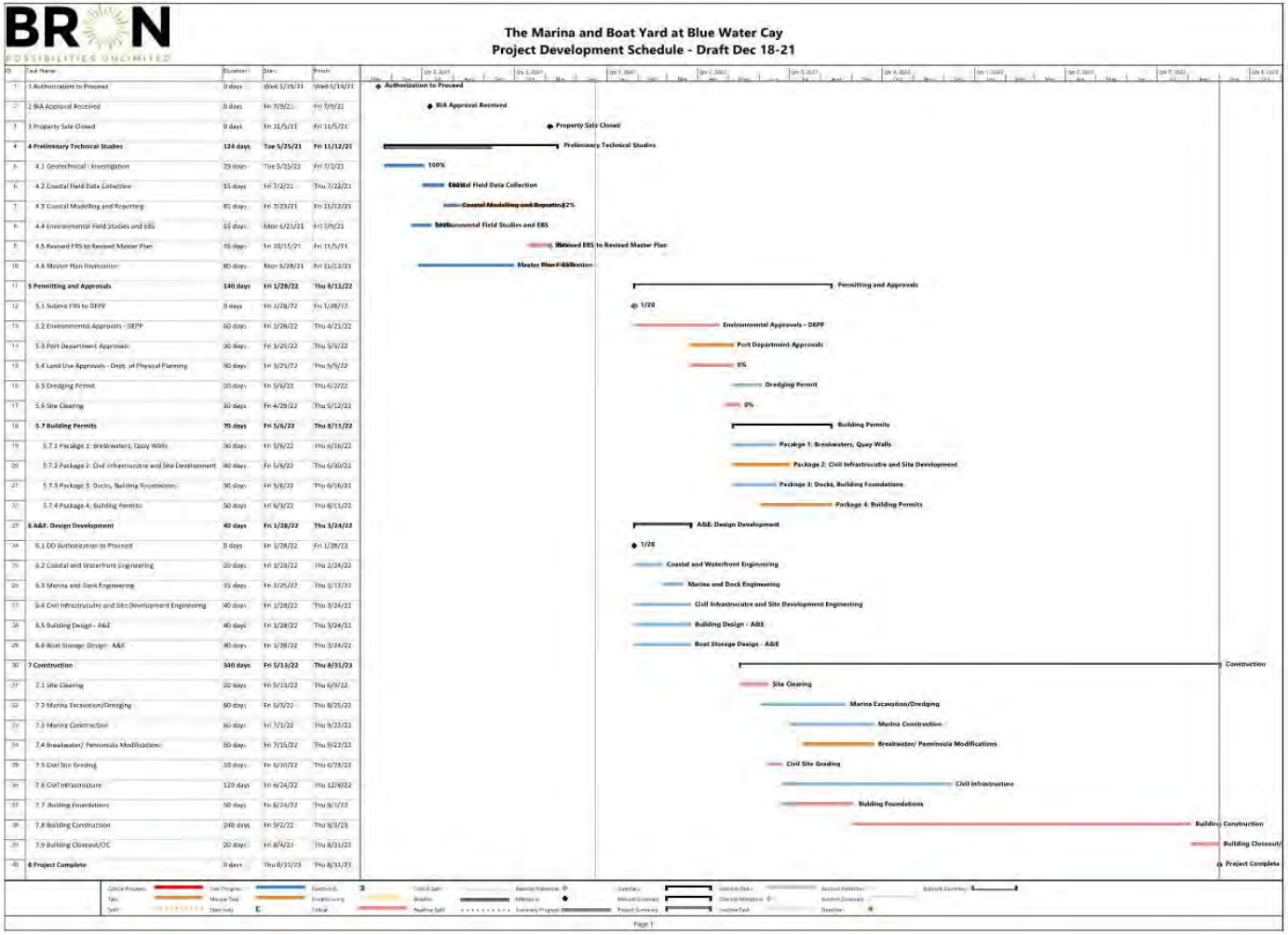


Figure 12. Legendary Marina Resort at Bluewater Cay Master Plan – Full Development. (Printed larger in Appendix B).

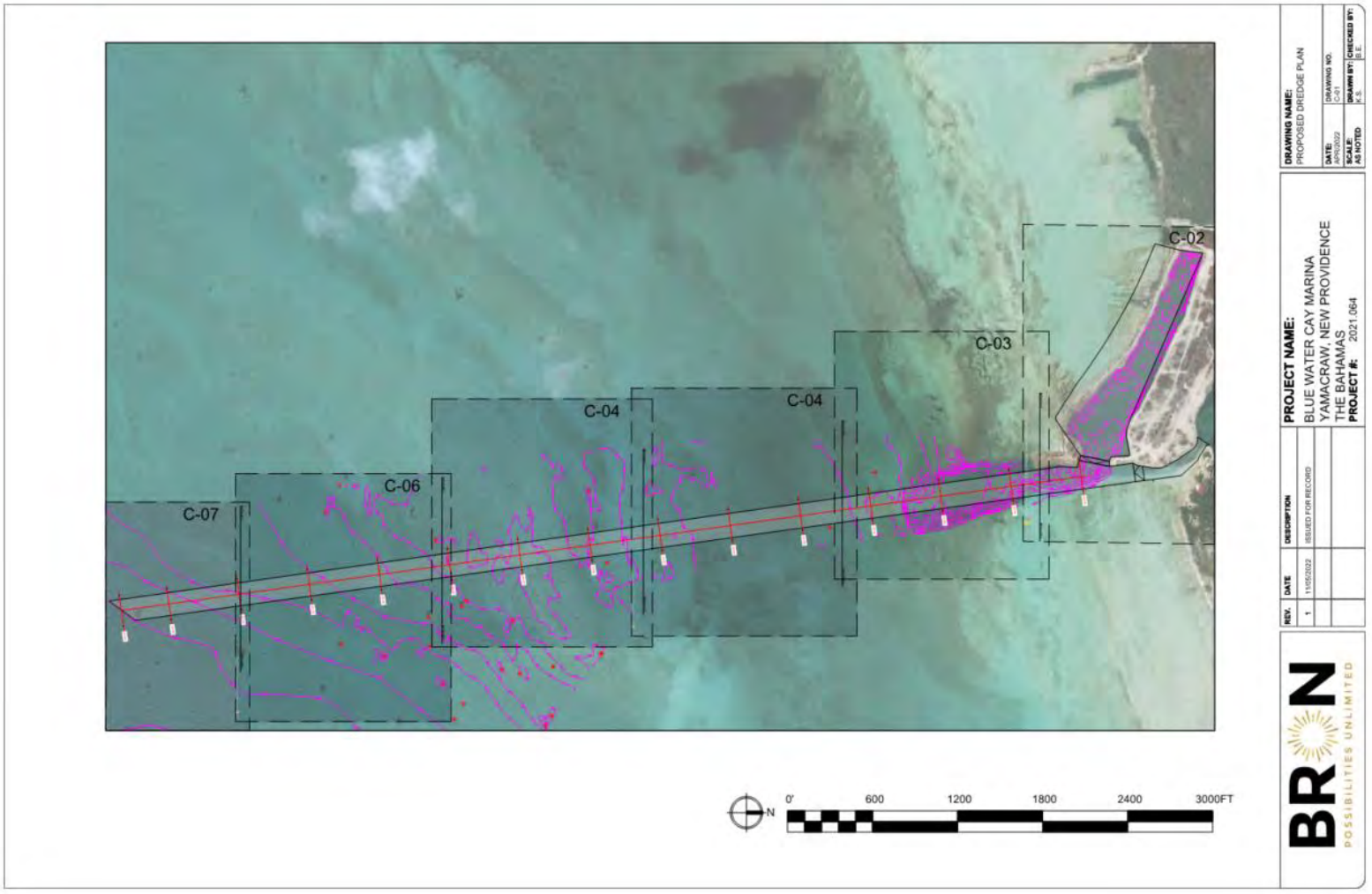
5.3 Dredge Plan

The dredge plan for the proposed development includes additional dredging within the existing marina basin, marina entrance channel and Yamacraw Lakes entrance channel. A navigation channel of 160 ft wide and 13 ft deep will be dredged to connect the marina to the 13ft contour depth (See Appendix D). The table below shows the dredge depth and extent. A more detailed dredging execution plan will be included in the EMP.

Table 2. Summary of dredge plan.

Marine Area of Interest	Dredge Depth (ft.)	Dredge Extent (ft.)
Extended Dredge Area (Navigation Channel)	~13 ft.	~6,840 ft.
Yamacraw Lakes Entrance Channel	~5 ft.	N/A
Blue water Cay Marina Entrance Channel	~13 ft.	N/A
Blue Water Cay Marina Basin	~12 ft.	N/A

Figure 13. Proposed dredged area (Printed larger in Appendix D).



5.4 UTILITIES DESCRIPTION

5.4.1 Potable Water

The Project will purchase water from the Water and Sewerage Corporation to supply the development with potable water. Potable water estimates for the Project provided by BRON Ltd., are listed in Tables 3 to 5. This estimated demand is based on the development of land and marina use. Please note these preliminary estimated demands may change as detailed engineering design is complete.

Table 3. Commercial building potable demand estimates.

Unit Type	No. of Bldg.	Building Area (sq ft)	Flow Per Bldg. Area (GPD)	Average Daily Flow (ADF) (GPD)
Cottages A	5	900	0.125	563
Beach Front Cottages A	9	900	0.125	1,013
Beach Front Cottages B	8	900	0.125	900
Mixed use A	1	10,000	0.125	1,250
Mixed use B	1	5,000	0.125	625
Boat Barn	1	189,200	0.0125	2,365
Fuel Docks	1	900	0.125	113
Storage Lockers/Maintenance Garage	1	7,200	0.125	900
Administration Building with Customs/ Immigration	1	7,200	0.125	900
Lodging A (Short/Mid Term Lease)	1	21,500	0.125	2,688
Lodging B (Condominiums)	1	37,950	0.125	4,744
Pool A	1	2,000	0.125	250
Pool B	1	2,000	0.125	250
Pool C	1	2,000	0.125	250
Restaurant	1	5,600	0.125	700
Bar	1	1,300	0.125	163
Hotel	1	64,000	0.125	8,000

Entry Gate/ Guardhouse	1	250	0.125	31
Work Force Housing A	1	7,000	0.125	875
Work Force Housing B	1	5,000	0.125	625
Total				**27,203**

Table 4. Marina commercial demand estimates.

Design Program Item No.	Unit Type (Boat size)	No. of slips	Daily demand per boat (GPD)	Average Daily Demand [ADD] (GPD)	No persons per Boat	No. Of persons
1	30 -50 ft	61	30	1,830	4	244
2	60 - 90 ft	31	50	1,550	6	186
3	100+ ft	5	100	500	13	65
Total				**3,880**		**495**
Note: GPD = Gallons per day						

Table 5. Commercial Potable Water Demand Summary

Item #	Boat Length (ft.)	Average Daily Demand [ADD] (GPD)	Maximum Daily Demand [MDD = 1.6X ADD] (GPD)
1	Commercial building Demands	27,203	43,524
2	Commercial Marina Demands	3,880	6,208
Total		**31,083**	**49,732**
Note: GPD = Gallons per day			

5.4.2 Energy

The Project site contains previously installed utility infrastructure. The developer intends to purchase energy from Bahamas Power and Light Co. Ltd. (BPL). Solar panels and accompanying battery cells, or other renewable energy sources, will be appropriately sized to provide a minimum of 30% of the power demand of the marina.

The estimated electrical load for the Project includes the entire development (up-land development and marina). Estimates are based on the project details spreadsheet, master plan

and marina concept, inclusive of the size of the amenities. In order to estimate the loads shown in Table 6 for each amenity, assumptions were made based on experience from past projects.

Table 6. Electrical demand estimates.

Buildings	
Facility	**Total load (VA)**
Entry Gate/ Guardhouse	2,000
Maintenance Garage	12,150
Yamacraw Lake	-
580' x 344' Boat Storage Building	104,600
Launch Area	-
Administration Building with Customs/ Immigration	68,400
Work Force Housing - Smaller	35,000
Work Force Housing - Larger	49,000
Restaurant	66,800
Pool	2,000
Lighthouse	1,700
Hotel	416,000
Fuel Docks	1,350
Cottages	36,000
Pool	2,000
Beachfront Cottages (typ.)	64,800
Short/Mid Term Lease	193,500
Pool	2,000
Beachfront Cottages (typ.)	57,600
Condominiums	303,600
Mixed Use/Retail	190,000
Buildings total	**1,608,500**

Marina	
Slip type	**Total load (VA)**
30 – 45 ft - 30no.	19,440
45 - 90 ft - 62no.	135,000
100 ft - 5no.	334,800
Total - Demand factors applied	**489,240**
Total Development	
Item	**Total load (VA)**
Buildings	1,608,500
Marina	489,240
Future/Spare	314,661
Total - Demand factors applied	**2,412,401**

5.4.3 Solid Waste

Waste will be collected, contained, and delivered to the New Providence Ecology Park. The Table below includes the average yearly demand for the Project. Solid waste generated by the Project will be collected and disposed of in accordance with DEPP and DEHS guidelines. This process will be further detailed in the EMP.

Table 7. Estimated solid waste average yearly demand.

Item No.	Description	No. of Persons	Waste produced per year (KG)	Average Yearly Demand [AYD]
1	Boats	495	45	22,275
2	Staff	60	45	2,700
3	Hotel Staff	Unknown		
4	Hotel/Condo guest	Unknown		
5	Live on property	Unknown		
Total		555		24,975
Factor of increase				2.0
Updated Total				49,950.0

5.4.4 Wastewater

Wastewater estimates for the Project provided by BRON Ltd., are listed in Tables 8 - 10. This demand is based on the development land use.

Table 8. Commercial building Sewer Flow.

Design Program Item No.	Unit Type	No. of Bldg.	Building Area (sq ft)	Flow Per Bldg. Area (GPD)	Average Daily Flow (ADF) (GPD)
1	Cottages A	5	900	0.125	563
2	Beach Front Cottages A	9	900	0.125	1,013
3	Beach Front Cottages B	8	900	0.125	900
4	Mixed use A	1	10,000	0.125	1,250
5	Mixed use B	1	5,000	0.125	625
6	Boat Barn	1	189,200	0.0125	2,365
7	Fuel Docks	1	900	0.125	113
8	Storage Lockers/ Maintenance Garage	1	7,200	0.125	900
9	Administration Building with Customs/ Immigration	1	7,200	0.125	900
10	Lodging A (Short/Mid Term Lease)	1	21,500	0.125	2,688
11	Lodging B (Condominiums)	1	37,950	0.125	4,744
12	Pool A	1	2,000	0.125	250
13	Pool B	1	2,000	0.125	250
14	Pool C	1	2,000	0.125	250
15	Restaurant	1	5,600	0.125	700
16	Bar	1	1,300	0.125	163
17	Hotel	1	64,000	0.125	8,000
18	Entry Gate/ Guardhouse	1	250	0.125	31

19	Work Force Housing A	1	7,000	0.125	875
20	Work Force Housing B	1	5,000	0.125	625
Total	-				**27,203**

Table 9. Commercial Marina Sewer Flow.

Unit Type	No. of slips	Daily Flow per boat (GPD)	Average Daily Flow [ADF] (GPD)
30-50 ft	61	20	1,220
60-90 ft	31	40	1,240
100+ ft	5	80	400
Total			**2,860**

Table 10. Sewer Flow Summary.

Boat Length (ft.)	Average Daily Demand [ADD] (GPD)	Maximum Daily Demand [MDD = 1.6X ADD] (GPD)
Commercial building Demands	27,203	43,524
Commercial Marina Demands	2,860	4,576
Total	**30,063**	**48,100**

5.4.5 Roads

Fox Hill Road (south) will be reconfigured to allow for security of the development while maintaining beach access for the public.

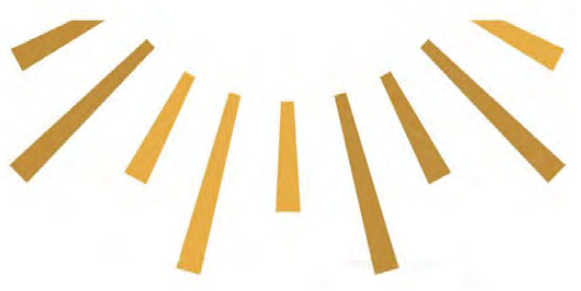
6. ALTERNATIVES

6.1 Other Considerations

Other designs were considered for the Project which included more buildings. However, this was not feasible for the site. Thus, modifications were made to the master plan which reduced the total amount of buildings on site. Also, the site was chosen because it was previously developed/disturbed. Thus, reducing the amount of construction required to achieve the proposed Project's designs.

6.2 Specify "No Action" Alternative

No development at the Project site will retain the current environment within the area of interest. The existing conditions may continue to deteriorate. Additionally, coastal erosion may increase with aid from the growth of invasive species on site. The Project provides additional economic



and recreational stimulus by providing job opportunities during construction and operation phases, as well as additional boating facilities created by the marina. Therefore, no development may halt economic growth for the surrounding communities.

7. PHYSICAL AND BIOLOGICAL BASELINE

7.1 CLIMATE

The general climate of The Bahamas is classified as Aw – tropical on the Köppen and Geiger classification scale. Average temperatures for the Central Bahamas range from 60°F to 75°F in the winter, and from 78°F to 90°F and above in the summer months. The tropical dry savanna designation is characterized by average monthly temperatures above 18°C (64°F) and total annual rainfall is generally lower than 60 mm (2.36 in). Rainfall patterns across the archipelago are dependent on island size, proximity to other islands, and relative position within the archipelago. The northernmost islands (Grand Bahama, Abaco, New Providence, Andros) tend to receive more rainfall and have a larger freshwater lens when compared to the southernmost islands (Inagua, Ragged Island, Mayaguana, San Salvador). Winter temperatures are influenced by trade winds ranging from mid-70's to mid-80's°F. The winter season is dry due to the onset of the cold air from North America. The northernmost islands tend to be colder than the remaining islands during the winter, and the southernmost islands up to 5° hotter in the summer months.

Table 11. New Providence climate data values.

Climatological Means & Extreme Values for New Providence 1981-2010												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Temperature (^{0}F) ***Highest Temp.***	88.3	89.2	91.4	91.4	95.5	97.7	96.8	96.6	95.4	95.4	92.1	89.1
***Mean of Daily** Max Temp.*	78.2	79.0	80.4	82.6	85.8	88.5	90.3	90.4	89.4	86.4	82.2	79.6
Mean of Daytime Temp.	70.9	71.4	72.8	75.0	78.4	81.8	83.3	83.3	82.3	79.9	76.1	72.6
Mean of Daily Min. Temp.	63.4	64.3	65.4	67.6	70.9	74.4	76.0	76.0	75.4	73.4	69.6	66.0
Lowest Temp.	41.4	46.6	44.6	48.6	55.5	53.8	65.7	64.4	64.2	59.0	52.0	45.7
Humidity ***Mean Relative Humidity (%)***	77	76	75	74	76	78	77	79	80	79	78	78
Mean Dew Point (^{0}F)	62.8	62.9	63.8	65.7	70.0	74.4	75.5	75.8	75.4	72.4	68.2	65.2
Wind *Mean wind speed (knots)*	7.9	8.3	8.7	8.1	7.6	6.7	6.5	6.2	6.2	7.2	8.0	7.9
Sunshine ***Mean Daily sunshine (hours)***	7.3	8.0	8.1	9.4	9.1	8.0	8.6	8.4	7.4	7.6	7.3	6.8
Rainfall ***Total Monthly Rainfall (inches)***	1.92	1.95	2.55	2.46	4.54	8.77	5.89	8.54	7.18	5.41	3.11	2.03
Max fall in a Day (inches)	2.76	5.86	4.33	3.87	5.74	6.20	5.01	4.55	4.77	5.47	8.18	3.13
Max rain days	8	6	7	6	10	15	17	18	17	14	9	8

Note: The Bahamas' Department of Meteorology updates these tables every 10 years.

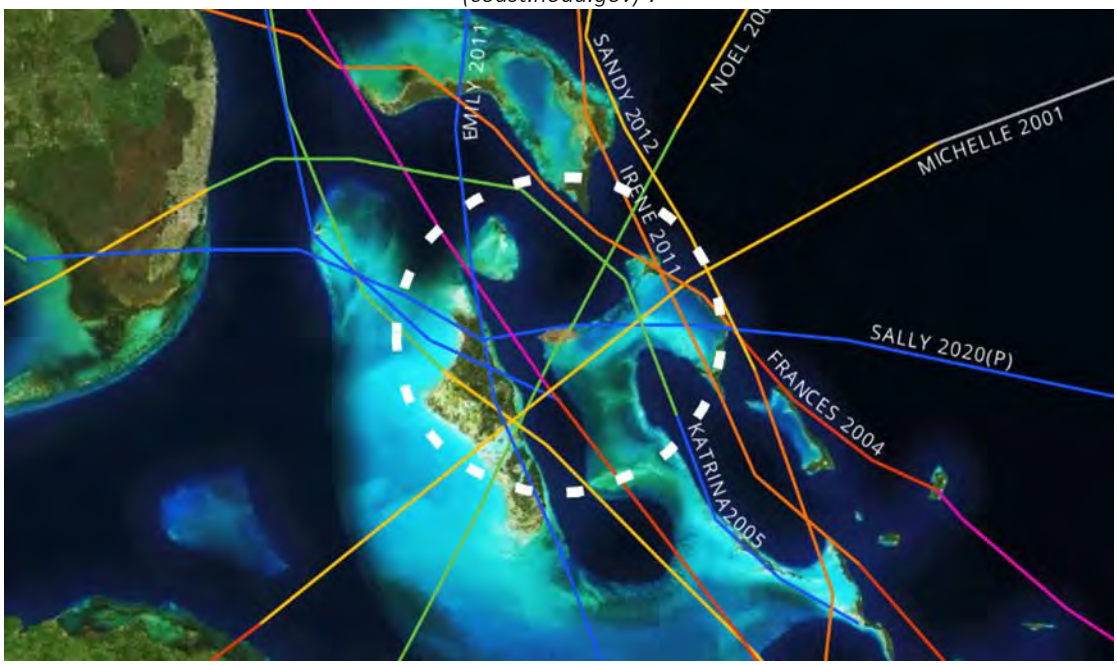
7.1.1 Hurricane History

The months of June-November are considered active hurricane months and are known as 'Hurricane Season' in The Bahamas. During hurricane season in The Bahamas, a tropical storm and/or hurricane is expected to occur an average of every two years. This is due to the country's location within the warmer waters of the Atlantic Ocean, which causes an area of low pressure, an active ingredient for the creation of a hurricane. Hurricane Isaias was the most recent hurricane to impact New Providence in 2020. The storm was a Category 1. In 2016, Hurricane Matthew made landfall on the island of New Providence, causing major flooding and destruction as a Category 4 hurricane. A summary of the hurricanes from 1992 to 2020 impacting the island of New Providence is presented in the table below.

Table 12. Summary of hurricane history to impact New Providence (coast.noaa.gov).

STORM NAME	DATE RANGE	MAX WIND SPEED	MIN PRESSURE	MAX CATEGORY
SALLY 2020	Sep 10, 2020, to Sep 18, 2020	90	967	H2
ISAIAS 2020	Jul 23, 2020, to Aug 05, 2020	75	987	H1
THREE 2019	Jul 22, 2019, to Jul 23, 2019	30	1013	TD
MATTHEW 2016	Sep 28, 2016, to Oct 10, 2016	145	934	H5
SANDY 2012	Oct 21, 2012, to Oct 31, 2012	100	940	H3
IRENE 2011	Aug 21, 2011, to Aug 30, 2011	105	942	H3
EMILY 2011	Aug 02, 2011, to Aug 07, 2011	45	1003	TS
NOEL 2007	Oct 24, 2007, to Nov 06, 2007	70	965	H1
KATRINA 2005	Aug 23, 2005, to Aug 31, 2005	150	902	H5
FRANCES 2004	Aug 25, 2004, to Sep 10, 2004	125	935	H4
MICHELLE 2001	Oct 29, 2001, to Nov 06, 2001	120	933	H4
FLOYD 1999	Sep 07, 1999, to Sep 19, 1999	135	921	H4
ERIN 1995	Jul 31, 1995, to Aug 06, 1995	85	973	H2
UNNAMED 1993	May 31, 1993, to Jun 03, 1993	30	999	TD
ANDREW 1992	Aug 16, 1992, to Aug 28, 1992	150	922	H5

Figure 14. Illustration of hurricane tracks which have passed through or near New Providence in the past 21 years (coast.noaa.gov)[1].



7.1.2 Hurricanes Extreme Analysis

The Bahamas is frequently affected by hurricanes. An analysis of historical hurricanes was recently completed by accounting for all hurricanes passing within a 200 nautical miles radius from 1979 to 2020, therefore providing a suitable dataset for a preliminary assessment of the frequency of occurrence and magnitude of hurricane events impacting New Providence. There have been 27 hurricanes passing New Providence, and average of one hurricane in every 1.6 years. The hurricane season lasts from June 1st to November 31st.

Hurricane Andrew, a Category 4 hurricane occurred in 1992, had a strong wind speed of 145 mph. Hurricane Matthew in 2016 caused 8-ft storm surge at the southwest coast of New Providence and Grand Bahama. As the hurricane data are more reliable during this time frame due to the launches of meteorological satellites in 1970s, historical hurricanes for 1979 to 2020 were used for storm surge and hurricane wave modelling., HURDAT2 (NOAA) hurricane track data provides the wind forcing for the hydrodynamic and wave models. Details of these major hurricanes are presented in Table 13 below.

[1] https://coast.noaa.gov/hurricanes/#map=4/32/-80

Table 13. Details of Historical Hurricane Passing with 200 nmi of the project site (1979-2020).

Name	Year	Pressure (milibars)	Max Sustainable Wind (knots)	Category	Duration (Days)
DAVID	1979	976	80	H1	15
GERT	1981	996	70	H1	9
KATE	1985	967	95	H2	8
FLOYD	1987	994	50	H1	6
ANDREW	1992	930	125	H4	13
ERIN	1995	985	75	H1	7
BERTHA	1996	968	80	H1	13
FRAN	1996	952	105	H3	19
LILI	1996	970	90	H2	16
GEORGES	1998	987	80	H1	15
DENNIS	1999	976	75	H1	16
FLOYD	1999	930	110	H3	13
IRENE	1999	985	65	H1	8
MICHELLE	2001	980	75	H1	9
FRANCES	2004	960	90	H2	17
JEANNE	2004	957	100	H3	17
RITA	2005	992	60	H1	8
KATRINA	2005	1000	45	TS	9
WILMA	2005	955	105	H3	12
NOEL	2007	981	70	H1	14
IRENE	2011	950	90	H2	10
SANDY	2012	968	70	H1	11
JOAQUIN	2015	942	110	H3	20
MATTHEW	2016	952	110	H3	13
IRMA	2017	924	145	H5	14
DORIAN	2019	910	160	H5	15
ISAIAS	2020	987	70	H1	12

7.2. Topography and Physical Geology

The site is considered flat with elevations of 0 -7ft. above sea level. The highest elevation (7ft.) is located south of the parcel, near the southeastern coastline. Site topographic survey is shown in Figure 15.

7.2.1 Physical Geology

The Geotechnical Investigation Report (Appendix F) section 2 on page 5 of 44 states, “The archipelago of The Bahamas is comprised of a series of karst islands. The islands are predominantly low lying, with most of the topography less than 100 ft above sea level. All land higher than 24 ft or so formed through Aeolian transport processes (I.e., sediment deposits produced by the action of wind). Rock formation between sea level and 24 ft above sea level is a mixture of marine, lacustrine and terrestrial limestone. These rock features were formed over periods of fluctuating sea levels (Curran and White, 1995).”

A total of 12 bore holes and 9 test pits were assessed at the site. The subsurface was consistently poorly graded sand/sand gravel mixtures. The N values ranged from 5, which signifies loose substrate, to the maximum value of 100 (refusal), signifying very dense substrate. Clean limestone fill was observed at each of the 9 test pits.

Figure 15. Topographic survey.

7.3 Coastal Processes

7.3.1 Metocean Discussion

The site of the proposed Project is located at the southeast corner of New Providence. As Google Earth images show, the site is protected by the New Providence landmass from northerly, northeasterly, northwesterly, and westerly winds and waves.

Figure 16. Project Location Map (Source: Google Earth, 2022).

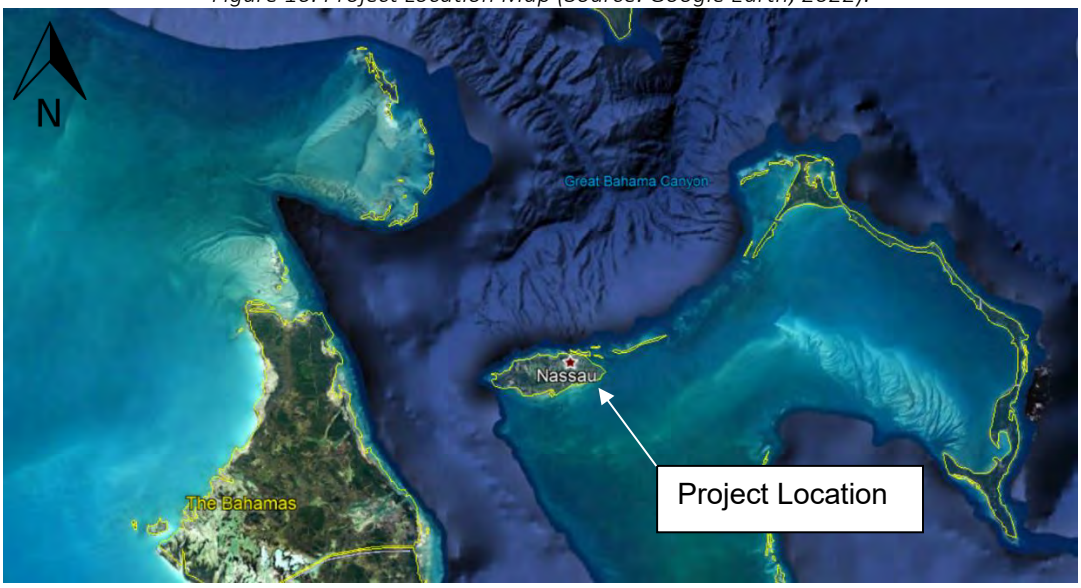


Figure 17. Project Location Map (Source: Google Earth, 2022).

In the event of a hurricane, storm surge increases water depth, and thus increases the maximum wave height that can be experienced at the shoreline of the site. The magnitude of the storm surge relies heavily on the storm's intensity and path.

The proposed development consists of a marina, and a dredged channel connecting the marina to deeper water, and a breakwater east of the marina for wave protection of the marina (Figure 18). Both the marina and the channel are to be dredged to 12-13 ft below Mean Lower Low Water (MLLW). Please note, the existing maria is mostly dredged to -9.0ft. The existing navigation channel was also dredged to -9ft contour, however, due to siltation and in order to accommodate the largest design vessel, this channel will require a dredge depth of 13ft and to be widened to a total width of 160 ft to safely accommodate two-way vessel traffic (see Figure 19).

The existing dredged navigation channel will also be extended to the entrance of the Yamacraw Lake (Figure 20). The lake entrance at present is very shallow sandy bottom that almost dry at low tides. Widening and deepening the existing Yamacraw Lake entrance channel will allow local residents and recreational boaters to enjoy the Yamacraw Lake. This will also improve advective transport, thus enhancing the water quality of the lake. Detailed marina and access navigation channel and associated dredging plan is shown in Appendix E.

Figure 18. Conceptual Breakwater Plan.

Figure 19. Blue Water Cay Marina and Dredged Navigation Channel Approach

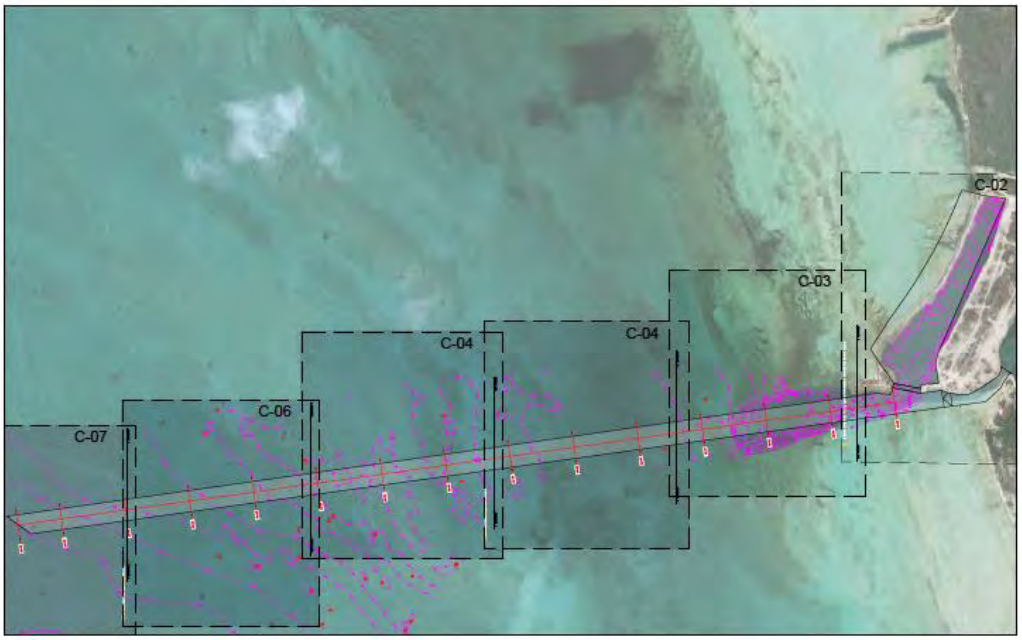
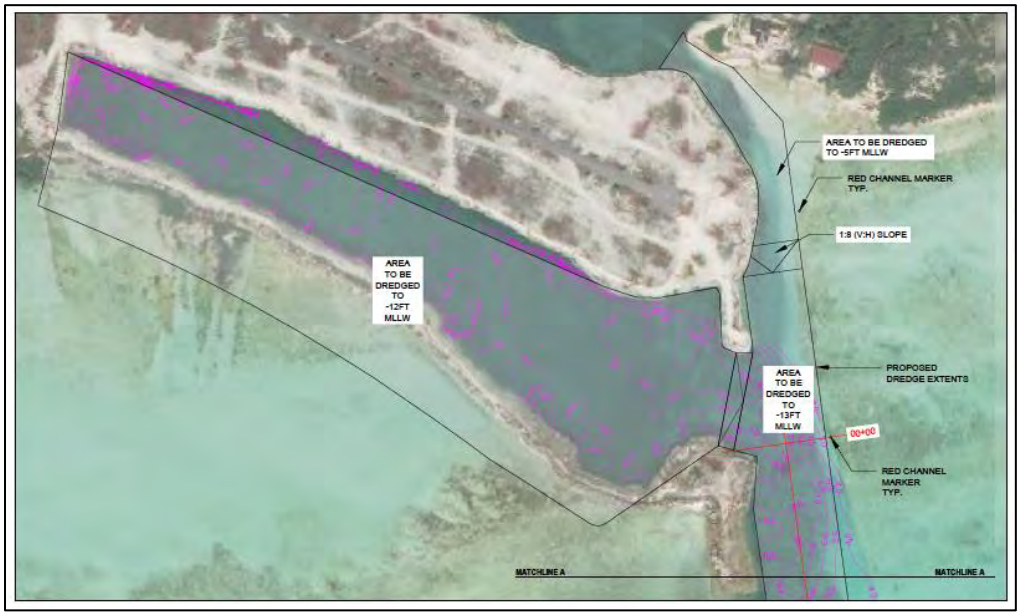


Figure 20. Blue Water Cay Marina & Dredged Channel to Yamacraw Lake Entrance.



Bathymetric survey data confirmed that water depth is shallow to the east and south of the site therefore only depth-limited waves impact the site. Wave heights (measured from trough to crest) are limited to a maximum of approximately 0.8 times the total water depth.

In the event of a hurricane, storm surge increases water depth, and thus increases the maximum wave height that can be experienced at the shoreline of the site. The magnitude of the storm surge relies heavily on the storm's intensity and path.

Numerical modeling is being conducted to simulate the impact of hurricanes on the site, using historical hurricane data for The Bahamas between the years 1979 and 2021. The results of the modeling will be used to establish site grades as well as coastal defense crest heights and armour unit sizes.

A detached breakwater is proposed to the east of the marina entrance channel. The primary purpose of this structure is to protect the basin from easterly wind-driven waves. The breakwater will also reduce sedimentation in the channel, and thus reduce the frequency of maintenance dredging.

The typical tranquility requirement, i.e., the maximum wave height allowed for the marina basin to be considered comfortable under normal, operational conditions is 1ft. The proposed breakwater is necessary to meet this tranquility requirement, and to provide a marina that is on-par with global standards.

7.3.2 Modeling Studies

7.3.2.1 Wind and Wave Climate

Numerical modeling has been conducted to simulate both wave climate and the impact of tropical storms and hurricanes on the site. The historical hurricane data for The Bahamas between the years 1979 and 2020 were used (Table 13). The results of the modeling will be used to establish site grades as well as coastal defense crest heights and armour units. The models used in this study are widely used and have been extensively calibrated and validated in several applications in The Bahamas, including the proposed development.

As a part of the numerical modeling, an operational wave hindcast / wave climate (no hurricanes) was undertaken using the calibrated WAVEWATCH III model for the period from 1979 to 2009. The model results are representative of "offshore" wave conditions in deep water 23 km south of the site. Figure 21 presents wave height (significant wave height, Hs) and wave period for the offshore wave climate. The wave rose shows that the peak wave direction is typically from NE to SE, corresponding to the prevailing winds and an opening to the North Atlantic. The wave period rose shows that the wave period is short (2-3 s), corresponding to the limited fetch length.

The general conclusion from the wave direction rose is that the waves typically approach from east and are generally below 1 m in height. The maximum offshore waves in the operational wave climate reached nearly Hs = 1.1 m (significant wave height), with a peak wave period (Tp) of 3.8 seconds. Table 14 summarizes the monthly wave climate. The wave condition is generally mild with an annually average wave height of 0.28 m. The dominant wave period is 2.3 seconds; and the dominant wave direction is 122 degrees. The offshore deep-water wave condition (swell) is so mild that the nearshore wave modeling will only consider locally generated wind waves.

Figure 21. Wave Height and Period Roses (3-Hours WAVEWATCH III Data from 1979 to 2009).

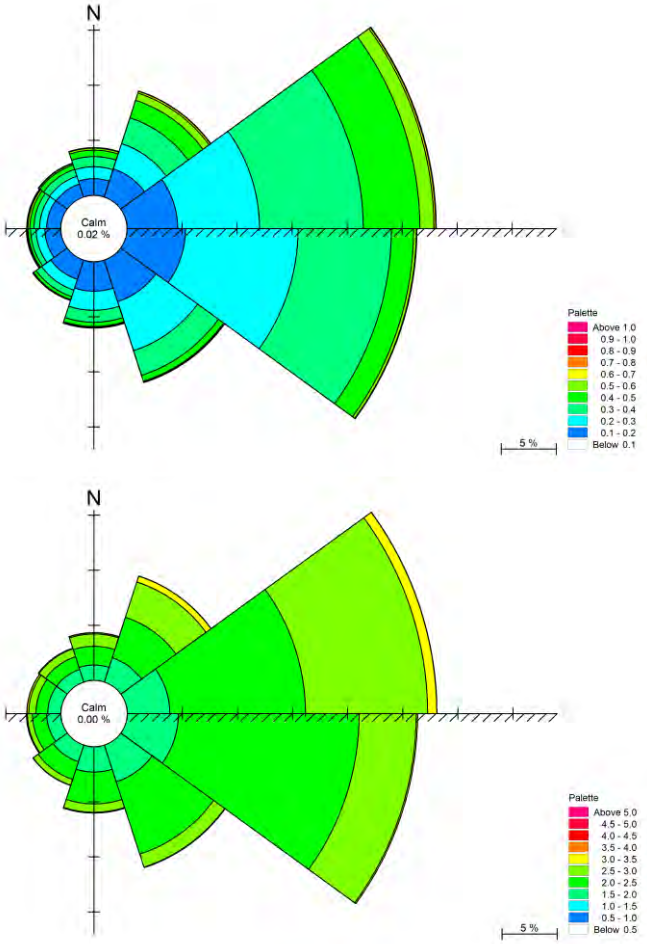


Table 14. Summary of the Wave Climate of New Providence Island.

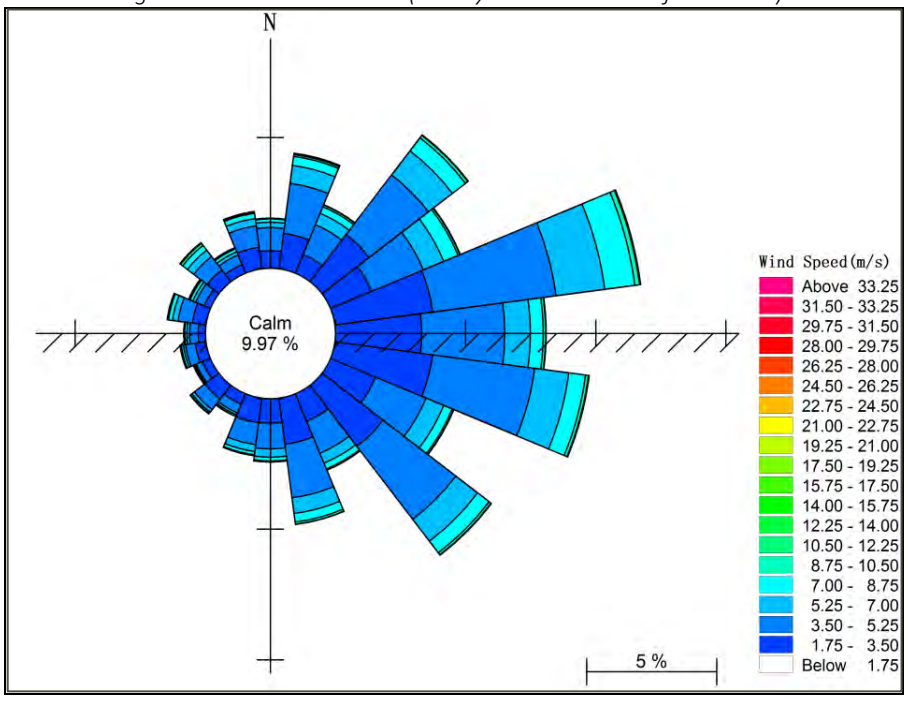
Month of year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max wave height (m)	0.82	0.88	0.84	0.74	0.68	0.65	0.72	0.79	1.06	0.95	1.04	0.86	1.06
Mean wave height (m)	0.31	0.30	0.31	0.28	0.26	0.24	0.24	0.24	0.26	0.28	0.32	0.31	0.28
Dominant wave period (s)	2.38	2.35	2.38	2.31	2.26	2.19	2.19	2.19	2.22	2.32	2.42	2.39	2.30
Dominant wave direction (deg)	134	137	134	131	112	126	121	118	117	105	105	121	122

Table 15 provides monthly wind statistics in Nassau. The local wind condition is mild in Nassau, with the annual average wind speed is 2.7 m/s. The maximum wind speed occurred in October with a value of 33.4 m/s, due to storm disturbance. However, a typical maximum wind speed ranges from 11 – 15 m/s. As the wind rose (Figure 22) shows the winds typically blow from northeast to the southeast quadrants, although occasional winds from the north and south are also observed.

Table 15. Summary of the Monthly Wind Condition in Nassau from 2016.

Month of year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max wind speed (m/s)	13.4	11.8	11.3	11.8	13.9	12.9	13.4	12.9	14.4	33.4	11.8	10.8	33.4
Mean wind speed (m/s)	3.0	3.0	2.7	3.2	2.5	2.0	2.7	2.2	1.6	4.2	2.6	2.4	2.7
Wind direction (deg)	67	67	67	67	90	112	112	112	112	67	67	90	90

Figure 22. Local Wind Rose (Hourly Measured Data from 2016).



7.3.2.2 Storm Suge

The best track data for these 27 storms were used for storm surge modelling, and an estimate of the surges at the project site was determined for each historical storm. The simulated storm surge elevation was compared with recorded data by NOAA for selected hurricanes. For example,

model results for Hurricane Matthew show that the surge elevation in northwest Nassau was 2.6 m (8.5ft), consistent with the NOAA hurricane report. As such, the model predictions were considered to be accurate.

An extreme value analysis was conducted to estimate the peak storm surge elevation at the project site by return period. From this analysis, the 50-year return period (or probability of occurrence of 0.02) storm surge elevation reaches 3.05 m-MSL (10ft). The extreme water surface elevation corresponding to different return periods are summarized in Table 16. Notice that this estimate does not include wave setup or long-term sea level rise.

Table 16. Extreme Conditions of Storm Surge Elevation at the Proposed Site.

Event	Surge Elevation (m-MSL)
5-Year	2.27
10-Year	2.54
25-Year	2.85
50-Year	3.05
100-Year	3.24

7.3.2.3 Wave Modelling

The magnitude of hurricane waves caused by the passage of a hurricane depends on the location of the storm track relative to the point of interest, and the size, intensity, and speed of the hurricane. The key variables of interest are the storm track, the minimum central pressure (which is strongly correlated to the maximum wind speed), the radius to maximum winds and the forward tracking speed. Same as the storm surge modelling, 27 major historical hurricanes passing the project site from 1979 to 2020 were simulated to obtain the deep-water hurricane wave height. The same mesh for storm surge modelling was used for deep-water wave simulation.

The hurricane wave model was validated using the model results from a previous report for North Abaco Port. The deep-water wave heights at (-77.3°E, 27.3°N) during selected hurricanes are compared; and the results show that the current model slightly overestimates the hurricane wave heights for most events. Therefore, the current study is considered to be a conservative analysis.

Nearshore wave transformations were also completed using the MIKE 21 Spectral Wave model (M21SW) with the extreme conditions developed in the previous sections. The wind was set to come from SW, S, and SE to produce the worst-case scenario.

The 100-year wave height distributions associated with three wind directions (SW, E, and SE) are shown in Figures 23-25, respectively. The waves undergo substantial refraction and dissipation as they propagate from deep water to the shoreline. The wave height distributions for the 25-year, 50-year, and operational conditions follow the same pattern with smaller wave heights, therefore

are not shown. Tables 17 to 19 present the wave height at different locations shown in Figure 26 for different wind directions. For the 100-year event, the wave height ranges from 1.0m to 2.5m depending on the extraction location and wind direction. The worst-case scenario of the wave heights for all wind directions is summarized in Table 20. In general, the wave heights at the site would range from 1.9m to 2.5m for extreme hurricane events.

Figure 23. Wave Height Distribution for the 100-Year Hurricane Waves due to SW Wind

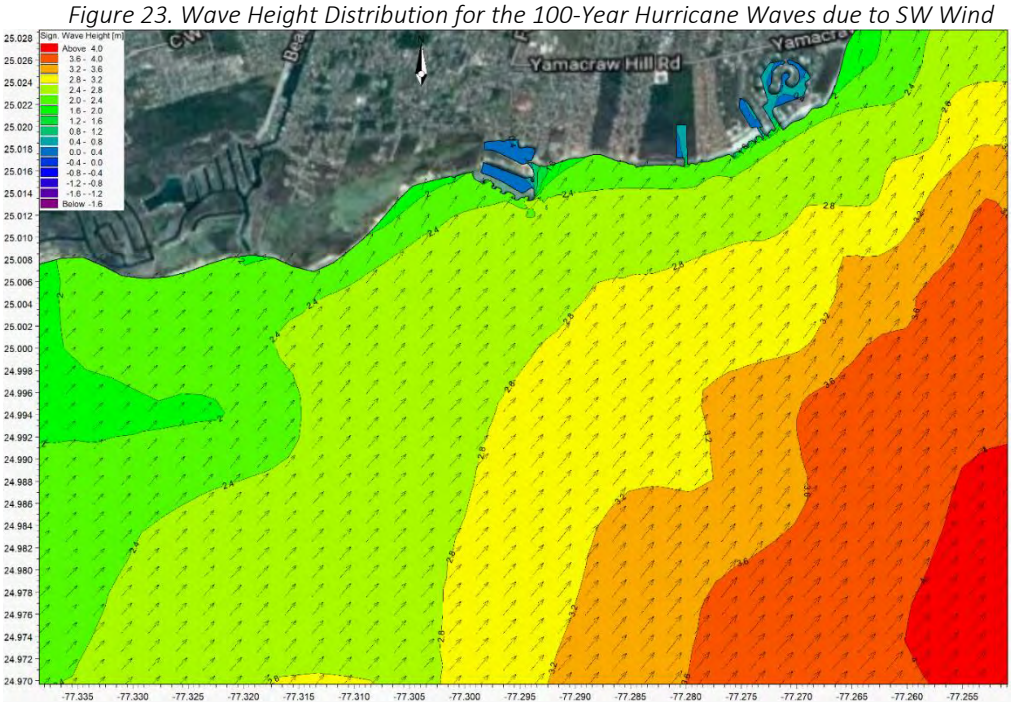


Figure 24. Wave Height Distribution for the 100-Year Hurricane Waves due to S Wind

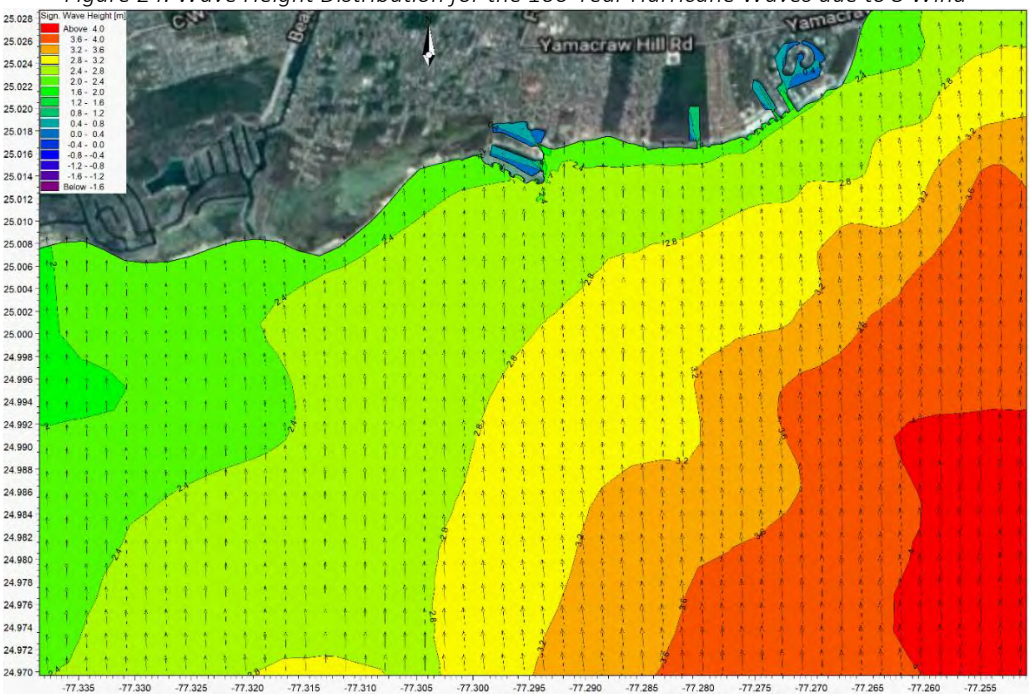


Figure 25. Wave Height Distribution for the 100-Year Hurricane Waves due to SE Wind

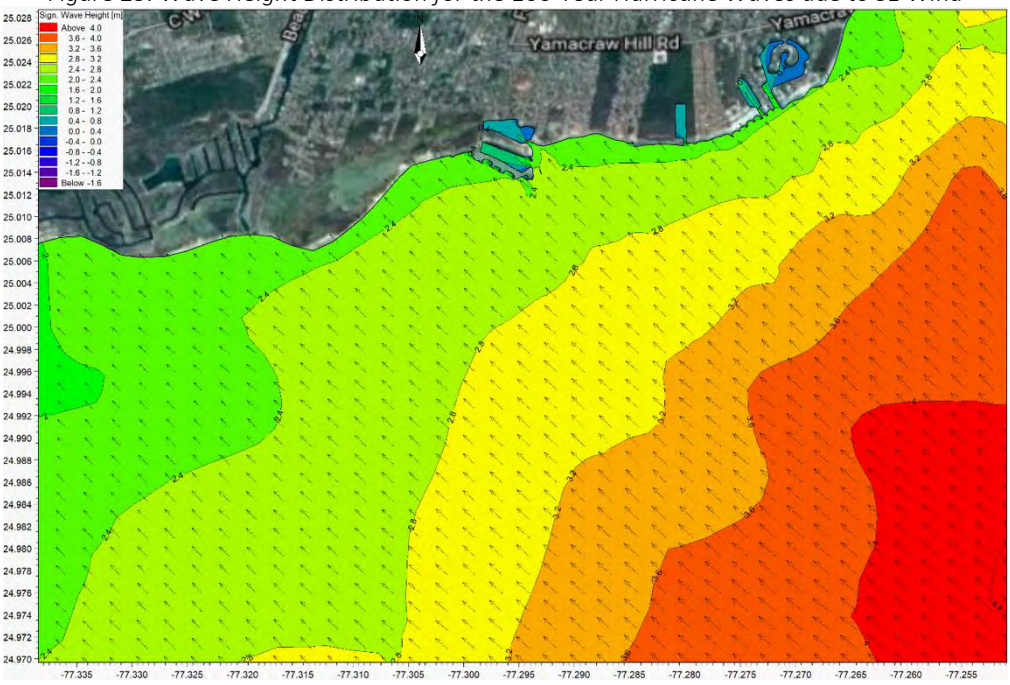


Figure 26. Locations where the Wave Heights were Extracted.

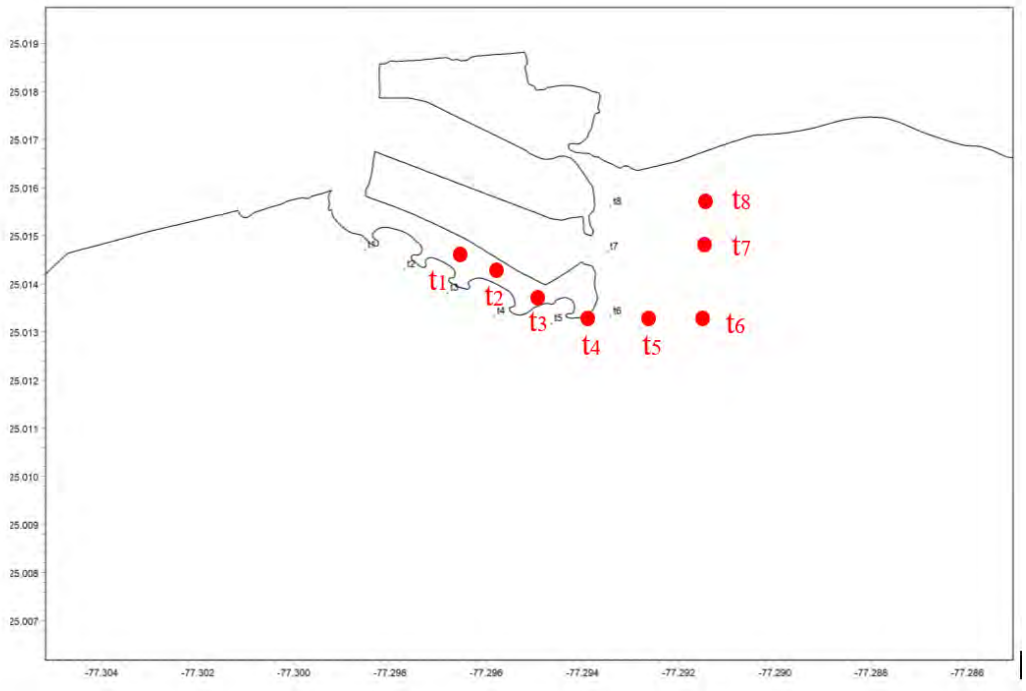


Table 17. MIKE21 SW Results for the Nearshore Waves due to SW Wind.

Event	Wave Height (m)							
	t1	t2	t3	t4	t5	t6	t7	t8
25-Year	1.9	2.0	2.1	2.1	2.1	2.2	1.0	1.1
50-Year	2.0	2.1	2.2	2.3	2.3	2.3	1.1	1.2
100-Year	2.2	2.3	2.3	2.4	2.4	2.5	1.1	1.2
Operational	1.6	1.6	1.7	1.8	1.8	1.8	0.8	0.9

Table 18. MIKE21 SW Results for the Nearshore Waves due to S Wind.

Event	Wave Height (m)							
	t1	t2	t3	t4	t5	t6	t7	t8
25-Year	2.0	2.1	2.1	2.2	2.3	2.1	1.8	1.9
50-Year	2.2	2.2	2.3	2.3	2.4	2.3	1.9	2.0
100-Year	2.3	2.3	2.4	2.4	2.5	2.4	2.0	2.1
Operational	1.7	1.7	1.8	1.8	1.9	1.7	1.4	1.5

Table 19. MIKE21 SW Results for the Nearshore Waves due to SE Wind (Worst-Case Scenario).

Event	Wave Height (m)							
	t1	t2	t3	t4	t5	t6	t7	t8

25-Year	1.9	2.0	2.1	2.2	2.1	2.2	2.1	2.0
50-Year	2.1	2.1	2.2	2.3	2.3	2.3	2.3	2.2
100-Year	2.2	2.2	2.3	2.5	2.4	2.5	2.4	2.3
Operational	1.6	1.6	1.7	1.9	1.7	1.8	1.8	1.7

Table 20. MIKE21 SW Nearshore Waves for the Worst-Case Scenario.

Event	**Wave Height (m)**							
	t1	t2	t3	t4	t5	t6	t7	t8
25-Year	2.0	2.1	2.1	2.2	2.3	2.2	2.1	2.0
50-Year	2.2	2.2	2.3	2.3	2.4	2.3	2.3	2.2
100-Year	2.3	2.3	2.4	2.5	2.5	2.5	2.4	2.3
Operational	1.7	1.7	1.8	1.9	1.9	1.8	1.8	1.7

7.3.2.4 Marina Wave Penetration / Wave Tranquility Analysis

A detached breakwater is proposed to the east of the entrance channel. The primary purpose of this structure is to protect the basin from easterly wind-driven waves and provide tranquility requirement for marina users. The breakwater will also reduce sedimentation in the navigation channel, and thus reduce the frequency of maintenance dredging.

The typical tranquility requirement, i.e., the maximum wave height allowed for the basin to be considered comfortable under normal, operational conditions is 1ft. The proposed breakwater is necessary to meet this tranquility requirement, and to provide a marina that is on-par with global standards.

Based on the results of the hydrodynamic and numerical modeling studies conducted, a detached breakwater is proposed to the east of the entrance channel. The primary purpose of this structure is to protect the basin from easterly wind-driven waves. The breakwater will also reduce sedimentation in the channel, and thus reduce the frequency of maintenance dredging.

Figure 27. Conceptual Breakwater Plan.

7.3.2.5 Sediment Transport Analysis

7.3.2.5.1 Sand Sample Analysis

Sediment samples were collected by BRON during the site work. The sediment samples were visually inspected to assess the constituents and were submitted to a soil laboratory for sieve analyses. The sieve analyses show a median grain diameter (D50) of 0.85mm, which were used for sediment transport modelling.

7.3.2.5.2 Jet Probe Results

A series of 28 jet probes were completed in vicinity of the project to determine the depth of sand cover over solid substrate. The jet probe system includes compressed air, a flexible hose, and PVC pipe. Air is jetted through the pipe as it is advanced into the seabed, with the flow causing the sand to liquefy, thereby allowing the probe to easily pass-through sand until “refusal” (i.e., when the probe encountered hard material).

The jet probing results show that the area has mostly rocky bottom with very little sand coverage. The maximum sand thickness observed was 0.5 ft.

7.3.2.5.3 Modeling Set Up and Input Conditions

For detailed information on the model setup and input conditions please refer to the Metocean discussion section of the EIA.

7.3.2.5.4 Model Results for Annual Average Conditions

The model results indicate that currents flow parallel to the shoreline of the proposed development towards west during flood and east during ebb with velocities on the order of 0.1 m/s. The flow fields are very similar for the existing and proposed cases except for regions near the coastal protection structures. The differences observed at the regions near the coastal protection structures is miniscule.

7.3.2.5.5 Analysis of Wave-induced currents at the Project Site

The corresponding nearshore currents due to easterly waves is presented in Figure 28. Nearshore currents are important because they generally define the direction and magnitude of alongshore transport. Figure 28 indicates that the net current direction is towards the west along the shoreline of the development. The corresponding nearshore circulation pattern is likely due to local variations in wave height caused by the existing seabed changes of the southeast tip of Nassau.

Figure 29 provides the predicted nearshore current velocity vectors during east waves. The results indicate that the wave-induced flow patterns are very similar for the existing and proposed configurations.

Figure 30 presents the corresponding wave-induced current due to southerly waves. Figure 31 provides a direct comparison of predicted velocity vectors between the existing and proposed configurations. Areas with slightly different current velocity are limited to the proposed structures and their immediate vicinity. The rest of the nearshore area is shown to experience similar current velocities and patterns under both existing and proposed configurations.

Figure 28. Nearshore Current Distribution during East Waves

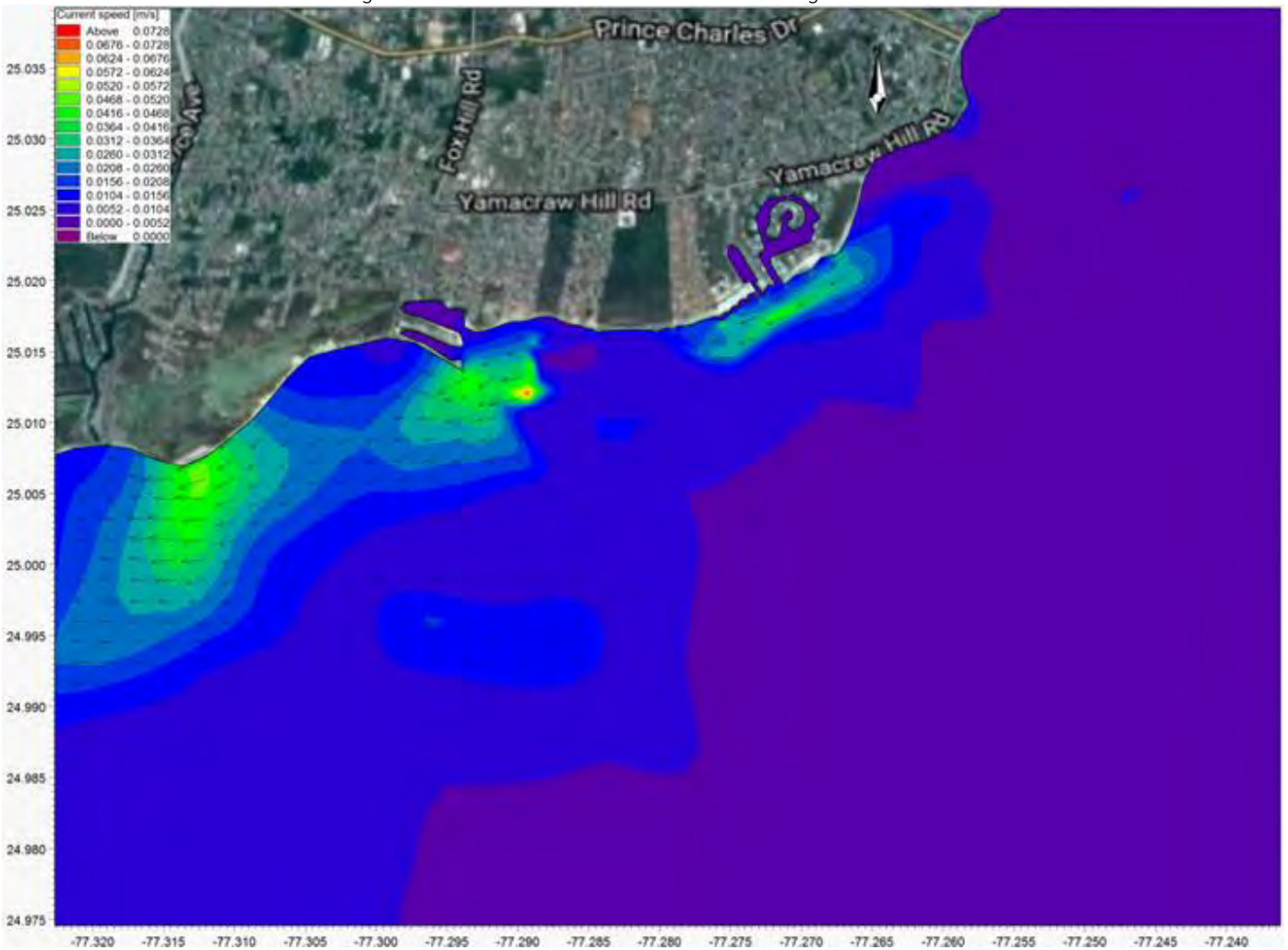


Figure 29. Nearshore Current Velocity Vectors during East Waves.

Figure 30. Nearshore Current Distribution during South Waves

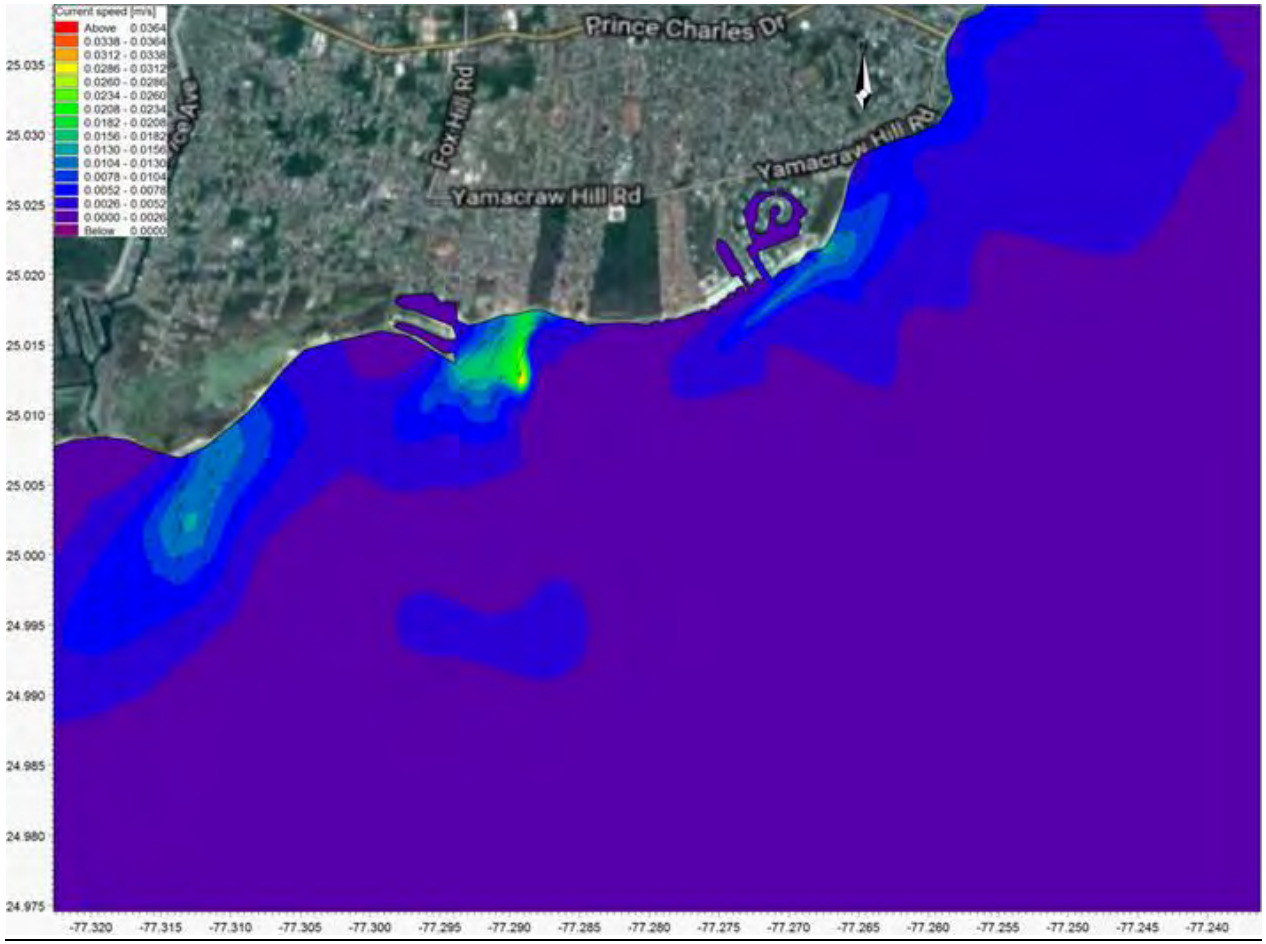


Figure 31. Comparison of Nearshore Current Velocity Vectors during South Waves.

7.3.2.5.6 Long-Term Potential Sediment Transport Analysis

There are two primary concerns associated with sediment transport:

1. The influence of sediment transport on potential sedimentation in the marina.
2. The impact of the interruption of natural sand transport by the proposed structures on coastal processes and beach and seabed stability.

A quantitative evaluation of sediment transport processes in the study area has been completed to assess these two concerns.

7.3.2.5.7 Sand Transport Rate Estimates

The MIKE 21 sand transport module (M21ST) was utilized to calculate the long-term potential sediment transport. M21ST is a module for the calculation of sediment transport capacity and resulting bed level changes for non-cohesive sediment due to combined waves-currents effects. The module calculates sand transport rates on a flexible mesh covering the area of interest based on the hydrodynamic data obtained from hydrodynamics provided by the FM module, wave data generated by the SW module, and information about the bed material properties.

The M21ST model was run to determine the longshore sand transport rate around the site for water level, current, and wave conditions described in previous sections. A numerical interpolation program was used to estimate the long-term average potential sediment transport rates across four transects. Calculations were completed for a median grain size of 0.85 mm to match the predominant grain size conditions of the beaches at the site.

These long-term sediment transport (LST) estimates do not consider the rare but intense impacts from hurricanes that could move sediment in almost any direction. Note that it is not possible to assess the possible future impacts of an extreme event. Slight variations in the storm track could drastically change the sediment processes during these short-term but intense transport events. However, the long-term trends should control the general characteristics of the shorelines in the region.

The resulting estimates of average annual LST are presented in Figure 32. The net LST is from east to west as expected since the predominant waves are from east. It is important to note that M21ST assumes the seabed is always covered with sand and therefore its predictions are conservative and should be considered as potential values. Actual transport rates would depend on sediment availability and would be much smaller. As shown in the jet probe analysis, very little sand was observed in the nearshore area. Most of the selected transects for long-term calculations were extended perpendicular to the shoreline out to the 3-m depth contour to better represent actual LST values. Therefore, numerical model estimates presented here represent a potential transport rate that would only be realized if unlimited sand is available out to the 3-m depth contour.

Starting from the Beach at the southeast tip of Nassau, the predicted potential net LST rate is approximately 28,989 m^3/year towards the west (Figure 32). Further west along the Yamacraw

marina shoreline is a zone of relatively high wave height and longshore current velocity which results in a large potential to transport sediment. A westward net transport past the shoreline is predicted and the potential net LST rate is 37,752 m³/year. The potential transport rate is relatively high, but the jet probe analysis indicates there is little apparent supply of sediment to contribute to any significant realized LST in this area.

M21ST predicts that the potential net LST rate decreases to 11,282 m³/year at the beach west to the development as the shape of the beach forms a natural sand sink. This potential then increases to 27,459 m³/year towards the Marshall Rd area.

It is likely that rare episodic and specific hurricane events could result in a greater rate of transport over a short period of time. However, the short-term effects of such an event would soon revert to the long-term conditions.

Figure 32. Long-term Annual Potential LST Rates for Existing Condition. (Note, actual LST less than potential LST due to limited sand availability)

7.3.2.6 Sediment Transport Analysis Summary

Results from the MIKE 21 numerical modeling indicated the following:

- Shoreline's alterations due to coastal protection structures at the proposed development have little impact on the current flow and wave fields at the southeastern shoreline of New Providence.
- Under the existing condition, the net longshore sediment transport at the southeast tip of New Providence is approximately 28,989 m³/year along the shoreline towards the west. A westward net transport just east of the proposed site location is 37,752 m³/year and the potential transport rate reaches 31,088 m³/year at Bluewater Cay area, as the shape of

the beach forms natural sand sink. LST decreases to 11,282 m³/year at the beach west to the Bluewater Cay and then increases to 27,459 m³/year towards the Marshall Rd area.

- Under the proposed condition, the net longshore sediment transport is similar to that of the existing conditions at sites east and west of the Project area, but it is reduced to 4,241 m³/year towards west. This reduction is due to the installation of the proposed shore protection (e.g., the breakwater).
- The highest potential for sediment transport is at the location of the proposed breakwater. It is therefore deemed that this breakwater is required to help mitigate sedimentation of the entrance channel.

7.3.2.7 Flushing Analysis

Numerical simulations were carried out on the proposed Bluewater Cay Marina development using DHI's MIKE21 FM model. The model was constructed using a combination of collected field data and other available existing data. Model results were compared with DEPP and EPA guidelines for new marina design that recommend a minimum 90% flushing reduction in the basin within 24 hours. Five model cases were investigated involving tracer placement, typical (regional) wind, and neap tide conditions. A tracer with a concentration of 100 mg/L was used in all cases. The following conclusions were noted:

If a contaminant is applied over the entire basin (from the surface to the basin floor) then it is unlikely that the concentration of the substance within the basin area will reduce by 90% over a 24-hour period.

However, this situation is extremely unlikely to occur, and a point-source release of contaminant (such as a fuel spill) is a more likely scenario.

If the northwest or the southwest corner of the basin is contaminated, the DEPP/EPA criteria can be met if the contaminated area is equal to or under 350 m². However, the contaminant concentration decreased much more slowly after 24 hours and would remain at a notable concentration (nearly 10 mg/L) after 72 hours.

If the northeast or the southeast corner near the entrance of the marina basin is contaminated, the DEPP/EPA criteria would be easily met. Moreover, the results also suggest that the typical regional wind generally improves basin flushing. It is likely that this effect is underestimated in the model and more mixing will occur in reality because of wind induced current shear in the water column.

It should be noted that the model is limited in its application and ability to replicate the true physical mixing and flushing processes. However, the results found during this investigation are likely conservative in nature and that the basin will flush more readily than the model demonstrates.

Some additional comments relating to the marina are as follows:

- Increasing the depth and the width of the entrance channel would allow more flow into the basin thus improving flushing.

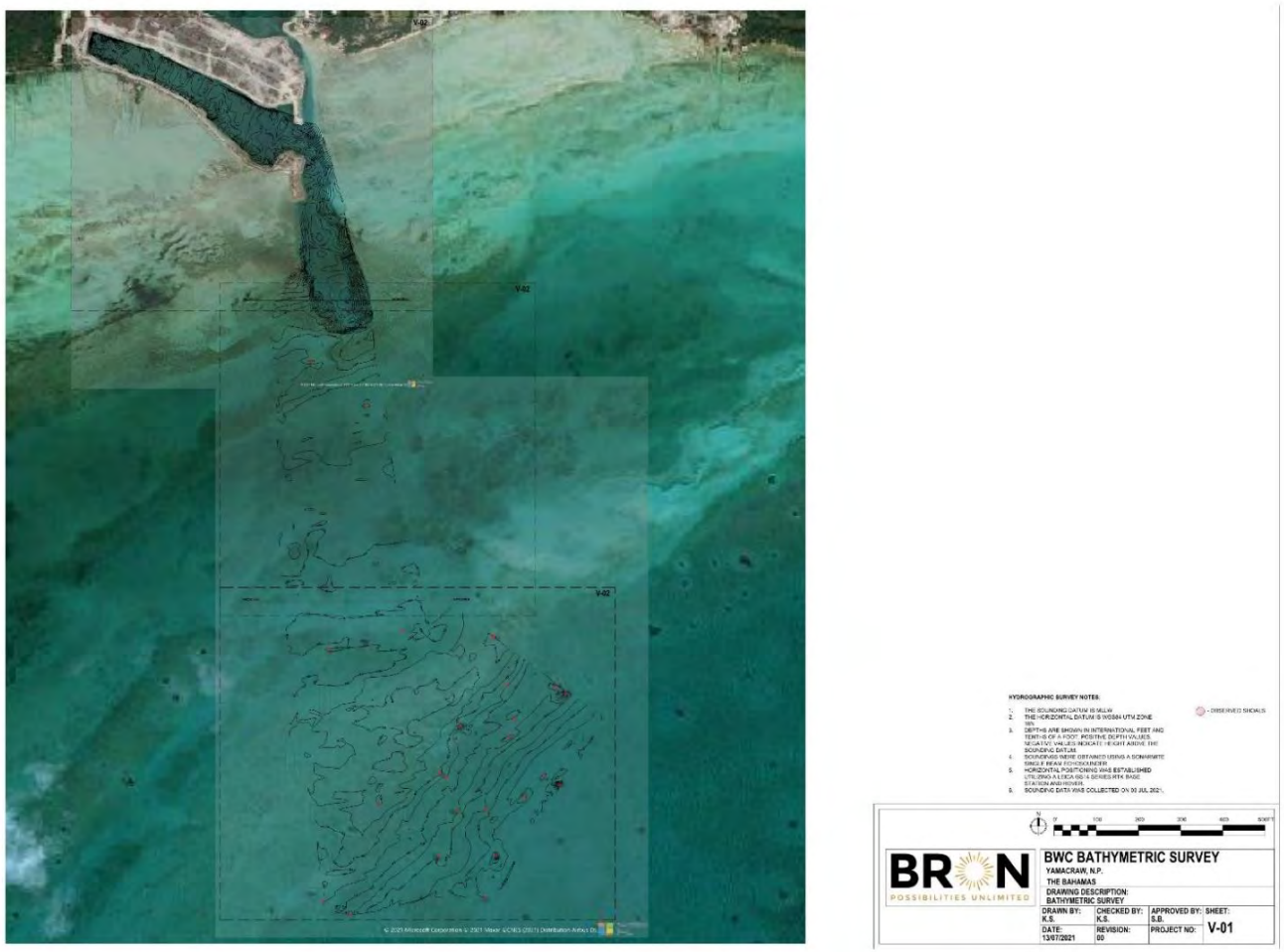
- The construction of a flushing channel at the marina's southwest corner would improve the flushing performance at the marina's northwest and southwest corners.
- Although circulation and flushing play important roles in the distribution and dilution of potential contaminants, there are also practical active means of spill management and remediation such as containment with booms, and pumping/absorption and disposal of the contaminant.

The detailed Flushing Analysis is included in Appendix G.

7.3.3 Bathymetry Survey

The Bathymetric Survey identifies depths of approximately 3 - 12ft. MLLW within the proposed Projects area of interest. See Figure 33 below and Appendix H for more details.

Figure 33. Bathymetry survey (printed larger in Appendix H).



7.4 Air and Noise Quality

Ambient air conditions shown in Table 21 were measured using a Kestrel 5200 Meter on June 11th, 2021.

Table 21. Ambient Air Conditions at Project Site.

Ambient Air Conditions	June 11, 2021
Temperature (°F)	89.6
Relative Humidity (%)	63
Air Pollution Level	001 [Fresh]
Formaldehyde (mg/m^3)	0.000
Total Volatile Organic Conditions (mg/m^3)	0.000
PM 2.5 (mg/m^3)	003

The ambient air quality at the Project site is considered to be of good quality, as this area has no large scale industrial or commercial developments producing emissions that would impact air quality in the area. Current sources of air emissions in the Project area include personal and commercial vehicles, fishing boats and passenger boats. Furthermore, the consistent easterly winds proximity to the open ocean aid in the removal of minor temporary disturbances to the existing air quality. Sources of noise in the Project area are transient and originate from residents, passing vehicles, boats, and planes. No consistent sources of noise exist.

7.5 Water Quality

Water quality was measured using a Horiba U52G water quality meter on June 11, 2021, and June 25, 2021. Measurements were read at 6 different locations on site and recorded accordingly, as presented in Figure 34 and Table 22 below.

Figure 34. Water Quality Testing Points (Google Earth 2021).

Table 22. Water quality readings.

Sample Point	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Date / Time	11/06/21 2:10 p.m.	25/06/21 10:02 am	25/06/21 10:13 am	25/06/21 10:29 am	25/06/21 11:24 am	25/06/21 11:30 am
Depth m	0.5	1.65	1.85	2.35	2.10	1.85
Temperature °F	97.8	84.8	84.7	85.8	85.3	85.4
pH	8.00	7.95	7.83	7.91	7.97	7.76
Dissolved Oxygen %	76.3	91.0	88.6	81.7	91.2	84.4
Dissolved Oxygen mg/L	4.95	5.68	5.66	5.07	5.65	5.22
Salinity ppt	10.05	38.96	34.78	38.23	39.04	89.45

Water quality measurements were taken in the open body of marine water located at the Project site using a Horiba U52G water quality meter. Parameters measured during water body sampling

include temperature, pH, oxidation reduction potential, electrical conductivity, turbidity, dissolved oxygen, total dissolved solids, salinity, and depth (see Table above).

Water temperature is a measure of the average amount of thermal energy available in a body of water, a result of kinetic energy of water molecules. Temperature is an important parameter impacting the ecology of a water body, as it influences other water quality parameters. Temperature changes have been known to influence the metabolism and behavior of marine fauna, as well as the photosynthetic and growth rate of marina flora. As temperature increases, the dissolved oxygen holding capacity of a water body decreases and the electrical conductivity increases.

Electrical conductivity and total dissolved solids are related to the salinity of a water body. The electrical conductivity relates to the concentration of ions from inorganic matter and salts. Total dissolved solids (TDS) represent the total of dissolved material in a body of water. Salinity is the measurement of the amount of dissolved salts in a body of water which equates the water's ability to conduct electricity. The average salinity of a marine habitat is measured at 35 parts per thousand (‰). These parameters act as an indicator of any possible changes in the water quality within an aquatic environment, which may indicate signs of contamination. Therefore, affecting the development of aquatic organisms.

Turbidity is a term used to describe the passage of light through a body of water. This parameter measures the presence of suspended particles in a body of water which includes inorganic and organic matter. Its units of measurement are Nephelometric Turbidity Units (NTU). The association with turbidity and water quality aids in identifying suitable conditions for aquatic organisms to thrive. For instance, clarity within the water column allows light to penetrate algae and other primary producers that support complex food webs.

Measurements of pH provide an indication of the relative alkalinity or acidity of a sample of water. The device measures the potential difference of free Hydrogen ions (H+) and is expressed as a number between 1-14; 1-6 being acidic, 7 neutral, and 8-14 alkaline. The pH is equal to $-\log 10c$, where c is the hydrogen ion concentration in moles per liter. The pH of a body of water has a direct impact on resident biology, impacting the ability for organisms to regulate life-sustaining processes dependent on the exchange of ions with the water and respiration. The ideal pH range for aquatic organisms has been suggested as 6-9, although algae, fish and other extremophiles have been known to colonize extremely acidic and alkaline conditions where other life would not thrive. Ocean water has a pH range of 5-9, with a pH of 7 representing ideal conditions for marine life.

The oxidation reduction potential is a measure of the state of equilibrium between the oxidants and reductants that coexist in a solution, which determines its ability to release or accept electrons during chemical reactions.

Dissolved oxygen represents the amount of atmospheric oxygen dissolved throughout a body of water. The EPA water quality criteria states that the dissolved oxygen should not fall below 4.0ml due to its negative effect on aquatic organisms and mortality rate (O'Brien, 2008[2]).

7.5.1 Water Quality Discussion

The water quality readings in Table 22 show some signs of concern to the marine environment and subaquatic life within the sample area. Dissolved oxygen (DO) at all locations shows values above 4.0ml which indicates that DO is sufficient for marine life to survive. The pH readings indicate that the area may have an increase in acidity, which may negatively affect marine organisms' ability to develop calcified organic material such as shells or skeletons. Salinity readings vary within the six (6) points of collection. For instance, Point 1 has a reading of 10.05 ‰ and Point 6 has a reading of 89.45 ‰. This indicates two (2) extreme ends of the spectrum with regards to salinity. Due to their location and depth, it's likely that the reading in Point 1 reflects that of fresh/brackish water from settled fresh water on the surface. Also, the reading for Point 6 was collected in a shallow area near the sandbar, where evaporation rates are high, resulting in a concentration of salinity within this area. Surface temperatures average ~87.3°F which are common in this region.

Based on the readings, this suggests that the immediate marine environment has some suitable conditions for marine organisms within this area to sustain life. However, the anthropogenic factors affect the pH of the water which would then affect the water quality and marine organisms.

7.5.2 Freshwater Resources

Expected surface groundwater resources on and near the Project site are shown in the following figure from the US Army Corps of Engineers report[3]. The surface water is classified as scarce or lacking. This was confirmed during the ecological surveys as no surface water bodies were identified within the site boundary.

Groundwater resources below the surface was measured between 4 and 5 feet below ground at the time of drilling. The Geotechnical Investigation Report discusses the groundwater in section 3.4 on page 7 of 44 (Appendix F). The water table was measured at 6 feet at Boreholes 8 and 9 which were located at the western boundary of the site.

The main source of freshwater at the site is rainwater. The average rainfall on New Providence is higher in the wet season, which is May to October, than in the dry season, which is November to April. Figure 37 shows the average annual rainfall on New Providence. June and August average the highest showing over 200mm and January and February average the lowest showing less than 100mm. As no surface water bodies were observed on the site, precipitation percolates through the limestone to the water table which is about 4 to 5 ft below the surface and is not

[2] O'Brien, P. (2008). Interpretation guidance for marine dissolved oxygen (DO) standard. Retrieved From: http://www.dec.ny.gov/docs/water_pdf/togs116.pdf
[3] US Army Corps of Engineers. 2004. Water Resources Assessment of the Bahamas. Accessed 17 February 2022. https://www.sam.usace.army.mil/Portals/46/docs/military/engineering/docs/WRA/Bahamas/BAHAMAS1WRA.pdf

collected or stored on the site in natural waterbodies. There are wetlands immediately to the east and west of the site which likely absorbs and collects rainwater. The topographic survey shows the southeast corner of the site has a steep slope toward the coast which may indicate runoff is likely in this area. During the baseline ecological surveys this area was observed as rocky intertidal.

Figure 35. Groundwater resources on New Providence Island.

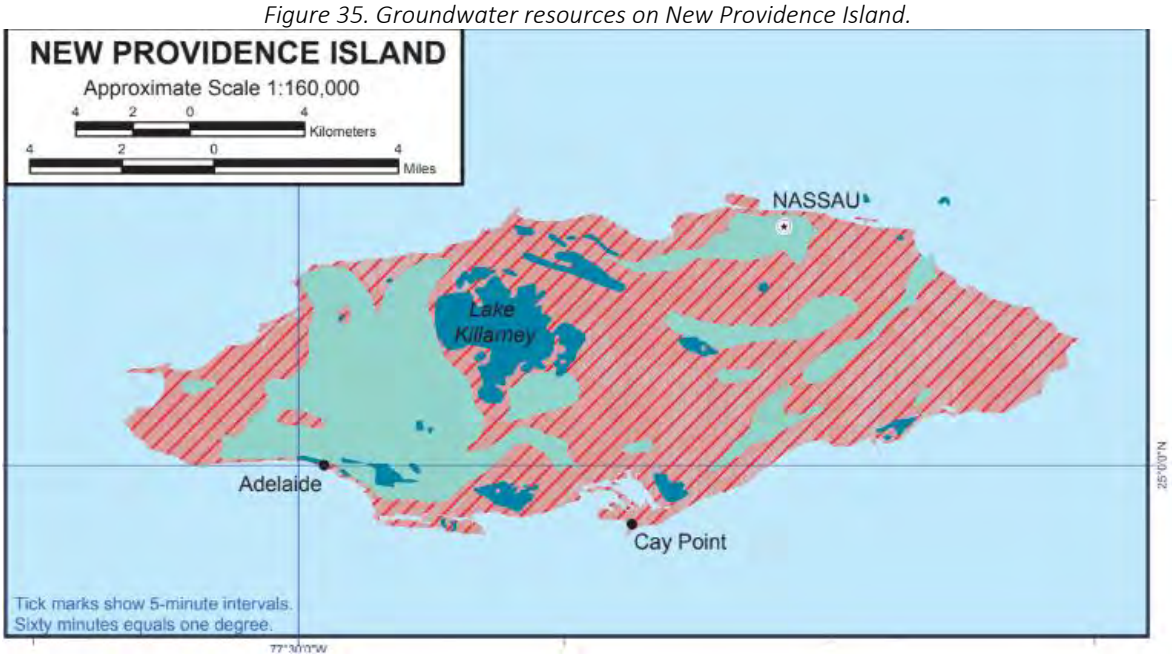


Figure 36. Legend for the above Water Resources on New Providence map.

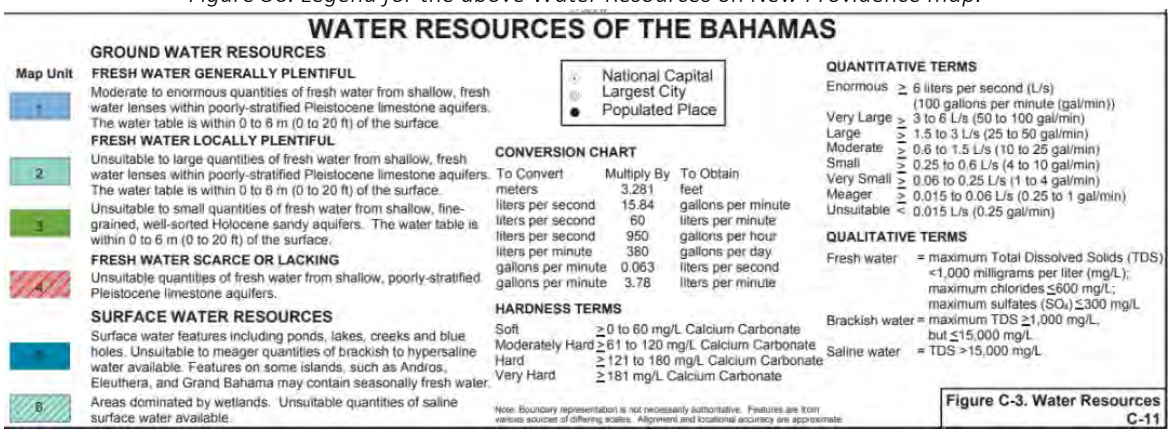
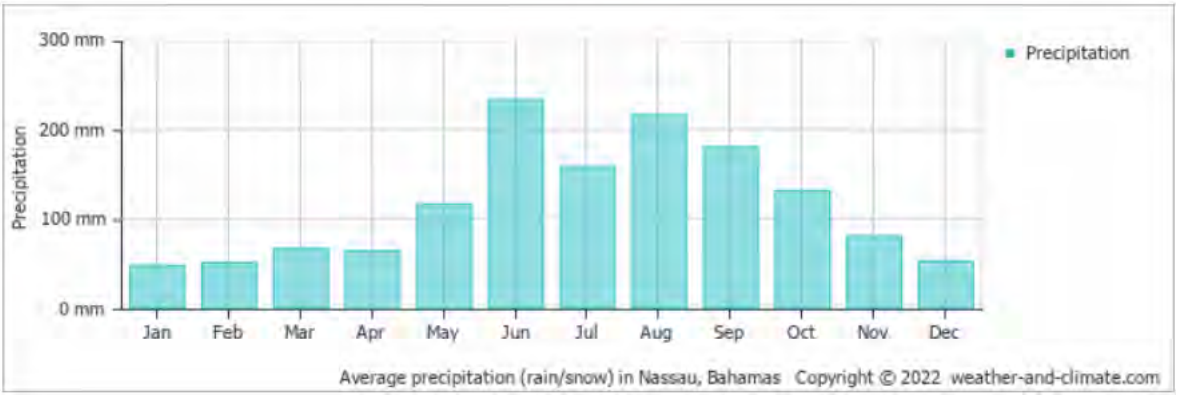


Figure 37. The mean annual rainfall on New Providence.



7.6 TERRESTRIAL RESOURCE SURVEY

7.6.1 Botanical Survey Methodology

Botanical surveys were conducted on June 16th, 24th- 25th, 2021, July 8th, 2021, and April 12th, 2022, at the proposed Project site to determine vegetation types, structure, and diversity. Walking relevé surveys were conducted to generate comprehensive botanical lists for the site and to delineate terrestrial habitats and their transition zones.

7.6.1.1 Protected Plant Surveys

Protected plant sampling was done on April 12th, 2022, to estimate protected plant density on the site. Plant sampling was done using 66ft^2 (0.1 acre) vegetation plots that were randomly placed throughout the site. All protected plants that were observed in each plot were recorded. The average of each protected plant species was calculated and then multiplied by 10 to estimate the number of protected plants per acre. Because the BWC site consisted of both terrestrial (Casuarina dominated/disturbed habitat) and coastal habitats (coastal/shrubland, intertidal wetland, Rhizophora dominated wetland and rocky shoreline), two calculations were done to estimate total protected plants in the terrestrial habitat (area =18.48 acres) and coastal wetland (area = 1.52 acres).

7.6.1.2 Vegetation Type/ Habitat Type

The Legendary Marina Resort at Blue Water Cay site is dominated by weedy and invasive plant species such as Casuarina, Brazilian Pepper, Jumbey, Jasmine Vine and Hawaiian Lettuce. The removal of these and other species can be beneficial for the native flora of the site, improving the chances for native vegetation to grow. Casuarina, although invasive, can be economically beneficial as its incredibly dense wood can be used for outdoor furniture. It can also be used as mulch, and firewood/charcoal.

Figure 38. Terrestrial Habitat Map.

Protected trees such as mangroves inhabit much of the area in the southern part of the Legendary Marina Resort at Blue Water Cay Site. The development will have a substantial impact on the mangrove ecosystem. To mitigate this, mangrove seedlings should be collected prior to clearing and replanted in locations such as Bonefish Pond National Park or other locations on the island such as South Beach.

Due to the previous development of the site and the nature of the reclaimed land, the terrestrial vegetation on the Project site is mostly dominated by invasive and weedy vegetation. The natural habitats on the site are confined to the southernmost coastline of the site, where sandy flats and intertidal zones are colonized by salt tolerant and mangrove species. The site has also been landscaped with non-native exotic botanical species which persist until the present day. The dominant substrate on the reclaimed land area is limestone, with very little organic matter accumulating in these areas. *Casuarina equisetifolia* and *Scaevola taccada* completely dominate the reclaimed peninsula terrestrial areas.

7.6.1.3 Protected Plant Survey Results

Based on the protected plant calculations in seven vegetation plots randomly distributed throughout the site (four plots in terrestrial habitat and three in coastal), it is estimated that 3,118 protected plants reside on the site. This number consists of 845 *Conacarpus erectus*, 343 *Senna chapmanii*, 228 *Rhizophora mangle*, 28 *Languncularia racemosa*, and 1674 *Avicennia germinans*.

Table 23. Botanical habitat map.

Habitat	Estimated Habitat Size (Acres)
Reclaimed Peninsula and Entrance Road	18.48
Coastal	1.52

Table 24. Botanical Species List.

Common Name	Scientific Name	Habitat[4]	Notes[5]
Casuarina	*Casuarina equisetifolia*	RP, ER	INV
Hawaiian Lettuce	*Scaevola taccada*	RP, ER, CS	INV
Bay Cedar	*Suriana maritima*	RP, CS	NAT
	Sporobolus virginicus	RP, CS	NAT
Sea Rocket	*Cakile lanceolata*	RP, CS	NAT
Button wood	*Conocarpus erectus*	RP, ER, CS	NAT, PROT
Coast Spurge	*Euphorbia mesembrianthemifolia*	RP, CS	NAT
Black Torch	*Erithalis fruticosa*	RP, CS	NAT, WFS
Sea Ox Eye Daisy	*Borrichia arborescens*	RP, CS	NAT, WFS
Red Mangrove	*Rhizophora mangle*	RP, CS, MN	NAT, PROT
Sea grape	*Coccoloba uvifera*	RP, ER, CS	NAT, ED
Obeah Bush	*Stemodium maritima*	RP, CS	NAT, BM
Pink Trumpet Tree	*Tabebuia heterophylla*	RP, ER	EXO
White Sage	*Lantana involucrata*	RP, ER	NAT, BM
West Indian Mahogany	*Swietenia mahagoni*	RP	NAT, PROT
Poison Wood	*Metopium toxiferum*	RP, ER	NAT, WFS
Narrow Leaf Blolly	*Guapira discolor*	RP, ER	NAT, PROT
Sea Purslane	*Sesuvium portulacasturm*	RP, CS	NAT, ED
Cough Bush	*Neurolaena lobata*	RP, ER	NAT, BM
Seaside Mahoe	*Thespesia populnea*	ER, CS	EXO
Jumbey	*Leucaena leucocephala*	ER	INV
Snake Plant	*Sansevieria trifasciata*	ER	INV
Brazilian Pepper	*Schinus terebinthifolius*	ER	INV
	Abutilon sp.	ER	NN
Elephant Grass	*Pennisetum purpureum*	ER	INV
Beach Pea	*Canavalia rosea*	ER, CS	NAT
Horsebush	*Gunlachia corymbosa*	ER, CS	NAT
Poincianna	*Delonix regia*	ER	EXO
Black Mangrove	*Avicennia germinans*	CS, MN	NAT, PROT
White Mangrove	*Laguncularia racemosa*	CS, MN	NAT, PROT
Saltwort	*Salicornia virginica*	MN, CS	NAT, ED
Dogwood	*Piscidia piscipula*	ER	NAT

[4] *Habitats: RP-Reclaimed Peninsula, ER-Entrance Road, CS-Coastal, MN-Mangrove Creek.*
[5] *Notes: NAT-Native, ED-Edible, PROT-Protected, EXO-Exotic, INV-Invasive, BM-Bush Medicine, WFS- Wildlife Food Source.*

7.6.2 Faunal Survey Methodology

Avian and terrestrial fauna assessments were conducted June 25thand July 8th, 2021, and April 5th, 2022, from 6:30 am- 1 p.m. BRON environmental scientists used point counts and walking transects throughout the site to determine avian and non-avian species richness. A spotting scope was used to survey birds within the rocky intertidal zone and wetland areas.

7.6.2.3 Faunal Survey Results

The Legendary Marina Resort at Blue Water Cay site supports a surprisingly high diversity of bird species. This can be attributed to the forested area within the site, the mangroves to the east and the coastal habitat along the southern and eastern perimeter of the property which provides essential habitat resources for various species of birds. Although the terrestrial habitat is dominated by invasive (Casuarina, Brazilian Pepper, Jumbey, Hawaiian Lettuce) and weedy vegetation, several species of birds listed as Species of Concern use the site for foraging, breeding, and roosting. Birds such as the Black-faced Grassquit have been observed feeding on Casuarina seeds and Bananaquits and Bahama Woodstars use the casuarina as a nest site. The alteration of this habitat during the development phase will have an impact on the site's avifauna, so proper steps should be taken to minimize these impacts. Activities that can be done to minimize the harm of birds include leaving native vegetation such as the West Indian Mahagony as a roosting site for the birds. The coastal areas around the site have many mangrove seedlings that can be removed and replanted to maintain some habitat for wetland birds. If a bird is seen nesting, especially ground nesting species such as the Antillean Nighthawk and Wilson's Plover, that area should be marked and avoided until the chicks have fledged. Wilson's Plover chicks can run away from danger within 24 hours of hatching.

Active monitoring for invasive species such as feral cats and raccoons is important to ensure the safety of birds on the site. Traps can be set up throughout the site to assist in invasive species control.

A total of thirty-two (32) species of birds were seen at the site during the survey period (Table 25). Six (6) species (Mangrove Cuckoo, White-crowned Pigeon, Wilson's Plover Ruddy Turnstone, Prairie Warbler and Cape May Warbler) are listed as species of concern by the US Fish and Wildlife Service. Two (2) species (Antillean Nighthawk and Wilson's Plover) have been observed actively nesting and raising chicks on the property. White-crowned Pigeon is listed as Near Threatened by the International Union for the Conservation of Nature (IUCN) and is one of the most important game birds in the country. Other animals observed include the Bahama Brown Anole, Sea grape Snail, a recently deceased juvenile Bahamian Boa, White-land Crabs, a species of longhorn beetle, Ox Beetle, and the endemic Bahamian Cicada (Table 26).

Table 25. Avian Species List. Asterisks indicate species of concern. All wild birds are protected under the Wild Birds Act.

Common Name	***Scientific Name***	Habitat[6]
Red- winged Blackbird	*Agelaius phoeniceus*	ER
Limpkin	*Aramus guarauna*	ER
Great Egret	*Ardea alba*	CS/MN
Ruddy Turnstone*	*Arenaria interpres*	CS
Killdeer	*Charadrius vociferus*	CS
Wilson's Plover*	*Charadrius wilsoni*	CS
Antillean Nighthawk	*Chordeiles gundlachii*	RP
Mangrove Cuckoo*	*Coccyzus minor*	ER
Bananaquit	*Coereba flaveola bahamensis*	ER/RP
Common ground Dove	*Columbina passerina*	ER/RP
Smooth-billed Ani	*Crotophaga ani*	ER/RP
Grey Catbird	*Dumetella carolinensis*	ER/RP
Common Gallinule	*Gallinula galeata*	ER
Laughing Gull	*Larus atricilla*	F
Black-faced Grassquit	*Melanospiza bicolor*	ER/RP
Northern Mockingbird	*Mimus polyglottus*	ER
Bahama Woodstar	*Nesophlox evelynae*	ER/RP
Yellow-crowned Night Heron	*Nyctanassa violacea*	ER
Osprey	*Pandion haliaetus*	CS
White-crowned Pigeon*	*Patagioenas leucocephala*	F/ER/RP
Glossy Ibis	*Plegadis falcinellus*	F
Black-bellied Plover	*Pluvialis squatarola*	CS
Ovenbird	*Seiurus aurocapilla*	ER
Prairie Warbler*	*Setophaga discolor*	ER
Cape May Warbler*	*Setophaga tigrina*	ER
American Redstart	*Setophage ruticilla*	ER
American Kestrel	*Sparverius spaveroides*	ER
Least Tern	*Sternula antillarum*	CS
Red-legged Thrush	*Turdus plumbeus*	ER
Grey Kingbird	*Tyrannus dominicensis*	ER
Thick-billed Vireo	*Vireo crassirostris*	ER
Green Heron	*Butorides virescens bahamensis*	ER/RP/CS

[6] *Habitats: RP-Reclaimed Peninsula, ER-Entrance Road, CS-Coastal, MN-Mangrove Creek, F- Flyover*

Table 26. Reptile & Other Terrestrial Wildlife.

Common Name	Scientific Name	Habitat[7]
Bahama Brown Anole	*Norops sagrei ordinatus*	RP/ER
Bahamian Boa	*Chilabothrus strigilatus strigilatus*	ER
Longhorn beetle sp.	*Elateropsis rugosus*	RP
Seagrape Snail	*Hemitrochus varians*	RP
White land Crab	*Cardisoma guanhumi*	RP
Ox-beetle	*Strategus aloeus*	RP
Bahamian Cicada	*Diceroprocta bonhotei*	RP

7.6.3 Human Altered Habitat

As stated in Section 3.2, the site of the proposed development has been altered to include infrastructure and facilities. With time, these facilities have been worn down and left in a state of disrepair. Thus, the presence of plant species such as Casuarina, Jumbey and Brazilian Pepper suggests that these species grew within this area as a result of human-altered activities, as they are known to grow in environments disturbed by humans. An estimated 90% of the proposed Project site has been impacted by previous development of the project. This is inclusive of the marina basin and the reclaimed terrestrial upland areas.

7.6.4 Caves and Blue Holes

During baseline surveys, no immediate caves or blue holes were observed within the marine or terrestrial area of interest.

7.7 Marine Resource Survey

7.7.1 Methodology

Marine habitat and species data were collected on June 11th, June 25th, July 8th, and August 18th, 2021, as well as April 5th, 2022, at the Project site. These survey dates were planned based on favorable weather conditions that allowed for clear visibility and were conducive to the safety of divers. Approximately 87.11 acres of marine habitat was surveyed inclusive of Yamacraw Lakes, existing marina basin and dredge scar, as well as the marine area south of the southern peninsula. Surveys were conducted via Manta Tow, Kayaking and Snorkeling activities. Observations were documented in photos as shown in Section 7.7.3 Observed Species. Fish species were recorded and assigned one of four abundance categories based on their species count within the area (Single = 1, Few = 2 - 11, Many = 11- 100, and Abundant = > 100).

7.7.2 Benthic Habitat Description

Located north of New Providence lies the reef slope and fringing reef system. The benthic habitat at Bluewater Cay consists of sandy bottom habitat with sand, rubble, sparse coral, and seagrass. The benthic habitat within the project site is characterized by rocky intertidal zone and sandy bottom. Several species of flora and fauna were observed in these habitats.

[7] *Habitats: RP-Reclaimed Peninsula, ER-Entrance Road, CS-Coastal, MN-Mangrove Creek, F- Flyover*

Figure 39. Depth of coral reef systems/type surrounding the island of New Providence. The project site is indicated with a red arrow.

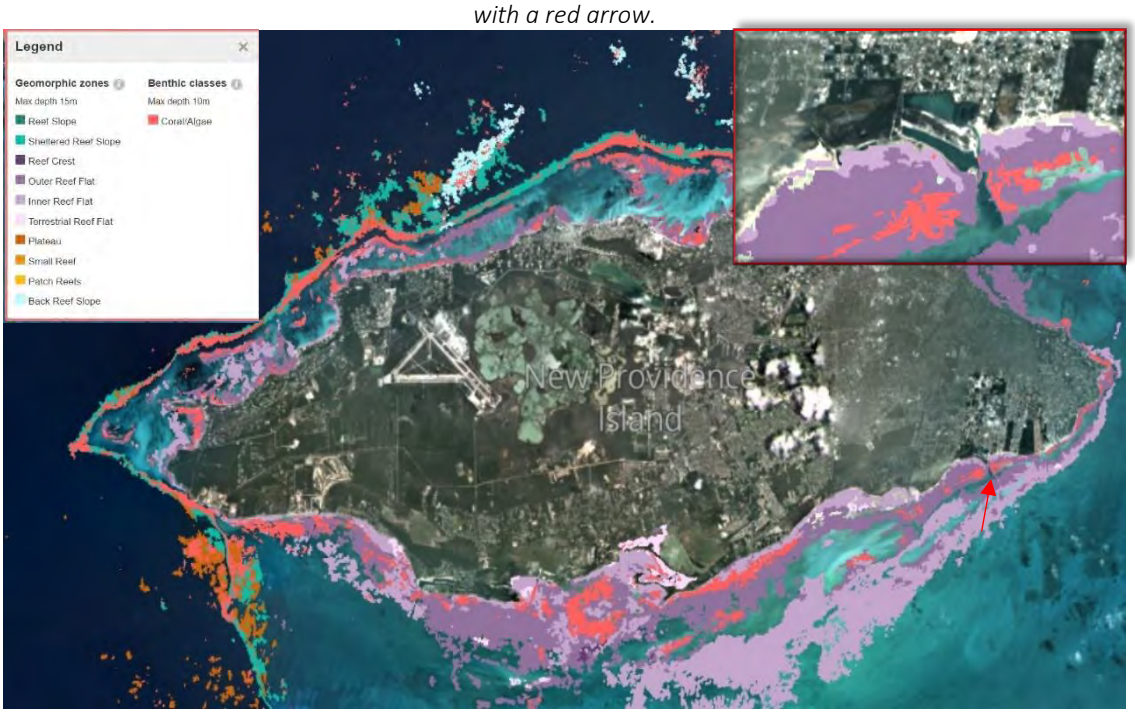
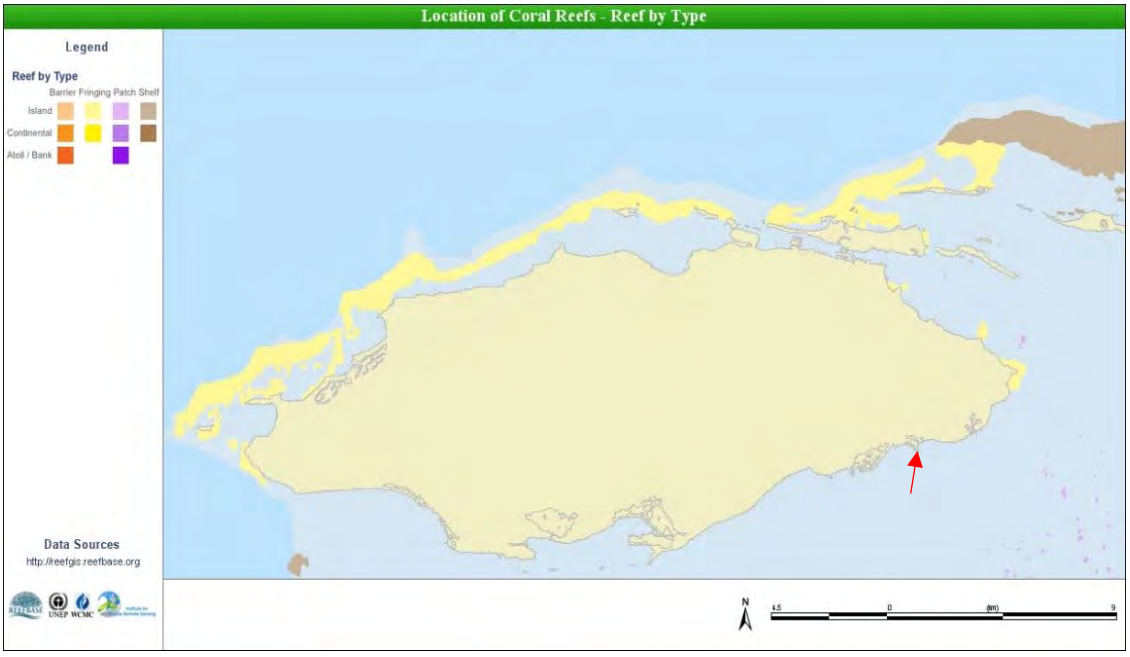


Figure 40. Reef type located north of New Providence and Paradise Island. The project site is indicated with a red arrow.



The habitat type observed throughout the Project area include the rocky intertidal zone, sandy bottom, seagrass, hard bottom, coral rubble. Also, the habitat type nearest the shoreline was previously impacted by the existing dredge scar.

The marine habitat map is a visual representation of the different marine ecosystems within the area and an estimate of the total habitat size. There was a large amount of algal growth on the bottom of the canals. Additionally, there were various species of soft and hard coral scattered throughout the entrance channel area, along with very sparse seagrass and mostly sandy bottom habitat. Sparse seagrass was observed throughout the southernmost canal (marina basin). The rocky intertidal zone / hard bottom housed a variety of marine biodiversity which are listed below in Tables 28-31. The habitat map below also helps in visualizing where the marine organisms are located as the species list mentions their observed habitats.

Figure 41. Marine Habitat Map

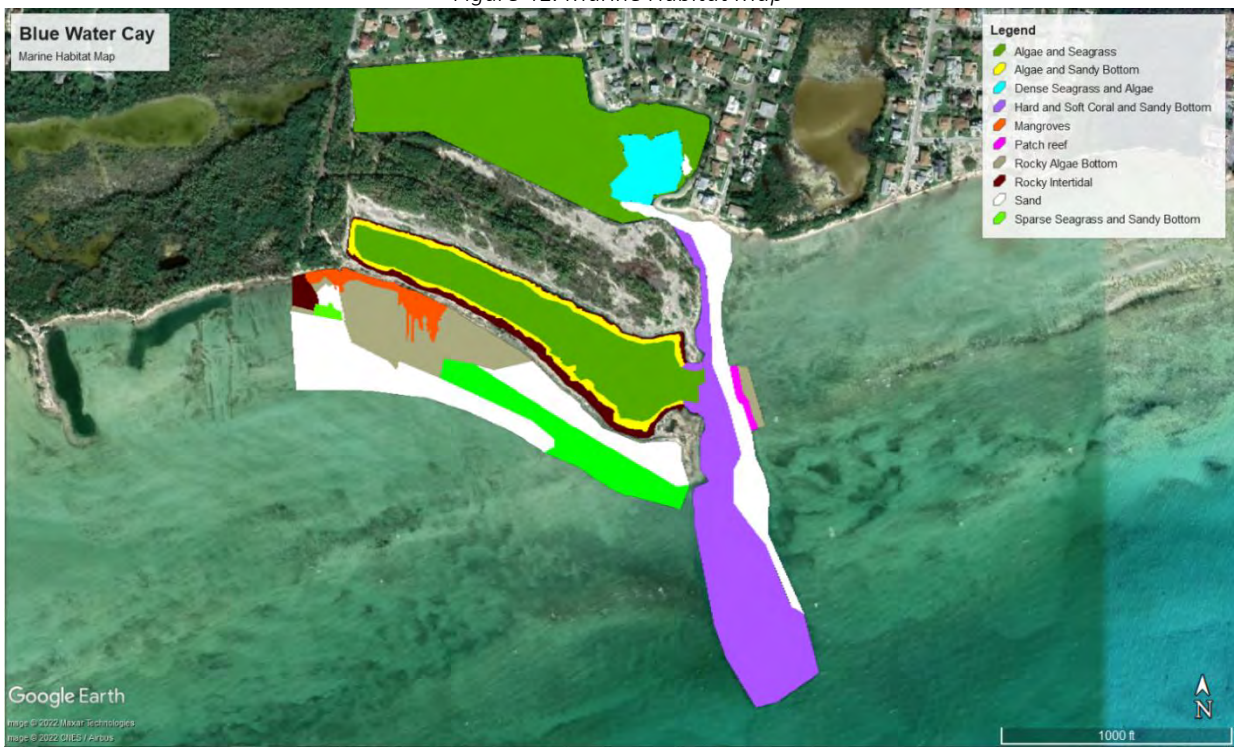


Table 27. Marine habitat acreage.

Habitat	Estimated Habitat (Acres)
Algae and Sandy Bottom	1.83
Algae and Sparse Seagrass	19.87
Dense Seagrass and Algae	1.71
Hard and Soft Coral and Sandy Bottom	9
Mangroves	1
Patch Reef	0.73

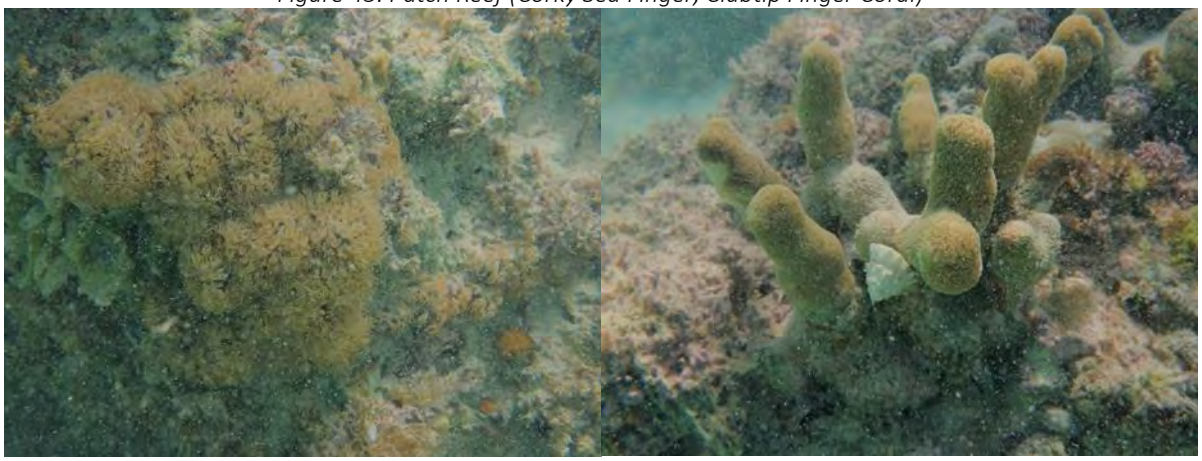
Rocky Algae Bottom	4.18
Rocky Intertidal	1.84
Sand	9.89
Sparse Seagrass and Sandy	3.34

Figure 42. Sandy Bottom.

Figure 43. Rocky Intertidal Zone/ Rock Ledge.

Figure 44. Seagrass habitat (turtle and manatee seagrass).

Figure 45. Patch Reef (Corky Sea Finger, Clubtip Finger Coral)



7.7.3 Observed Species

Locals reported frequent dolphin, stingrays, and turtle sightings within the area of interest. Turtles were observed during the June 2021 survey. Species observed during the surveys are listed in the following tables.

Table 28. Marine Vertebrates Species.

Common Name	Scientific Name	Abundance [8]	Habitat
Yellowfin Mojarra	*Gerres cinereus*	Many	Rocky Intertidal
Sergeant Major	*Abudefduf saxatilis*	Few	Rocky Intertidal/Patch Reef
Yellowtail Damselfish	*Microspathodon chrysurus*	Few	Rocky Intertidal/Hard Bottom
Slippery Dick	*Halichoeres bivittatus*	Few	Hard Bottom/Patch Reef
Princess Parrotfish	*Scarus taeniopterus*	Few	Hard Bottom
Bluehead Wrasse	*Thalassoma bifasciatum*	Few	Hard Bottom
Blue Tang	*Acanthurus coeruleus*	Few	Patch Reef
Great Barracuda (juvenile)[9]*	*Sphyraena barracuda*	Few	Sandy Bottom
Gray Snapper*	*Lutjanus griseus*	Many	Sandy Bottom
Bluestriped Grunt*	*Haemulon sciurus*	Many	Hard Bottom
Atlantic Spadefish	*Chaetodipterus faber*	Many	Artificial Habitat (car)
Nassau Grouper*	*Epinephelus striatus*	Few	Hard Bottom
Atlantic silversides	*Menidia menidia*	Abundant	Surface
Bar Jack*	*Carangoides ruber*	Many	Open Water

[8] *Marine species were recorded during the survey and assigned one of four abundance categories based on their species count within the area (Single = 1, Few = 2 - 11, Many = 11- 100, and Abundant = > 100).*

[9] **** Commercially Important Species.***

Beaugregory Damselfish	*Stegastes leucostictus*	Many	Sandy Bottom/Patch Reef
Checkered Pufferfish	*Sphoeroides testudineus*	Few	Sandy Bottom
Schoolmaster Snapper*	*Lutjanus apodus*	Few	Hard Bottom/Patch Reef
Princess Parrotfish	*Scarus taeniopterus*	Few	Hard Bottom
French Grunt	*Haemulon flavolineatum*	Few	Hard Bottom
Four Eyed Butterflyfish	*Chaetodon capistratus*	Few	Hard Bottom
Blue Parrotfish	*Scarus coeruleus*	Few	Hard Bottom
Stripped Parrotfish	*Scarus iserti*	Few	Hard Bottom
Red Snapper	*Lutjanus campechanus*	Few	Artificial Habitat (car)
French Angelfish	*Pomacanthus paru*	Many	Artificial Habitat (car)
Silver Jenny	*Eucinostomus gula*	Few	Hard Bottom
Southern Stingray	*Dasyatis americana*	Few	Sandy Bottom
Spotted Eagle Ray	*Aetobatus narinari*	Few	Sandy Bottom
Mottled Mojarra	*Eucinostomus lefroyi*	Few	Rocky Intertidal / Hard Bottom
Yellowfin Mojarra	*Gerres cinereus*	Few	Sand
Longfin Damselfish	*Stegastes diencaeus*	Few	Hard Bottom
Green Turtle*	*Chelonia mydas*	Few	Open Water

Table 29. Coral Species.

Common Name	Scientific Name	Habitat
Mustard Hill Coral	*Porites astreoides*	Hard Bottom, Hard and Soft Coral and Sandy Bottom
Ten Ray Star Coral	*Madracis decactis*	Hard Bottom, Hard and Soft Coral and Sandy Bottom
Lesser Starlet Coral	*Siderastrea radians*	Hard Bottom, Hard and Soft Coral and Sandy Bottom/Patch Reef/Rocky Intertidal
Golfball Coral	*Favia fragum*	Hard Bottom, Hard and Soft Coral and Sandy Bottom/Patch Reef/Rocky Intertidal
Clubtip Finger Coral	*Porites porites*	Hard Bottom/Patch Reef
	Colpophyllia natans	Hard Bottom, Hard and Soft Coral and Sandy Bottom
Rose Coral	*Manicina areolata*	Hard Bottom, Hard and Soft Coral and Sandy Bottom/Patch Reef
Black Sea Rod	*Plexaurella homomalla*	Hard and Soft Coral and Sandy Bottom
Sea Plume	*Antillogorgia bipinnata*	Hard and Soft Coral and Sandy Bottom

Corky Sea Finger	*Briareum asbestinum*	Patch Reef

Table 30. Marine invertebrate species.

Common Name	Scientific Name	Habitat
Giant Anemone	*Condylactis gigantea*	Hard Bottom
Stinker Sponge	*Ircinia felix*	Hard Bottom/Patch Reef
Yellow Tube Sponge	*Aplysina fistularis*	Hard Bottom
Brown Tube Sponge	*Agelas conifera*	Hard Bottom
Black Ball Sponge	*Ircinia strobilina*	Hard Bottom
True Tulip	*Fasciolaria tulipa*	Rock Intertidal/Patch Reef
Cassiopeia	*Cassiopea xamachana*	Sandy Bottom
Bivalve Mollusk (A)	*Agelas conifera*	Rocky Intertidal
Fuzzy Chiton	*Acanthopleura granulata*	Rocky Intertidal
Mangrove Tunicate	*Ecteinascidia turbinata*	Hard Bottom
Furry Sea Cucumber	*Astichopus multifidus*	Hard Bottom
Inflated Sea Biscuit	*Clypeaster rosaceu*	Sandy Bottom
Brown Sea Anemone	*Fasciolaria tulipa*	Patch Reef/Rocky Algae Bottom
Cushion Star	*Oreaster reticulatus*	Sandy Bottom/Sparse Seagrass and Sandy Bottom
West Indian Star Snail	*Lithopoma tectum*	Patch Reef

Table 31. Algal Species.

Common Name	Scientific Name	Habitat
Flat Top Bristle Brush	*Penicillus Pyriformis*	Rocky Intertidal / Hard Bottom/Patch Reef/Rocky Algae Bottom
White Scroll Algae	*Padina jamaicensis*	Patch Reef
Sargassum	*Sargassum fluitans*	Patch Reef
Fuzzy Tip	*Batophora oerstedii*	Hard Bottom/Rocky Algae Bottom/Patch Reef/ Algae and Seagrass
Green Bubble Weed	*Dictyosphaeria cavernosa*	Rocky Intertidal / Hard Bottom
White Mermaid's Wine Glass	*Acetabularia crenulata*	Hard Bottom/Patch Reef
Green Feather Algae	*Caulerpa sertularioides*	Sandy Bottom
Manatee Grass*	*Syringodium filiforme*	Dense Seagrass/Sparse Seagrass and Sandy Bottom/Algae and Seagrass
Turtle Grass*	*Thalassia testudinum*	Dense Seagrass/Sparse Seagrass and Sandy Bottom/Algae and Seagrass

7.7.4 Species of Economic & Cultural Importance

7.7.4.1 Terrestrial

Mahogany is a valuable hardwood known for furniture making and crafts. It is also known in Bahamian cultural for medicinal use. Local market value for this protected species is at approximately $225 /30 GAL[10]. Sea Grape is a culturally significant fruit commonly harvested by Bahamians. This sweet fruit is known to be consumed once in season. The Narrow Leaf Blolly is a known food source for birds (i.e., White Crowned Pigeon). Its red fruit attracts native and migrant birds which contribute to biodiversity. Its international value is an estimated $1,500/100 GAL[11].

Mangroves provide an intrinsic value by contributing to ecosystem services such as shoreline stabilization and shore protection, carbon sequestration and natural ability to filter pollutants, particularly phosphates and nitrates, fishing and providing nursery habitat for juvenile marine species. Its value cannot yet be determined. The economic value of mangroves is difficult to quantify and depends on the type of goods and services considered as well as the method of valuation[12].

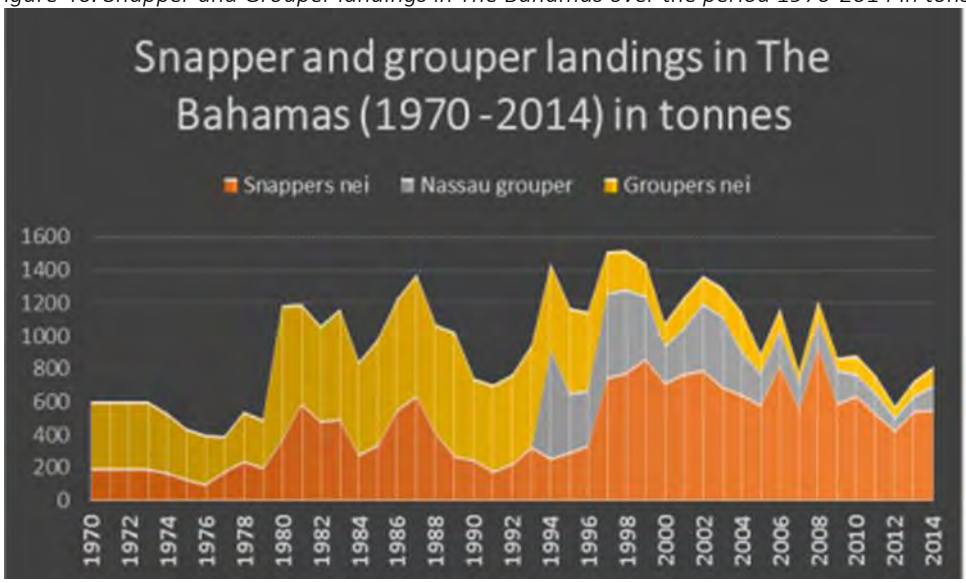
7.7.4.2 Marine

Various commercially important fisheries resources were observed during the marine surveys. These identified species have been proven to provide cultural and economic importance to Bahamians. Culturally, species such as Nassau Grouper, Snappers and Grunts are incorporated in native dishes and are a staple in the Bahamian community. Food is an essential part of Bahamian culture, as Bahamians are historically known to have derive food resources from the sea. It has been an integral part of their way of life for generations.

Economically, fisheries products contribute an estimated 1% to The Bahamas' Gross Domestic Product (GDP)[13]. In 1997, the total export value of Snappers, Grunts, Nassau Groupers and Jacks were an estimated $1,565,370[14]. In 2015, the fisheries export product accounted for an estimated 31% of the domestic exports of The Bahamas. It was noted that over the years, trends in fisheries export decreased in both weight (lbs.) and value. Scaled fish export quantity and value in 2015 were an estimated 143,372lbs. at $340,692.27. Future export quantity and value in 2021 were an estimated 28,670lbs. at $25,600[15]. Thus, illustrating possible prohibiting factors such as increase fisheries regulations and/or environmental changes.

[10] https://www.wilcoxnursery.com/store/Mahogany-p189118523
[11] https://www.treeworldwholesale.com/thank-you/
[12]https://www.iucn.org/news/forests/201704/what-are-mangroves-worth-there%E2%80%99s-no-easy-answer#:~:text=Mangrove%20ecosystems%20in%20particular%20provide,spiritual%20space%20(cultural%20services).
[13] *Department of Statistics. (2016). The Bahamas National Accounts Report 2015, Nassau.*
[14] *Department of Marine Resources and Food and Aquaculture Organization of the United Nations. (2016). Fisheries and aquaculture in The Bahamas: A review.*
[15] *Department of Marine Resources.*

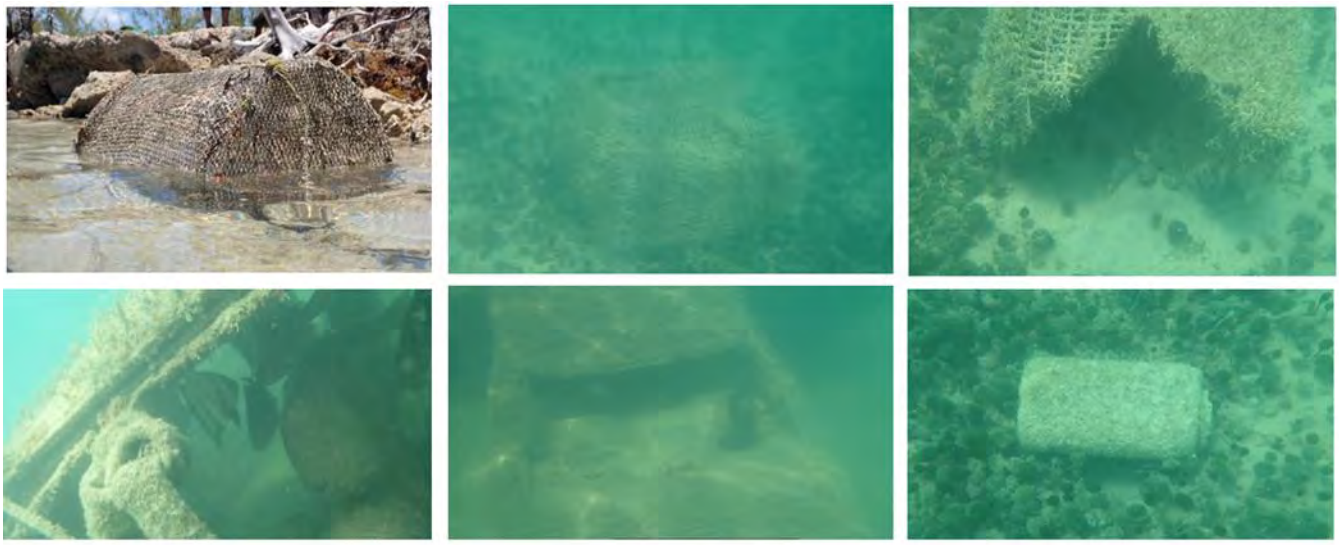
Figure 46. Snapper and Grouper landings in The Bahamas over the period 1970-2014 in tons.



7.7.5 Human Influence

The Project site (northern peninsula) has previously been cleared and the canals have previously been dredged for boats within the area. Other than the physical changes to this environment there is human influence seen in the garbage and fishing equipment found within the canals. During the marine surveys there were a number of debris seen, suggesting that this site might be used for dumping in certain area in particular where a whole car was found. During the marine survey, residents expressed concerns pertaining to the current land use of the area by neighbors who were discarding various forms of waste within the marine area inclusive of dog feces. Additionally, there were a number of fishing cages found and also fishing line and ropes. This shows that people use this site as a fishing ground which would affect the fish population of the area.

Figure 47. Example of Human Influence: Fishing Cages, Car, Garbage



7.8 Habitat Utilization and Food Sources for Native Fauna

7.8.1 Terrestrial

Shorebirds and sea birds forage along the shore and waters around the northern peninsula. Nectivorous, granivorous, and omnivorous birds have been observed foraging on flowers, fruits, and arthropods on the site. Black-faced Grassquits have been observed feeding on the fruits of the invasive casuarina trees. Bananaquits, Antillean Nighthawks, Wilson's Plovers, and Least Terns have been observed nesting and raising chicks on the grounds.

7.8.2 Marine

Within the marine environment there is a large amount of seagrass within the inner northern canal where sea turtles can be found entering and existing. Mollusks and bivalves were observed, along with a Southern Stingray which would suggest that they may feed within the area. Additionally, Parrotfish were observed within the area near patches of coral that were scattered throughout the site. Patch reefs are an important ecosystem for many commercial fish which includes supporting marine biodiversity. Patch reefs are composed of many different species of coral which allow for such a beneficial ecosystem. Many of the marine species found use the patch reef as a home or a source of food. Furthermore, patch reefs are used for breeding purposes, which include reproduction and nursery.

As it pertains to habitat utilization, there were a number of Beaugregories found along the edges of the canal within the cracks of the rock protecting their territory. There was a car found where a group of Atlantic Spadefish and a Gray Angelfish that seemed to use this car as shelter.

7.9 Protected and Threatened Species

7.9.1 Terrestrial

All Wild birds are protected under the Wild Birds Act. Avian species of concern include the White-Crowned Pigeon (*Patagioenas leucocephala*) which is listed as Near Threatened by the IUCN, Wilson's Plover (*Charadrius wilsoni*), Ruddy Turnstone (*Arenaria interpres*), Mangrove Cuckoo (*Coccyzus minor*), Cape May Warbler, (*Setophaga tigrina*) and Prairie Warbler (*Setophaga discolor*).

Protected plant species observed on site included Narrow Leaf Blolly (*Guapira discolor*), West Indian Mahogany *(Swietenia mahagoni)* and Mangroves [Red *(Rhizophora mangle)*, White (*Laguncularia racemosa*), Black (*Avicennia germinans*) and Buttonwood (*Conocarpus erectus*)] which are all included in the 2021 Declaration of Protected Trees Order.

Mahogany is an endangered species on New Providence due to the encroachment on natural areas such as broadleaf coppice forest. This species has also been harvested for its hardwood and is rarely available in the coppice habitats on the island.

Narrow Leaf Blolly is used as a food source for migratory and native bird species. It is listed as Least Concerned in the 2018 IUCN Red List due to a stable population.

Mangroves act as a carbon sink, provide habitat for avian and marine species. The IUCN status for mangroves are listed as Least concern due to stable population.

7.9.2 Marine

The Green Turtle (*Chelonia mydas*) and Nassau Grouper (*Epinelphus striatus*) are protected marine species in The Bahamas. The Nassau Grouper (*Epinephelus striatus*) is a commercially important marine species in The Bahamas. Nassau Grouper spawning occurs from December to the end of February annually. According to the IUCN[16], this species is considered critically engendered due to overfishing (Sadovy et al., 2018). The Green Turtle (*Chelonia mydas*) has been listed as endangered on the IUCN red list due to population decline as a result of loss of nesting and foraging habitats[17].

As of February 16th, 2021, Seagrass (Turtle Grass and Manatee Grass) were listed as a protected species in the 'Forestry (Declaration of Protected Trees) Order, 2021'. This signifies the cultural and economic importance of this habitat as it aids in increasing biodiversity, functions as a primary producer/of food source and provides habitat for commercially important fisheries species.

[16] *Sadovy, Y., Aguilar-Perera, A. & Sosa-Cordero, E. 2018. Epinephelus striatus. The IUCN Red List of Threatened Species 2018: http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T7862A46909843.en.*

[17] *Seminoff, J.A. (Southwest Fisheries Science Center, U.S.). 2004. Chelonia mydas. The IUCN Red List of Threatened Species 2004: e.T4615A11037468. https://dx.doi.org/10.2305/IUCN.UK.2004.RLTS.T4615A11037468.en. Accessed on 20 April 2022.*

7.10 Invasive Species

Invasive species were not identified in the marine environment and invasive terrestrial fauna was observed on site. The invasive flora observed on site include the Casuarina, Hawaiian Lettuce, and Brazillian Pepper. Casuarina is a highly invasive plant whose root structure causes sand erosion and whose leaves and stems from thick mats on the ground, preventing other plants from growing. However, birds use the tree for nesting and foraging (Black-faced Grassquits have been observed feeding on the fruit.). Brazilian Pepper is another invasive species whose sap is toxic and can cause mild to moderate dermatitis. Its small, red fruit is highly attractive to birds which assist in its dispersal. Like the Casuarina, Brazilian Pepper form dense monocultures that prevent other plant species from growing. Both the Casuarina and Brazillian Pepper should be removed and replaced with native fruit trees such as Gum elemi (*Bursera simaruba*), a hardy, hurricane resilient plant that is native and produces fruits for birds to consume.

Figure 48. Casuarina

Figure 49. Hawaiian Lettuce.

Figure 50. Brazillian Pepper.

7.11 Aesthetics

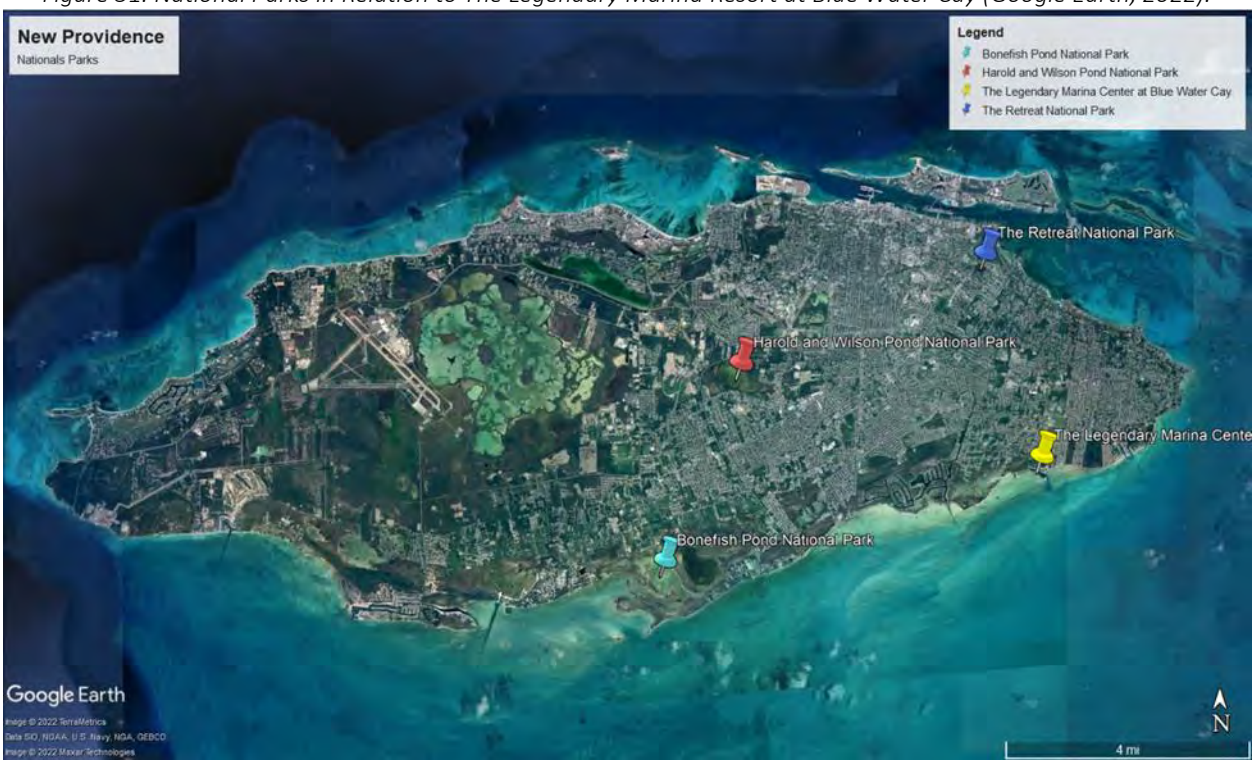
To date, the aesthetics of the proposed Project site is in poor condition. Existing facilities and building structures are in a state of disrepair. Additionally, the site consists of overgrown invasive vegetation. A sunken vessel and vehicle rest within the marine habitat near the northern peninsula, as well as other forms of debris within the marine and terrestrial areas. The existing retaining wall is dilapidated in some areas. Overall, leaving the site with an unattractive aesthetic.

7.12 Protected Areas

There are no protected areas within the immediate vicinity of the Project site, the nearest protected area being The Retreat which is 3.13 miles away. The Retreat is an important protected area because it is a sanctuary for wildlife such as birds and reptiles and acts as a hub for the Bahamas National Trust where many educational workshops and outreach programs occur. The Harold and Wilson Pond is the second closest national, park which is centrally located, is 3.72 miles from the Project Site. Harold and Wilson Pond is an inland wetland system which is an important ecosystem to wetland birds and is a valuable freshwater system. Other than The Retreat and Harold and Wilson Pond, there is also Bonefish National Park which is also on the Southern side of the island and is 5.36 miles away. Bonefish National Park is an important

protected area because it is the only marine/coastal protected island in New Providence which is home to a very large wetland systems with all species of mangroves which are protected trees.

Figure 51. National Parks in Relation to The Legendary Marina Resort at Blue Water Cay (Google Earth, 2022).



7.13 Socio-economic Aspect

7.13.1 Human Uses of Biodiversity

The current site is used by locals and those that visit for recreation, fishing, and dumping. During a site visit, children were observed swimming within the area and dogs walking out onto the sand flats. During the marine survey there were multiple fishing traps found and fishing line and ropes which suggest that people fish within this area. Speaking to those who are familiar with the site as well it was expressed that this site is commonly used as a fishing ground. There was garbage found both on land and in the water, and even an abandoned submerged car which would suggest people use the area as a dumping ground as well.

7.13.2 Population/Demographics

The Project site is found at the back of the residential community of Yamacraw. During the 2010 census it was recorded that the population of the Yamacraw constituency was 7,716 people with a total of 2,305 households within the community. The population was fairly even between men and women that lied in the area with 3,573 men and 4,143 women.

7.14 Cultural Resources

7.14.1 Historical Overview

The Eastern District of New Providence is filled with rich cultural history. Specifically, the Fox Hill and Sandilands communities. The Fox Hill community is named after Samuel Fox, a freed slave that owned pieces of land in the Eastern District. He was granted approximately 23.5 acres of land in the year 1801. Thus, giving the community in its vicinity the aforementioned “Fox Hill” name. Fox’s estate is on the present site of St. Augustine’s Monastery. This community included people of African descent. Mostly, Congo, Yoruba and Nango Tribes created villages in this area. Also, pineapple farming was a popular crop grown in this community.

Another village in the Eastern District of New Providence was established by judge Robert Sandilands. He mortgaged portions of land to the industrious and laboring class. In order to facilitate commerce and transportation, Sandilands created a major throughfare from his community connecting the Eastern Road and through Village Road. This road was needed to transport wood and other materials.

Within the 1700’s, the northeastern district of New Providence was used as a port of defense from an American invasion. At Fort Montague, warning shots were fired to scatter enemy American invaders that sought refuge in the Fox Hill Creek area (approximately 2 miles northeast of Fort Montague).

7.14.2 Historical, Archaeological and Paleontological Resources

There are no known or observed archaeological, historical, or religious resources onsite. However, it is recommended that the Antiquities, Monuments and Museums Corporation (AMMC) of The Bahamas be notified immediately if cultural resources are discovered during construction or operation.

7.14.3 Tourist and Recreational Areas

The proposed Project site is currently used by locals for various recreational activities. This includes swimming, fishing, and onloading and access to the sea for personal small vessels. A local baseball park known as Freedom Farm is located approximately 0.48miles north of the site. Local youth and baseball enthusiasts use the park to develop their skills and enjoy the sport. Also, Palm Cay Marina is located approximately 2.21 miles east of the site. It is a tourist destination which offers a marina, beach club/restaurant and long-term housing.

7.15 Transportation

Currently, Fox Hill Road is the only road that provides access to the Project site. This is a major thoroughfare that connects to Yamacraw Hill Road (east) and Joe Farrington Road (west), it then intersects another major thoroughfare known as Prince Charles Drive. Fox Hill Road continues approximately 2.58 miles north to the Eastern Road located in the northeastern district in New Providence. Also, the site can be accessed via the existing dredged entrance channel south of the northern peninsula and via Yamacraw Lake (north of the northern peninsula).

8. ENVIRONMENTAL REGULATORY BODIES AND LAWS

8.1 RELEVANT REGULATORY BODIES

Office of the Prime Minister - Office of the Prime Minister coordinates ministries, government, and parliamentary business. Specific related departments and agencies are listed below.

Department of Lands and Surveys - This department is responsible for planning, mapping, and monitoring of crown land (i.e., where beaches begin and end, high water marks, etc.).

National Emergency Management Agency (NEMA) - NEMA aims to reduce life and property loss in the event of a natural disaster.

Antiquities Monuments and Museum Corporation (AMMC) - The mission of AMMC is "to protect, preserve, and promote the Historic Cultural Resources of The Bahamas, and to be the number one conservation Agency in the world. We will do this while protecting our environment, encouraging research and archaeology, and by protecting, preserving, and promoting our Historical Sites."

Ministry of Agriculture, Marine Resources and Family Island Affairs - The Ministry of Agriculture Marine Resources and Local Government is responsible for the implementation, monitoring and evaluation of policies related to agricultural lands and marine resources. The Ministry serves as the Management and Scientific Authority for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in The Bahamas.

Department of Marine Resources (DMR) - DMR is primarily responsible for the administration, management, and development of fisheries in The Bahamas. The department was created to administer, manage, and develop the fisheries sector as stipulated by the Fisheries Resources (Jurisdiction and Conservation) Act. The department is also tasked with enforcement of Fisheries Regulations, Marine Mammal Regulations and the Seafood Processing and Inspection Regulations.

Ministry of Public Works and Utilities - The Ministry of Public Works maintains the physical infrastructure and natural environment of The Bahamas by providing quality services to its client agencies.

Department of Public Works - The Department of Public Works maintains public infrastructure inclusive of government buildings, roads, docks, bridges, and cemeteries.

Department of Physical Planning - The Department of Physical Planning manages town, physical, country and land use planning, zoning, private roads and subdivisions for New Providence and the Family Islands.

Water and Sewerage Corporation - The Water and Sewerage Corporation is entrusted with managing, maintaining, distributing, and developing the water resources of The Bahamas.

Ministry of Environment and Natural Resources - The Ministry of Environment and Natural Resources serves to protect, conserve, and manage the environment of The Bahamas. This ministry focuses on environmental control, solid waste management, public sanitation, and the beautification of public areas such as parks and beaches.

Department of Environmental Planning & Protection (DEPP) - The functions of the Department are to provide for and ensure the integrated protection of the environment of The Bahamas and ensure the sustainable management of its natural resources." DEPP is responsible for the evaluation of EIAs and EMPs and managing international environmental conventions.

Department of Environmental Health Services (DEHS) - DEHS manages the disposal of all wastes and management of environmental pollution (on land or in water). This department also promotes planning and approves various measures designed to ensure wise use of the environment.

Forestry Unit - The Forestry Unit's mandate is "to develop the forest resources of The Bahamas to their maximum potential by applying sound, scientific and sustained yield forest management principles and concepts."

Bahamas National Trust (BNT) - The mission of the BNT is "Conserving and protecting the natural resources of The Bahamas, through stewardship and education, for present and future generations."

Ministry of Labour - The Ministry of Labour oversees and regulates labour relations within The Bahamas.

Department of Labour - The Mission of the Department of Labour promotes good industrial relations between employer and employee, while promoting a high level of employment.

8.2 National Laws and Regulations

Agriculture and Fisheries Act, 1964 - "An Act to provide for the supervision and development of agriculture and fisheries in The Bahamas," where Section 4 explains that "The Minister may make rules for all or any of the following purposes, (a) to define area hereinafter called 'protected areas' within which it shall be unlawful for any person except a licensee especially licensed in that behalf to plant, propagate, take, uproot or destroy any species of plant…".

Antiquities, Monuments and Museum Act, 1998 (Ch. 51) - "An Act to provide for the preservation, conservation, restoration, documentation, study and presentation of sites and objects of historical, anthropological, archaeological and paleontological interest, to establish a National Museum, and for matters ancillary thereto or connected therewith", where, section 3 speaks to the declaration of a monument by reason of its historical, anthropological, archaeological or paleontological significance.

Bahamas National Wetlands Policy[18] – see Ramsar Convention.

Bahamas Public Parks and Public Beaches Authority Act, 2014 – An Act to establish the public parks and public beaches authority, to provide for the property rights and liabilities of the public parks and public beaches authority and to identify, regulate, maintain, develop and conserve public parks and public beaches and for connected purposes." Where section 5 speaks to functions of the Authority.

Buildings Regulation, 1971 (Ch. 200) - "An Act to regulate the construction, alteration and repair of buildings, to provide for the re- instatement or removal of dangerous or dilapidated buildings, to authorize the publication of a building code and for purposes connected therewith." Where, Section 2. (c) speaks to the interpretation of 'building' including "any dock, bulkhead, pier and any works for the protection of land against encroachment by, or for the recovery of land from, fresh or salt water;" and Section 17 speaks to the Building Code.

Buildings Regulation (General) Rules, 1971 - (further to Section 19 of Ch. 200) and Section 9 speaks to the execution of permitted works.

Coast Protection Act, 1968 (Ch. 204) - "An Act to make provision for the protection of the coast against erosion and encroachment by the sea and for purposes connected therewith", where section 8 speaks to approval for coastal protection work and section 9 speaks to the excavation of materials that compose of the seashore.

Conservation and Protection of the Physical Landscape of The Bahamas Act, 1997 (Ch. 260) - "An Act to make provision for the conservation and protection of the physical landscape of The Bahamas. The Act contains parts regarding administration, regulation of excavation and landfill operations, provisions governing dangerous excavations, landfill operations, quarries or mines, zoning of The Bahamas for the purposes of quarrying and mining operations, protected trees, and general entries", where Section 27 speaks to applications, permits and licenses, appeals, fees, offences, and penalties.

Disaster Preparedness and Response Act, 2006 (Ch. 34A) - "An Act to provide for a more effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters." This Act contains parts regarding Director of NEMA, Advisory Committee, policy review and plan; emergency operation centers and shelters; obligations of other public officers; specifically, vulnerable areas; disaster alerts and emergencies; and miscellaneous entries.

Environmental Health Service Act, 1987 (Ch. 232)- "An Act to promote the conservation and maintenance of the environment in the interest of health, for proper sanitation in matters of food and drinks and generally, for the provision and control of services, activities and other matters

[18] *http://www.best.gov.bs/Documents/Bahamas_national_wetlands_policy.pdf*

connected therewith or incidental thereto", where section 5 speaks to functions of the Department of Environmental Health.

Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004 (Ch. 232) - "These Regulations may be cited as the Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004", where section 18 speaks to removal of construction waste and section 19 speaks to industrial waste disposal.

Environmental Impact Assessment Regulations, 2020 – An extension of the Environmental Planning and Protection Act that outlines the Environmental Impact Assessment Regulations which apply throughout the territory of The Bahamas including every island and cay; "The Minister, in exercise of the powers conferred by section 12 of the Environmental Planning and Protection Act, 2019 (No. 40 of 2019)".

Environmental Planning and Protection, 2019 – An Act to establish the department of environmental planning and protection; to provide for the prevention or control of pollution, the regulation of activities, and the administration, conservation, and sustainable use of the environment; and for connected purposes.

Forestry Act, 2010 – An Act to provide the conservation and control of forests and for matter related thereto.

Forestry (Declaration of Protected Trees) Order, 2021 – The declaration of protected trees for the purpose of this Act are specified in Part I (Endemic or Endangered or Threatened Protected Trees) and II (Cultural or Historical and Economic Protected Trees).

Forestry (Amendment) Regulations, 2021 – "The Minister, in excise of the powers conferred by section 34 of the Forestry Act, 2010, makes the following Regulations." Where the amendment speaks to Regulation 36 subsection 3A "The Minister, acting on the advice of the Director of Forestry, may where a hurricane, tornado, or any other natural disaster has occurred in any island, islet or cay throughout The Bahamas which causes grave damage to any forest, forest estate, forest reserve, conservation forest or protected forest to be payable as specified in the Second Schedule, for royalties, permits and licenses for the purpose of these regulations."

Forestry Regulations, 2014 – "5. Application for Permit to harvest protected tree. An application for the grant of a permit under section 12 of the Act to harvest a protected tree, shall be made to the Director and shall contain all the relevant particulars set out in Form No. 3 (A) in the First Schedule including the payment of the prescribed fee as set out in the Second Schedule." and

"6. Permit to harvest protected tree. A permit granted under section 11 of the Act to harvest a protected tree shall be made in the manner set out in Form No. 3 (B) in the First Schedule, shall be accompanied by the payment of the prescribed fee as specified in the Second Schedule and shall be valid for six months from the date of the grant unless otherwise prescribed in the permit."

and

"Construction or modification of road in a forest estate. A person shall not construct or modify a road or trail in a forest estate unless the construction or modification has been authorized by the Director of Forestry in writing, and the road, - a) or trail has been identified in an approved forest management plan; and b) layout has been approved by the Director of Forestry."

Fisheries Resources Jurisdiction and Conservation Act Regulations, which prohibits the removal of Sea Oats, *Uniola paniculata*. "13. No person shall cut, harvest, or remove from any beach or shore or from any area immediately adjacent thereto any Sea Oats except with the written permission of the Minister.[19]"

Health and Safety Work Act, 2002 (Ch. 321C) - *"*An Act to make provisions relating to health and safety at work and for connected purposes." where, Section 4 speaks to general duties of employers to their employees and where, Section 7 speaks to general duties of employees at work.

Health and Safety at Work (Amendment) Act, 2015 - (repeal and replacement of Section 17 of Ch. 321C) Contains parts regarding applications, permits and licenses, appeals, fees, offences, and penalties.

Marine Mammal Protection Act, 2005 (Ch. 244A) – "An Act to make provision for the protection of marine mammals".

Marine Mammal (General) Regulations (Ch. 244A) – "These Regulations may be cited as the Marine Mammal Protection (General) Regulations and shall come into force on the first day of May 2006", where Section 18 speaks to Marine Mammal Protection (General) Regulations and Section 19 speaks to Marine Mammal (Captive Dolphin Facilities) Regulations.

Town Planning Act, 1961 (Ch. 255) - "An Act relating to town planning", where section 7 speaks to committee sanctioned development activities.

Water and Sewerage Corporation Act, 1976 - "An Act to establish a Water and Sewerage Corporation for the grant and control of water rights, the protection of water resources, regulating the extraction, use and supply of water, the disposal of sewage and for connected purposes." where, section 3 speaks to government control of the production, extraction and use of water in the public interest.

Wild Birds Protection Act, 1952 (Ch. 249) – *"*An Act to make provision for the protection of wild birds.*"*

Wild Animal Protection Act, 1968 (Ch. 248) – *"*An Act to make provisions for the control of the taking and export of wild animals.*"*

[19] *laws.bahamas.gov.bs/cms/images/LEGISLATION/SUBORDINATE/1986/1986-0010/FisheriesResourcesJurisdictionandConservationRegulations_1.pdf*

8.3 International Conventions and Agreements

Stockholm Convention on Persistent Organic Pollutants – "As set out in Article 1, the objective of the Stockholm Convention is to protect human health and the environment from persistent organic pollutants[20]."

Commission on Sustainable Development – "The United Nations Commission on Sustainable Development (CSD) was established by the UN General Assembly in December 1992 to ensure effective follow-up of United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit[21]."

Kyoto Protocol – The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005[22].

Basel Convention on the Control of Transboundary Movement of Hazardous Wastes – "The Basel Convention is a global agreement between countries to protect human health and the environment against the adverse effects of hazardous wastes." [23]

Ramsar Convention on Wetlands – "the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources. The Convention was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975."[24]

Minamata Convention - "The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. The Convention draws attention to a global and ubiquitous metal that, while naturally occurring, has broad uses in everyday objects and is released to the atmosphere, soil, and water from a variety of sources. Major highlights of the Minamata Convention include a ban on new mercury mines, the phase-out of existing ones, the phase out and phase down of mercury use in a number of products and processes, control measures on emissions to air and on releases to land and water, and the regulation of the informal sector of artisanal and small-scale gold mining. The Convention also addresses interim storage of mercury and its disposal once it becomes waste, sites contaminated by mercury as well as health issues." http://www.mercuryconvention.org/

9. ENVIRONMENTAL IMPACT ANALYSIS

9.1 Methodology for the Environmental Impact Assessment

The impact analysis is a critical component of the EIA process as it evaluates the potential impacts resulting from the interaction between project related activities and the surrounding environment

[20] http://www.pops.int/TheConvention/Overview/tabid/3351/Default.aspx
[21] https://sustainabledevelopment.un.org/intergovernmental/csd
[22] http://unfccc.int/kyoto_protocol/items/2830.php
[23] http://www.basel.int/
[24] *Ramsar Convention Secretariat. 2014.* https://www.ramsar.org/

during construction and operations phases of the Project. Impacts are described as changes brought about to the surrounding environment as a result of project-related activities. The surrounding environment for this EIA is inclusive of the physical, biological, and socioeconomic environment within the Project's area of influence. Environmental aspects considered in this analysis are listed below.

Table 32. Environmental aspects under consideration for Impact Analysis.

Environmental Aspects	
Physical	Erosion
	Air Quality
	Noise Quality
	Hydrogeology
Coastal Processes	Hydrology / Hydrodynamic
	Turbidity / Sedimentation
	Beach
Biological	Nearshore / Coastal Habitats
	Marine Habitats
	Terrestrial Habitat
	Terrestrial Fauna
	Marine Megafauna
Socioeconomics	Neighboring Communities
	Relocation
	Boat Traffic
	Economics
Cultural	Archaeological, Historic & Paleontological Resources
	Fishing

Project related activities during construction and operations have the potential to impact the surrounding environment, and the nature of these impacts can be Negative or Positive and Direct or Indirect. Negative impacts are activities which result in an adverse change or degradation from the environmental baseline, while positive impacts result in a beneficial change or improvement to the environmental aspect under consideration. Direct impacts result from the direct interaction between Project related activities and the surrounding environment, while indirect impacts consequences of the Project implementation on the surrounding environment on a larger time and distance scale. Additionally, other parameters such as Significance, Duration and Intensity are used in determining the scale of environmental impact.

Significance in this assessment is a determination of the degree of importance assigned to an

environmental impact resulting from project related activities. An impact's significance is evaluated in terms of its magnitude and likelihood. Magnitude is a function of the impact's extent, whether restricted on site to the immediate project area, locally within a 10-mile radius, regionally to include the island of New Providence and the Central Bahamas and Nationally to include the extent of The Bahama Archipelago. The likelihood of an impact is a rating which evaluates the likely potential for an impact to occur, with typical rating categories being unlikely to occur, Likely to occur under most conditions, and definitely will occur.

The duration of the impact relates to the temporal scale which is required for changes in the host environment to return to baseline conditions or undetectable levels. Temporary impacts persist for a short duration and occur occasionally and/or intermittently. Short Term Impacts are expected to persist for the duration of the project activities related to the construction phase of the Project. Long Term impacts extend beyond the duration of the construction period and exist throughout the life of the Project. Permanent impacts persist far beyond the life of the Project and are irreversible changes to the host environment due to project related activities.

The intensity of an impact can be considered as Negligible, Low, Medium, or High. A Negligible impact is one which has no detectable change on the host environment. A low intensity impact does not affect the host environment in such a manner as altering natural flows and processes. Medium intensity impacts alter the natural flows and process of the host environment while allowing the flows and process to retain their natural functions. High intensity impacts alter natural flows and processes to the extent where natural functions are totally inhibited for a temporary or permanent period of time.

Cumulative impacts are the compounding effects of Project related activities when combined with past, current or future actions or activities related to this or another Project in the nearby environment. Cumulative impacts represent the interaction of impacting factors originating from different sources with the same host environment. The result is typically an exacerbation of the impact on the environmental aspect and is considered in this assessment.

Table 33. Impact Significance Summary

SIGNIFICANCE			
MAGNITUDE			**LIKELIHOOD**
Extent	**Duration**	**Intensity**	
On Site (O)	Temporary (T)	Negligible (N)	Unlikely (U)
Local (L)	Short-Term (ST)	Low (LW)	Likely (LK)
Regional (R)	Long-Term (LT)	Medium (M)	Definite (D)
National (N)	Permanent (P)	High (H)	

9.2 LAND USE IMPACT

A residential community exists north of the site. It is known as a boating community within the Yamacraw area. Another marina is located at a considerable distance east of the proposed site

with similar dredge extent (channel) of approximately 2,000 ft. Thus, providing the opportunity for the project to provide maintenance and storage services to local and international vessels.

It is possible that the proposed development may impact the existing community by increasing its value due to the added amenities/facilities. For instance, the current area may be considered a middle-class community. The value of homes and lots in the area ranges from an estimated $85,000 - $495,000[25]. This may increase due to the Project. “Homes in urban locations with proximity to employers, restaurants, mass transit, shopping, and recreation hold high value and can positively affect home value”[26]. Furthermore, "in the international property industry, it is understood that certain elements add immediate value to a property. For instance, property with an ocean view may be worth 10 to 15 percent more than a home a block away. Marinas may be the most valuable asset”[27].

The proposed development will provide security and increase the aesthetics within the area, as it will aid in the prohibition of possible nefarious activities and develop a once derelict area. Many communities within the eastern district are known as middle-class, upper middle- class and rich communities. Thus, aligning with the current land use of the area.

Land clearing to accommodate the marina and upland developments include the immediate project area. The development intends to be fully compliant with environmental laws, policies and/or regulations applicable to the nature of the project and/or required of them.

9.3 Aesthetic Impact

The Project will be beneficial aesthetically. Currently most of the project site is either cleared or overgrown with invasive species which is unsightly. The marine environment has garbage as if used to dump with the example of a car even being in one of the channels. The creation of this Project will remove invasives and beautify the area.

9.4 Air Impact

Air Quality will be temporarily impacted during construction. During land clearing, site grading and excavation where there will be dust that is dispersed within the air. This Project is directly behind and surrounded by a residential community. The dust and dirt can affect the surrounding community on particularly windy days during construction. There will also be emissions from machinery on site that can pollute the air if they are not properly maintained. There will need to be mitigation measures in place to ensure that dust is not dispersed to the surrounding communities. Once construction has been completed air quality should not be impacted as much. A description of the dust suppression activities will be provided in the Environmental Management Plan.

[25] *https://www.hgchristie.com/eng/sales/yamacraw-np-bhs*
[26] *https://www.homelight.com/blog/what-makes-property-value-increase/#Location*
[27] *https://www.puntapacificarealty.com/panama-news/the-marina-boost-for-panama-property-values/*

9.5 Noise Impact

Noise quality will be temporarily negatively impacted during construction. The Project site is located within a residential area where there is no noise coming from construction and commercial businesses so there will be a spike in noise levels during construction. During construction hours machinery and the actions of excavation and land clearing will raise noise levels. This will also affect the wildlife within the area such as birds who will be forced to relocate if they are not willing to withstand the sound.

9.6 Groundwater Resource Impact

The impact to groundwater resources is related to the below the surface resources on the site as no surface water bodies were identified on the site, and the groundwater stored in the adjacent wetlands east and west of the site. During construction, the impact to the below the surface resources has the potential to be negative and moderate impact as the water table was measured at 4 to 5 feet below ground and the excavation required for foundations and the installation of utilities is 6 feet below ground grade. To avoid a negative long-term impact to the groundwater resources, the site will be elevated prior to excavation. Once the site is elevated, the groundwater level will be deeper than the existing 4 to 5 feet below the surface. Appropriate spill management will be implemented to prevent oil and fuel from percolating through the limestone to the water table. Additional mitigation and best practices are introduced in section 11 and will be detailed in the EMP.

The Project will have a beneficial long-term impact on the groundwater stored in surface water in the wetlands during construction and throughout operation. The surface water resources adjacent to the site is classified as “meager quantities of brackish to hypersaline water” which indicates there is limited circulation between the wetlands, the site, and the nearby coastal area. Water quality measurements taken in the wetland west of the site also indicate poor circulation between the site and the wetland. To help improve circulation at the site a culvert will be installed under the access road to the site. The culvert design will be included in the EMP. To improve circulation in the wetland to the east of the site the wetland will be reconnected to the coast.

9.7 Geology Impact

The Project is expected to include minor excavation activities associated with building foundation and pool construction. Thus, removing the current soil type on site.

Land reclamation is intended to occur on the southern peninsula. This activity is inclusive of an estimated 80,000 cubic yards (118,800 tons) of fill material. Dredged and excavated material is expected to be used during the land reclamation phase of the Project.

9.8 Terrestrial Impact

The approximately 17 acres of the project site has been previously impacted by development. Most of the terrestrial upland and coastal areas are dominated by invasive species such as Casuarina and Scaevola. Land clearing for construction will remove these invasive species from

the landscape and replace it with native plants. Undisturbed areas of the property include the coastal and near shore areas along the southern boundaries of the site. The mangrove habitat in these coastal areas total approximately 2 acres. Development of the coastal features of the project will result in removal of the mangrove habitats along the southern shoreline of the property.

Utilizing native coastal and coppice species in the landscape will assist in increasing the biodiversity of the site after construction.

9.9 MARINE IMPACT

9.9.1 Construction

There will be habitat loss due to dredging associated with the marina development, which will remove the benthos of this environment. This can negatively affect the marine life and sea floor that is partially covered in coral, algae and seagrass. It is possible that the turbidity created during dredging activities will increase sedimentation within the area which can prevent sunlight for seagrass growth. Slow moving organisms should be removed prior to dredge activities. The construction of the marina would have a negative environmental impact on the marine resources within this area and its surrounding environments. This is due to the removal of habitat in the marina entrance channel, Yamacraw Lakes entrance channel, extended dredge area and excavation of the existing marina required to develop the turning basin. Furthermore, it is noted that the extended dredge area was not surveyed due to design changes after the marine surveys were conducted. The bathymetric survey in Section 7.3.3 identifies the presence of coal heads “Observed Shoals” dispersed throughout the dredging area of interest. The existing dredged area was surveyed and is described as various species of soft and hard coral scattered throughout the entrance channel area, along with very sparse seagrass and mostly sandy bottom habitat.

Noise created during dredging activity will be temporary and may have minor negative impacts on marine resources depending on the type of method used.

Light pollution due to light creation from the lighthouse could disrupt the natural patterns of marine life such as turtles in the area. Beach creation will create a new habitat for various species of shorebirds and beach dwelling organisms.

Water quality may be temporarily impacted during dredging activity as turbidity will increase within the immediate areas. When sediment is disturbed, and turbidity increases, it reduces light availability for primary producing organisms and their consumers. Turbidity silt curtains and other dredging methods (such as cutter-suction dredger) will be used to contain the disrupted sediments that were agitated during dredging activities.

Other sources of pollution during the construction stage include discharges from marine and land-based construction equipment and land based run off from dredge spoils. Discharges of grey or black water, petroleum-based products, solvents, and other hazardous chemicals during construction has the potential to alter chemistry in the immediate areas of the marina basin, adversely impacting marine resource utilizing these habitats. Accumulated marine impacts for the

Development include possible pollution that may affect the existing water quality. These moderate to adverse impacts may result from construction activities such as dredging, and exaction works.

During marine surveys debris was observed in the marina. Prior to opening, the Developer will remove all debris from the marina and provide transport to the New Providence Ecology Park (NPEP). This will benefit the immediate marine environment within the marina but also the adjacent coastal areas as marine debris will not be transported beyond the marina boundary.

Table 34. Dredge impacts on marine areas.

Marine Area of Interest	Dredge Depth (ft.)	Dredge Extent (ft.)	Dredged Area (acres)
Extended Dredge Area (Navigation Channel)	~13 ft.	~6,840 ft. (160ft wide)	~25.1[28]
Yamacraw Lakes Entrance Channel	~5 ft.	N/A	~1.33
Blue Water Cay Marina Entrance Channel	~13 ft.	N/A	~1
Blue Water Cay Marina Basin	~12 ft.	N/A	~7.37

9.9.2 Operation

The operations phase of the marina will have adverse impacts to marine resources in the immediate areas of the marina. Routine operations such as boat fueling, washing, repair and maintenance can introduce pollutants into the marine environment, eventually entering the open ocean habitats and impacting marine habitats and organisms. Increased boat traffic can potentially negatively impact turbidity in shallow areas through propeller wash, increase ambient noise levels in the immediate marine environment, and increase the risk of collisions with marine megafauna known to inhabit the site. Added fishing pressure may also be expected in the area as boaters practice recreational and sport fishing.

Increased light pollution may negatively impact marine species during operation. There are currently no existing sandy beaches within the Project site, which indicates turtles nesting is not taking place on the site. The Project proposes beach creation and constructing a lighthouse along the southern boundary of the site. There is a chance the turtles known to forage in the area may attempt to nest at site once the sandy beach is created. In the long term, the combination of the sandy beach and artificial light at night (ALAN) produced by the lighthouse may lead to negatively impacting turtles nesting at the site. While this is not a guaranteed occurrence as the turtles may not attempt to nest at a newly established site, the EMP will describe methods for managing ALAN to reduce the impacts in the event turtles may attempt to nest at the site.

[28] *This area is not included in the habitat map as the extended dredged area was not finalized. The dredge plan was received April 28, 2022.*

A mitigation option discussed in Section 11.2.2 is installing a culvert between the marina and the western mangrove habitat. While this is important, it should be mentioned that the water quality in the marina will impact the water quality in the mangrove habitat should this mitigation measure be approved by DEPP. To avoid negatively impacting marine resources in this mangrove habitat, spill management inclusive of immediate clean-up in the marina should be strictly followed. Also, water quality tests should be conducted at regular intervals near the culvert near basin and opposite mangrove habitat.

9.10 Socio-Economic Impact

9.10.1 Social

The current Project site has been abandoned for several years and has become an overgrown and hazardous site. The site has become a dumping ground and place where crime can take place due to its isolated location. Because this is behind a residential area this is harmful for the community and having the Project will be beneficial with the creation of the Legendary Marina Resort at Bluewater Cay the locals within the area will have a place to dock and fuel their boats if they wish and have a new recreational site.

In addition to cleaning the site up there will also be deepening (by dredging) at the opening of Yamacraw Lake which will allow improved water circulation and a larger space for residents to drive their boats in and out. The proposed culvert which will be placed by the entrance road will allow flushing and drainage to take place for the previously disconnected western section of Yamacraw Lake. This will assist in beautifying the stagnant swamp and create an area that visitors and locals want to visit.

There will also be replanting and protection of mangroves which are very useful in protecting the Yamacraw community from storm surge and hurricanes. Local schools within the surrounding community will also be engaged to learn about mangrove conservation and revitalization. There will also be a public access beach created for the locals on the southwest corner of the project outside of the security perimeter which will add to recreational attractions for the community.

9.10.2 Economics

The Project is anticipated to generate direct and indirect long term, sustainable benefits to the local economy as well as surrounding island destinations. Please refer to Appendix I – Economic Impact Study for full assessment of the Project's Scio-Economic benefits. See also Appendix D for summary of employment and capital investments of each phase of the Project development.

The Project's marine service facility will include a training component that will create a demand on BTVI and other vocational schools for qualified individuals seeking to be trained in the service and repairs of internationally branded outboard engines. Many of our staffing positions are planned to be skilled, long term career opportunities. Below is the projected employment for the different phases of the Project.

Phase 1 will consist of constructing approximately half of the marina assets. It is anticipated that 75 persons will be needed during the construction of Phase 1. During the operations of Phase 1, it

is anticipated that 40 staff positions will be required. The operations staff will be a mix of dockhands, marina supervisors, marina dispatch, forklift drivers, groundskeepers, retail clerks and marine service technicians.

Phase 2 will begin, completing the marina component of the development. It is anticipated that 75 persons will be needed during the construction of Phase 2. During the operations of Phase 2, it is anticipated that 40 additional staff positions will be required, bringing the operations staffing to approximately 80 people total. Building on Phase 1 operations, similar staffing positions are expected in Phase 2 operations.

Phases 3 and 4 will commence as the business matures and the necessary capital is raised. At full build-out, an operational need of 220 persons is expected between the marine, hospitality, and food & beverage aspects of the planned development. At all phases of development, the Developer will make every effort to achieve an employment ratio of 80% Bahamian to 20% non-Bahamian. All necessary work permits for expatriates will be applied for in accordance with Bahamian law and common practice.

A complete socio-economic study is included in Appendix I.

9.11 Archeological and Cultural Impact

There are no known or observed archaeological, historical, or religious resources onsite. However, it is recommended that the Antiquities, Monuments and Museums Corporation (AMMC) of The Bahamas be notified immediately if cultural resources are discovered during construction or operation.

Culturally significant recreational activities may be temporarily impacted due to the construction of the proposed development. However, the Developer intends to develop a public beach at the south-west corner of the project boundary and provide access for public use. This access will be adjacent to the secured proposed development as shown in Figure 52 below.

Figure 52. Intended public beach access adjacent to the project (area #22 show the public beach access west of the secured perimeter).

9.12 Traffic and Transportation Impact

The proposed development is not expected to affect local roadway infrastructure directly but will positively impact emergency access and egress to the Project and surrounding areas.

Reconfiguring the road for proposed beach access may impact mangrove species on the western side of Fox Hill Road south. Road mitigation will be detailed in the EMP.

The completion of the marina has the potential to encourage higher amounts of boat traffic in the near shore areas. Increased hazards and the likelihood of transportation-related accidents and incidents inherently created by the Project will be managed. For instance, signs will be posted on

the property during construction and operation to remind vehicle and vessel operators to remain particularly aware of pedestrians, swimmers, and marine life.

10. SUMMARY TABLE OF POTENTIAL ENVIRONMENTAL IMPACTS

Table 35. Impact summary table.

PROJECT COMPONENT	IMPACTING FACTOR	ASPECT																					
		PHYSICAL				COASTAL PROCESSES			BIOLOGICAL						SOCIOECONOMICS				CULTURAL		
		Erosion	Air Quality	Noise	Hydrogeology/ Groundwater Resources	Hydrology	Turbidity / Sedimentation	Beach	Terrestrial Habitats	Terrestrial Flora	Terrestrial Fauna	Marine Habitats	Marine Megafauna	Marine Resources	Neighboring Communities	Relocation	Traffic	Economic	Archaeological, Historic & Paleontological	Hunting	Fishing
CONSTRUCTION includes the Marina and Upland Development. MARINA includes dredging, floating dock construction, land reclamation, beach creation, and the groynes (rip rap) installation. UPLAND activities include the development of cottages, hotel, condominium, staff accommodations, marina club with restaurant and bar, pools, boat storage unit/barn, boat repair facility, parking lots, grocery/sundry store, customs/immigration operations, fuel storage and lighthouses. The impacts of the buildings are summarized together as "Buildings". The impacts of the parking lot, lighthouse and fuel storage are separated from the buildings.																						
DREDGING	Marina Basin & Entrance Channel																						
EXCAVATION	Marina Basin																						
	Culvert																						
FLOATING DOCK	Installation																						
GROYNE	Spoil Stockpile of Rip Rap																						
	Rip Rap installation																						
BEACH NOURISHMENT	Spoil Stockpile of Sand																						
	Sand Placement																						
	Site grading																						
LAND RECLAMATION	Dredge Spoil Stockpile																						
	Landfill																						
U P L A N D D E V E L O P M E N T includes buildings north and south of the Marina basin. North includes boat storage barn, maintenance garage, marina club (restaurant and pool), customs/immigration operations, retaining wall, hotel, launch area, and staff accommodations. South includes condos, cottages, pools and short-term lease cottages.																						
BUILDINGS	Excavation (Foundation, Pool & Utilities)																						
	Infrastructure Installation																						
PARKING LOT	Drainage																						
	Site Grading & Finishing																						

FUEL STORAGE	Infrastructure Installation																						
	Distribution																						
LIGHTHOUSE	Infrastructure Installation																						
OVERLAPPING FACTORS	Solid Waste																						
	Liquid & Hazardous Waste																						
	Accidental Spills (Fuel, Oil, Hydraulic Fluid & Sewerage Spills)																						
OPERATION includes the Marina and Upland developments																							
MARINA & FLOATING DOCK	Marine Traffic																						
CULVERT	Mangrove Connectivity (Water Quality)																						
	Boat Maintenance																						
LIGHTHOUSE	Light pollution																						
PARKING LOT & SERVICE YARD																							
POOLS																							
CUSTOMS & IMMIGRATION OFFICE																							
OVERLAPPING FACTORS	Solid Waste																						
	Liquid & Hazardous Waste																						
	Accidental Spills (Fuel, Oil, Hydraulic Fluid & Sewerage Spills)																						
	Emissions																						

Table 36. Impact Significance Key

Impact Significance Key	Negligible/None	Minor	Moderate	Severe	Beneficial

- Negligible/No Impact (White) – negligible impact is one which has no detectable change on the host environment. Medium intensity impacts alter the natural flows and process of the host environment while allowing the flows and process to retain their natural functions.
- Minor Impact (Yellow) – minor/low intensity impact does not affect the host environment in such a manner to alter natural flows and processes.
- Moderate Impact (Orange) – moderate/high intensity impacts alter natural flows and processes to the extent where natural functions are totally inhibited for a temporary or permanent period of time.
- Severe Impact (Red) – adverse/negative impacts to the immediate/extended environment and stakeholders.
- Beneficial Impact (Green) – positive impacts on the surrounding environment and/or stakeholders.

11. RECOMMENDATIONS AND MITIGATION STRATEGIES

11.1 METHODOLOGY

Once the Project impacts were determined, best management practices and mitigation strategies were developed based on desktop research and the technical team's experience with similar projects. The following table and sections summarize the proposed mitigation strategies for the Project. The Environmental Management Plan (EMP) will further detail each strategy. In accordance with DEPP standards, the Project will include a full-time Environmental Monitor on site during construction to ensure mitigation measures outlined in the EMP are adhered to. Following construction, these practices should be taken on by a resident Environmental Manager and/or the Construction Manager.

11.2 BIOLOGICAL RESOURCE MANAGEMENT

These practices include capitalizing on environmental windows (opportune times outside of mating/spawning or migrating seasons) for valued ecosystem components (Nassau Grouper, Mangrove Cuckoo, White-crowned Pigeon, etc.), as much as reasonably practicable, in an effort to limit disturbances to the natural environment during construction and operational activities.

11.2.1 Terrestrial

Predominantly invasive species will be removed from the site during the land clearing activities of the Project. The removal method will follow best management practices and will be further refined in the Project's EMP.

Protected mangrove species were identified on the southern peninsula of the site. The Environmental personnel under the guidance of the Environmental Manager will collect propagules and seeds from these species to establish a nursery for plants that will be replanted on the site as a part of the landscaping plan. The EMP will further describe the nursery.

11.2.2 Marine

The use of environmental windows, turbidity curtains, preclearance surveys, habitat creation, and improving the connectivity between both mangrove habitats adjacent to the Project site, and creation of living shoreline for mangroves are proposed mitigation measures for the Development. Environmental windows are periods of time known to be less active in a certain area for a species. For example, Green Turtles (*Chelonia mydas*) have been observed on the Project site. During the development of the EMP, the project team can consult with stakeholders to determine the time of year the turtles are observed more frequently in the marina basin. The dredging timeline can be shifted to avoid working during this time. Additionally, an Environmental Monitor should be present on site to prevent impacting turtles during construction.

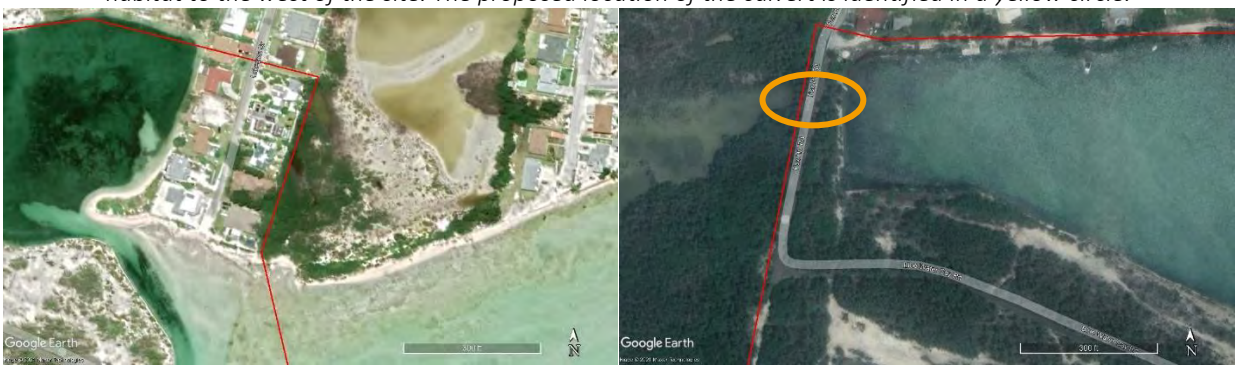
Installing turbidity curtains as needed prior to the start of dredging and/or excavation works can help reduce the amount of turbidity and sedimentation in the immediate marine environment and prevent sediment transport along the coast. The location of the turbidity curtains will be determined in consultation with the relevant project contractors and a proposed location will be

identified in the EMP. Proper dredging methods and equipment will be employed to reduce the potential for high turbidity in the water column (e.g., the cutter-suction dredger will not generate any suspended solids in the water column).

Pre-clearance surveys should be conducted to remove slow moving prior to dredging and land reclamation activities. As a result of the development activities associated with land reclamation, breakwater and groynes structures will create habitat (beach/living shoreline) to aid in coastal/marine biodiversity.

The mangrove habitat immediately to the west of the site was historically connected to the coastline, as shown through a Google Earth historical image search. Water quality tests in the area indicate there is low circulation in the area. By installing a culvert, the Developer can improve circulation in the mangrove habitat. The mangrove habitat to the east of the Project site would also benefit from excavation (deepening) of the entrance channel to reconnect the system to the coast. The following figures show the mangrove habitats to the east and west of the site, respectively. Also, it is recommended that mangroves seedlings and propagules are collected for replanting to create new mangrove habitats. The Developer proposes the establishment of a "living shoreline" along the northern and/or southern coastlines of the marina entrance. This would provide natural flushing/filtering of pollutants from the marina basin, while providing coastal erosion protection and replace mangrove habitat removed during construction. This process will be guided by The Forestry Unit and The Department of Environmental Planning and Protection.

Figure 53. The Project site is defined by a red line. (Left) Mangrove habitat to the east of the site. (Right) Mangrove habitat to the west of the site. The proposed location of the culvert is identified in a yellow circle.



Land reclamation in the south of the site will remove marine habitat. The following figure identifies the land reclamation area. Also, the developer proposes to incorporate the dredge spoil in its design. During the marine surveys various species of coral were observed growing along the sides of this man-made peninsula (breakwater). To mitigate the impact of losing these species, the Developer intends on provide artificial reefs under the guidance of The Department of Marine Resources and The Department of Environment Planning and Protection. A detailed artificial coral plan will be included in the EMP. Due to the distribution of Stony Coral Tissue Loss Disease (SCTLD) throughout The Bahamas, the method of coral transplantation may not be best suited for mitigation.

Seagrass, a common food source for green turtles, was also observed in this area. Removing this habitat will reduce the food source for the species. The Developer will not remove the dense seagrass patch growing in the northern section of the marina, refer to the habitat map shown in Figure 54.

Figure 54. Land reclamation area included within the red outline.

11.3 Turbidity and Erosion Control

The EMP will include dredging and turbidity monitoring and outlines the details of the dredging activities, and related impact mitigation and environmental oversight. In particular, the dredging extent, equipment, methodology, material handling and stockpile management, safety and environmental protection measures, responsible personnel, as well as turbidity monitoring and reporting protocols.

An appropriate site would be selected for the stockpile of excavated and dredged resources. These temporary stockpiles of removed resources are intended to be used in the construction of the upland developments and land reclamation. This stockpile storage site should not impact the surrounding community, inclusive of nearby public access and businesses. Best management practices for stockpile position and management will be outlined in the EMP.

Hazardous materials commonly generated due to boat service include[29]:

- Manual painting - Wastes generated by painting activities are considered hazardous where they contain solvents and/or heavy metals

[29] Environmental Protection Agency Tasmania: Department of Environment, Park, Heritage and the Arts (2009). Environmental guidelines for boat repair and maintenance Retrieved from <https://epa.tas.gov.au/Documents/Environmental_Guidelines_for_Boat_Repair_and_Maintenance.pdf>

- Spray painting - The environmental risks associated with spray painting include the release of volatile organic compounds (VOCs) and fine particles from overspray into the atmosphere and then onto soil and into water bodies
- Fiberglassing - the use of acetone (a solvent used to clean tools and other surfaces contaminated with resin) and styrene (the volatile component of the polyester resin) are the largest contributors of volatile emissions caused by fiberglassing activities.
- Welding and metal fabrication – may contribute to air pollution and cause metal contamination of soil, stormwater, and estuarine/coastal marine surface waters through the generation of airborne dusts and the emission of fumes and smoke.
- Engine maintenance and repair - Engine maintenance and repair activities involve the use of oil, fuel and solvents that are potentially hazardous to human health and the surrounding environment.

These hazardous materials will be stored in the back of house area/ storage area. All hazardous waste will be disposed of in accordance with the Department of Environmental Health standards. Prior to work within this area an impermeable layer will be applied to the ground before commencement. All hazardous waste will be sorted, sealed, appropriately labelled, and carefully transported to a designated waste disposal area by persons in appropriate Personal Protective Equipment (PPE). Details of the hazardous waste management will be explained in the Environmental Management Plan (EMP) after consultation with DEHS.

Boat cleaning will take place at the marina. To protect the surrounding marine environment, boaters should not release cleaning agents into the aquatic environment. The use of environmentally safe cleaning products will be used for cleaning maintenance.

11.4 Waste Management (solid, liquid, hazardous)

Waste collection and containment will follow standards provided by DEHS and will be guided by the EMP. Solid waste will be removed daily from the site by a DEHS approved waste removal service provider. The waste removal service provider must provide proof of disposal/treatment/recycling processes from the Department of Environmental Health Services.

11.5 Spill Management

Spill Management will primarily focus on spill prevention measures and secondarily focus on clean up and mitigation. In the event of a spill, the spill will be monitored and reported using a form similar to the one shown below the table. To prevent spills during construction the guidelines described in the table below will be followed on site. The Environmental Monitor will ensure the guidelines are followed.

Table 37. Spill management.

Spill Prevention	Required Equipment
Place drip trays beneath taps and valves and use overflow and drop containment measures at	Drip trays

connection points or at other possible overflow points.	
Secure the fuel and chemical storage area to prevent vandalism and damage of storage containers. An impermeable liner will be placed under storage containers in the back of house area and a secondary spill containment will be used.	Impermeable liner Spill berm
Use caution during hand transfer of fuel from storage containers to refuel equipment. Use a funnel to reduce the chances of leaks or spills.	Fuel storage containers Funnels
Fuel will be stored and transported in designated fuel storage containers. The containers will be covered until the fuel is needed for refueling.	Fuel storage containers Funnels
Do not store fuel or oil in damaged, unsealed containers. If a container is damaged, place the damaged container in an overdrum to prevent spills or leaks.	Overdrum
Use spill pallets and safety storage platforms when fuel / chemicals are transported around the site.	Spill pallets Safety Storage platform
Equipment will be maintained and serviced regularly by a local contractor to prevent leaks.	N/A
Equipment and vehicles will be repaired at a designated location on the construction site. The site will be lined with an impermeable liner to prevent oil, gas, diesel, etc. from percolating through the surface. If equipment repairs must be made on-the-spot, mechanics will use an impermeable liner during repairs to prevent contamination of the ground.	Impermeable liner Spill berm
Safety Data Sheets (SDS) will be available on site in two locations. SDS will be available in the site office and near the respective storage areas for the fuel and chemicals.	Relevant Safety Data Sheets

Figure 55. Example Spill Report Form.

Date: _____ Weather Conditions: _____

Staff on Duty: _____

Contact Information: _____

Spill Details

Type of Spill/Product: _____

Description of Spill Location of Spill: _____

_____

Spill Estimated Quantity: _____

Remediation Method: _____

Disposal Method: _____

Cause of Spill:

_____

_____

_____

Prevention Method Employed: _____

_____

Please identify spill location on the map provided below:

Notes: _____

_____

_____

Please attach photos of spill activity.

Signed by:

_____

Site Safety Manager

Subcontractors will typically develop additional spill prevention measures during construction based on the project activities as construction progresses. In the event of a spill, the spill should be reported to the Site Manager and contained immediately. If the spill cannot be contained, this information should be communicated to the site manager who will contact the relevant Emergency Personnel on the island. A full spill management plan will be outlined within the EMP

11.6 Health and Safety

During construction, workers would be trained in proper tool operation and safety, handling of materials, driver safety and knowledge of first aid and safety response. All employees will be trained by requiring attendance of the “All Employee” training course. New hires will complete the course for “All Employees” and any other appropriate segments of training required for their specific duty assignments within 30 days of starting work. The “All Employee” training course will include the following elements:

- Spill prevention, response, and reporting procedures
- Discussion of good housekeeping practices
- COVID-19 awareness and prevention
- Site Orientation & Personal Protective Equipment (PPE) Requirements
- Proper use of PPE
- Identification of the Pollution Prevention and Spill Response Team members and their respective responsibilities
- Emergency Exits and Procedures; and
- Environmental Requirements.

Figure 56. Example of PPE[30]

Safety personnel should be trained in health and safety techniques, to be used in case of an emergency and to act as emergency first responders to ensure the safety of staff and students of the Legendary Marina Resort at Blue Water Cay. The Project will comply with applicable security guidance or regulations developed by The Bahamas or international regulations and guidance, concerning the protection of sensitive facilities from acts of terrorism.

11.7 Fire Management

- Project personnel will be trained in fire/explosion prevention and response.
- No burning or smoking will be allowed on the Project construction site.
- Fire extinguishers will always be accessible at designated muster stations on site.
- No burning, welding, or other source of ignition shall be applied to any enclosed tank or vessel, even if there are some openings, until it has first been determined that no

[30] https://safetyculture.com/topics/ppe-safety/

possibility of explosion exists and authority for the work is obtained from the foreman or Supervisor.

- Employees should be aware of the locations of fire extinguishers that have been provided throughout the project and know- how to use them. A five-pound ABC rated fire extinguisher must be readily available while welding, burning, cutting, or using flammable gases or liquids. Smoking is not permitted around gasoline or other flammable liquids or gases.
- Equipment must be turned off before refueling.
- Gasoline must be stored and transported only in approved safety containers and gasoline must not be used for cleaning purposes. Compressed gas cylinders must be kept secured, upright, capped and separated when not in use. Empty gas cylinders should be marked and returned to the storage area for pickup.
- Compressed gas cylinders must be kept secured, upright, capped and separated when not in use. Empty gas cylinders should be marked and returned to the storage area for pickup.

11.8 Severe Weather / Hurricane Management

An employee will be assigned the role of storm tracker who will be responsible for notifying the Site Manager of the storm's progress. Once a Hurricane Warning is released by the Bahamas Department of Meteorology, the hurricane prepared plan will be initiated.

The Site Manager will assign a person in charge who will be responsible for implementation of the Hurricane Plan. The Hurricane Plan is a series of checklists to make preparing for and recovering from the storm as straightforward as possible. There will be weekly check in meetings place during the Hurricane season (June 1 to November 20), to discuss the Hurricane Action Plan and the team members' roles and responsibilities.

Before the storm checklist:

- Make a list of names, addresses and phone numbers for vendors and contractors who can provide recovery services or supplies.
- Keep evacuation routes open for all vehicles.
- Fully charge all devices and batteries.
- Remove loose jobsite materials and debris that could become projectiles and clean the jobsite daily.
- Have garbage in dumpsters and other containers consolidated and properly disposed and remove dumpsters from the site.
- Move materials that cannot be relocated or secured otherwise to shipping containers/storage boxes. Cover all materials that cannot be relocated and elevate them to at least 4 inches above the floor to reduce water damage exposure.
- Ensure that construction trailers and shipping containers/storage boxes are properly anchored and tied down. If anchors are not available, use concrete filled drums with

embedded reinforcing steel loops and tether at least three locations for each trailer or storage container.

- Stop all material deliveries.
- All construction equipment mats should be tied together and anchored.
- Make a video/photographic record of the jobsite and surrounding properties to document the project condition and status prior to the storm.
- Fuel all vehicles and emergency equipment (such as generators)
- Once the site is secure, instruct subcontractors and employees to vacate the jobsite and not to return until the danger has passed.
- Establish a meeting place, if possible, for key recovery members.

11.9 Marine/Vehicular Traffic Control

Appropriate signage should be placed along the reconfigured road for public viewing. Furthermore, road striping should be clearly visible by motorists to indicate lane changes and direction.

During construction, dredge activity may affect marine traffic. Therefore, suggested passage routes should be outlined and communicated to boaters within the community. Furthermore, appropriate signage should be placed in visible areas for boaters to be made aware of dredging activities and diverted routes. Communication can be made via VHF radio frequency to alert boaters of dredge activities. During operation, the increased marine traffic within the area may cause disruptions. Therefore, appropriate signage should be placed in visible areas to alert boaters of impending traffic.

Detailed traffic mitigation will be outlined in the Project's EMP.

11.10 Outreach and Education

Environmental sensitivity/awareness training for construction and operations staff of the Legendary Marina Resort at Blue Water Cay will promote public awareness and education of native Bahamian species and vital ecosystems. Additionally, this environmental training program will inform staff of the importance of protecting these ecosystems. The various laws inclusive of the 2019 Environmental Planning and Protection Bill will be referenced as an educational aid in preparing this program and to inform staff of environmental policies implemented in The Bahamas.

The environmental awareness training program will include the following outline topics:

- Identification and the importance of the following:
- Bahamian ecosystems
- native and endemic Bahamian flora and fauna species
- protected species; and
- invasive species and their impact on the environment.
- Indications of turtle nesting sites (in the event of encountering a nesting site on the beach).

- Identification of types of spills and appropriate methodologies for cleaning and disposing of spills and contaminated substances.
- Importance of quick response to pollution and appropriate mitigation (fuel, oil, solid waste, sewage waste, etc.).
- Equipment inspection of plant pots, construction materials, and machinery for invasives (seeds, seedlings, eggs, larva, small animals, etc.).

The Developer can incorporate bird watching platforms in both mangrove sites adjacent to the project. Educational and interpretive signage can be installed to educate visitors about the natural resources of the mangrove habitat. Furthermore, local schools within the surrounding community will also be engaged to learn about mangrove conservation and revitalization techniques and the importance of revitalizing mangroves in the context of providing healthy ecologies and natural barriers to protect shorelines from erosion.

Table 38. Summary Impact vs. Mitigation table.

Impact	Mitigation
Geology / Site development [Permanent]	Land clearing and removing the invasive species will expose the topsoil which can lead to erosion. Local flora will be planted to prevent severe erosion and the land clearing will be conducted in phases to reduce the total surface area exposed at one time. There is evidence of erosion in the site (see Site Photos in Appendix J). The site will be graded, and native vegetation suited to the site conditions will be incorporated in the landscaping design of the site to help reduce erosion at the site.
Water Quality [Temporary]	Dredging the entrance channel will create turbidity. Turbidity curtains will be installed around the dredge area to prevent sediment transport along the coastline. Also, secure fencing and turbidity silt socks will be used to prevent run off from upland development into the marine habitats. An in-depth turbidity control plan would be included in the EMP.
Biological Resources [Permanent]	Invasive species will be removed from the site. While these are all recommended for removal by the National Invasive Species Strategy, it has been acknowledged that the invasive species provide some habitat for avian species. Removing the invasive species will temporarily reduce the amount of habitat available. However, landscaping with native plants will permanently improve the quality of the habitat on the site for the avian species. The native species may also encourage additional species to visit the site. To reduce the impact on birds, construction should be planned around the nesting season of the birds identified on site (March-September). The installation of whale tail (T-shape) groynes will reduce sand habitat permanently but will increase habitat for rocky shore species permanently. Marine debris will be removed as a part of a clean-up effort in the marine area. The installation of a culvert is recommended to restore connectivity between the marine area and the mangrove wetland immediately to the east and west of the Project site. There are protected plants identified on site. Cuttings and seeds from these plants will be harvested and cultivated to replant on site during the Project landscaping to retain genetic

	biodiversity of the site. Mangroves seedlings and propagules should be collected for replanting to create new mangrove habitats.
Air Quality [Temporary]	During construction, site watering should occur at least once a day to reduce the suspension of particulate matter. A tarped boundary fence should be erected around the Project site to prevent any dust and dirt from being carried off property and impacting the surrounding community. Machinery should be properly maintained to prevent any harmful emissions. If machinery were to produce harmful emissions during use all work for this machine should cease and until it is repaired.
Noise Quality [Temporary - Construction] [Permanent - Operation]	During construction noise on the site will increase as a result of heavy equipment operation. Machinery should be powered on only when being used. Construction will be scheduled during peak work hours of the day to not inconvenience surrounding local communities. During operation, the noise level on site will be less than the noise levels during construction, but the noise level will be higher on the site than the current noise level of the site.
Energy [Permanent]	The use of renewable energy will be considered for use to help reduce the energy demand of the Project by 30% as a part of The Bahamas National Energy Policy.
Recreation [Permanent]	The area will be fenced in to prevent unmonitored, unsafe activity such as swimming within the dredged area and construction site. Also erecting signage to inform locals that swimming and fishing within the area is prohibited prior to the commencement of construction and dredge activities.
Transportation [Permanent]	The surrounding community launches boats from the area. Public consultation is needed to prevent any inconvenience to local boat owners. The nature of the Project will increase vessel and vehicular traffic in the area. With the increase in traffic, safety signage is recommended to be implemented with wake and speed restrictions. The increase of speed bumps could also be helpful in reducing any vehicle accidents within the community.

12. PUBLIC CONSULTATION

No formal public consultations with regards to the development of the Project have been held to date. Nonetheless, public consultation will be coordinated with DEPP and other relevant government agencies once the EIA is submitted.

The public consultation process will be guided by the 'Environmental Impact Assessment Regulations, 2020', which states, "the mode and procedure of a consultative process shall be determined by the Department (DEPP)". As a result, the following process is proposed and will be finalized through consultation with DEPP.

The date and time of a virtual public consultation meeting will be included in the public notification. During the meeting, the developer will provide detailed information concerning the proposed project, including the potential environmental, social, economic, and cultural affects, including adverse effects of the project on the immediate project site, and the adjacent properties and communities. The developer will address concerns raised during the meeting and during the remainder of the public consultation period. The public consultation period is 21 working days after the date of the public meeting. A summary of the public consultation process will be included in a Public Consultation Report, which will be submitted to DEPP for approval then made available electronically.

13. ENVIRONMENTAL MANAGEMENT

The Environmental Management Plan (EMP) for Legendary Marina Resort at Bluewater Cay will detail the best safety and environmental practices for construction and operation phases of the project. These guidelines explained in the EMP should assist in alleviating adverse impacts.

13.1 DRAFT ENVIRONMENTAL MANAGEMENT PLAN (EMP) TERMS OF REFERENCE (TOR)

1. Executive Summary
2. Introduction
3. Project Description
4. Relevant Environmental Regulatory Bodies
5. Environmental Management Organization
6. Environmental Impacts Summary
7. Management Plans and Mitigation Strategies
8. Emergency, Health, and Safety Plan
9. Public Consultation
10. Monitoring and Reporting
11. Conclusion

14. CONCLUSION

The development of the Legendary Marina Resort at Bluewater Cay has the potential to stimulate the New Providence economy, as well as the economy of wider Bahamas. The most potentially adverse impacts result from the land reclamation and dredging which will both cause large amounts of turbidity, and this will also change the existing environment, causing an impact on the flora and fauna. Nevertheless, the potentially adverse environmental impacts identified are expected to be managed, reduced, and in some cases even mitigated through the EMP to be produced for construction and operation phases of the project.

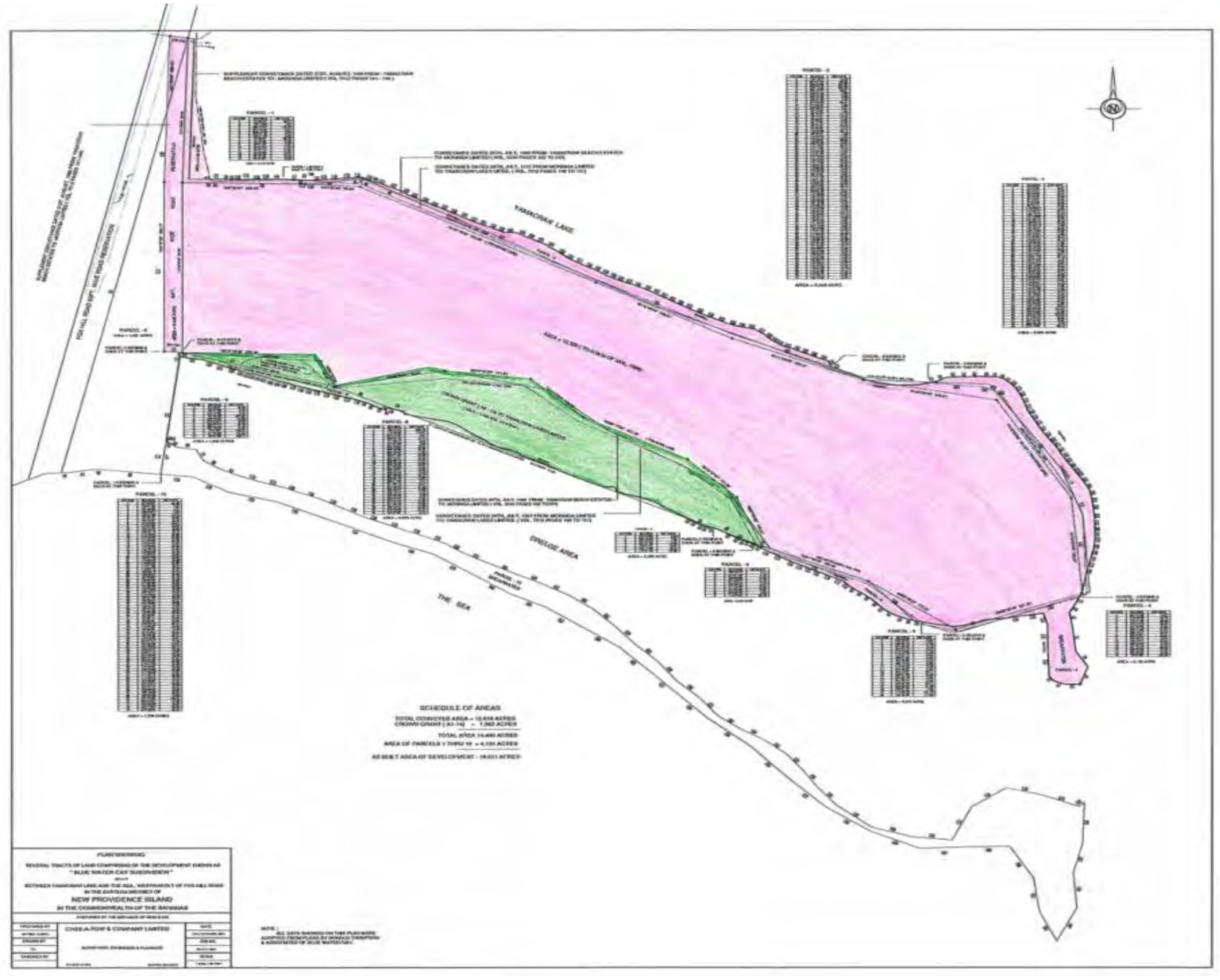
The Developer, Legendary Marine Bluewater Cay Ltd., is committed to minimizing the adverse environmental impact of the Project activities, while maximizing the environmental and social benefits of the proposed development through mitigation measures summarized below:

1. The existing site has been abandoned for several years and has become a hazardous location to the neighborhood. There are trash dumps on site and stolen boats have been found in Yamacraw Lake. The project will enhance the surrounding environment by bringing a security presence to the area and cleaning up a blighted site.
2. The Developer is also proposing to dredge the very shallow entrance to Yamacraw Lake, which will allow residents to access the lake with their vessels and enhance the water circulation and exchange flow with the sea, thus enhancing the water quality of the lake.
3. The planned development will include the construction of a culvert under the entrance road, thereby connecting the mangroves wetland with Yamacraw Lake at the north-west corner of the lake (near the gatehouse). This will re-establish historical drainage patterns that allow the mangrove swamp to the west of the project to flush naturally with tidal activity.
4. To the extent possible, mangroves will be protected, and every effort will be made to replant mangroves that are incidentally removed. The benefits of re-stablishing the historical flushing characteristics with the adjacent mangrove swamp will offset incidental removal of existing mangroves.
5. To further mitigate the Project impact on mangroves, the Developer proposes the establishment of a “living shoreline” along the northern and/or southern coastlines of the marina entrance. This would provide natural flushing/filtering of pollutants from the marina basin, while providing coastal erosion protection and replace mangrove habitat removed during construction. An option considered is to incorporate the dredge spoil in its design.
6. Engage public schools in the nearby community to develop programs to study mangroves, mangrove revitalization techniques and the importance of revitalizing mangroves in the context of providing healthy ecologies and natural barriers to protect shorelines from erosion.
7. The Developer intends to construct unimpeded public access to a public beach location at the south-west corner of the Project site. This access will be outside of the security perimeter of the planned development and will connect to Fox Hill Road. The Developer

understands the development of the proposed sandy beach at the current rocky shore and black mangrove habitat will have negative ecological impact. This impact will be mitigated by construction of a living shoreline along the groynes /jetty that separates the beach from the development.

APPENDICIES

APPENDIX A – SITE SURVEY PLAN


YAMACRAW LAKE
THE SEA
DREDGE AREA
SCHEDULE OF AREAS
NEW PROVIDENCE ISLAND
IN THE COMMONWEALTH OF THE BAHAMAS
CHEA-TOW & COMPANY LIMITED

APPENDIX B – PROJECT MASTER PLAN: PHASE ONE (PH1)


Hanna Road.
Carter Dr.
Ingraham Dr.
NT
1
2
3
4
5
6
7
Legendary
MARINA RESORT
AT BLUE WATER CAY
Nassau, Bahamas
PHASE 1
PHASE 1 LEGEND
1. Entry Gate
2. Phase 1 Boat Storage Building
3. Boat Launch Area
4. Phase 1 Parking
5. Phase 1 Admin Building
6. Wet Slip Marina
7. Fuel Docks

APPENDIX C – PROJECT MASTER PLAN: FULL DEVELOPMENT


Hanna Road.
Carter Ct.
Lakeside Dr.
NT
Legendary
MARINA RESORT
AT BLUE WATER CAY
Nassau, Bahamas
MASTERPLAN
MASTERPLAN LEGEND
1. Entry Gate / Guardhouse
2. Mixed use / Residential
3. Maintenance Garage
4. Yamacraw Lake
5. 580'x344' Boat Storage Building
6. Launch Area
7. Administration Building with Customs / Immigration
8. Work Force Housing
9. Restaurant
10. Pool
11. Lighthouse
12. Hotel
13. Fuel Docks
14. Cottages
15. Pool
16. Beachfront Cottages (typ.)
17. Short/Mid Term Lease
18. Pool
19. Beachfront Cottages (typ.)
20. Condominiums
21. Mixed Use / Retail
22. Public Beach with Access

APPENDIX D – LEGENDARY MARINA RESORT AT BLUE WATER CAY – SCHEDULE 2: DESCRIPTION OF PROJECT WITH PHASES AND TIMELINES

Legendary Marina Resort at Blue Water Cay
Schedule 2: Description of Project with Phases and Timelines

Legendary Marina Resort at Blue Water Cay intends to be a full service marina located near Yamacraw Settlement on New Providence island. The main feature will be what we believe is a first of its kind in the Bahamas: a boat storage building capable of storing boats up to 53ft in length inside constructed to withstand winds up to a Category 5 hurricane. The Project will ultimately include a marine service facility, marina basin with up to 100 slips, restaurant, hotel, pool, marine store, rental villas and retail area as well as materially improving the local environment. Our Legendary Marina facility in Destin, Florida, stores over 600 boats up to 50ft in length in dry storage so we have a keen understanding of how to operate this type of marina. Here a few common questions and responses about how the development at Blue Water Cay will operate:

1. ***What are the advantages of available dry storage for boats in the Bahamas?***
Keeping a vessel in dry storage at our marina will have many benefits. Boaters who come to the Bahamas by air will now have an ability to safely store their boat, ready for use when they arrive. We anticipate that many people who were previously hesitant to boat in the Bahamas and concerned about crossing the Gulf Stream, by being able to store their vessel in our facility, will now travel to and boat in the Bahamas, thereby increasing tourism and Stimulating the Bahamian economy. Our facility will be a first of its kind in the Bahamas. For boats up to 53' a dry storage marina is far superior to wet slip. For example:

(i) Storm Protection. The dry storage building at our facility will be designed to withstand Category 5 wind speeds and all current design codes. This ensures that any vessel stored inside will enjoy the maximum protection available by today's technology. Additionally, we offer a hurricane plan to vessels that are not stored in our facility. This plan allows for owners to store their vessel inside our facility for a fee, space permitting.
(ii) Lower Maintenance. Vessels stored in dry storage have less maintenance issues due to not sitting in saltwater and out of the sun when not in use. Everyone is familiar with the harsh toll that saltwater takes on a boat. Cushions get sun bleached and dry rot, electronics fade and the gel coat will get dull. Vessels stored in our facility will have the engines flushed and entire boat rinsed after every use before being stored inside.
(iii) Peace of Mind. Our facility will be monitored with closed circuit tv (CCTV), and onsite security guards, 24 hours per day. In addition, we will have perimeter fencing and an entrance gate staffed with security personnel. CCTV will provide security on the docks and at the entrance to the marina basin so that the facility is secure by water as well as by land.

2. *How big is the boat storage building and how many boats will be stored inside?*
At full build out (Phase 2), the boat storage building will measure 580ft x 345ft with an eave height of approximately 59ft. The number of boats can vary based on the size of the boat itself and the configuration of the beams supporting the racks inside. Our facility will be capable of storing up to a maximum of 600 vessels with lengths up to 53ft in anywhere from three to five levels. Figure 1 is a typical section view through half of the dry storage building:

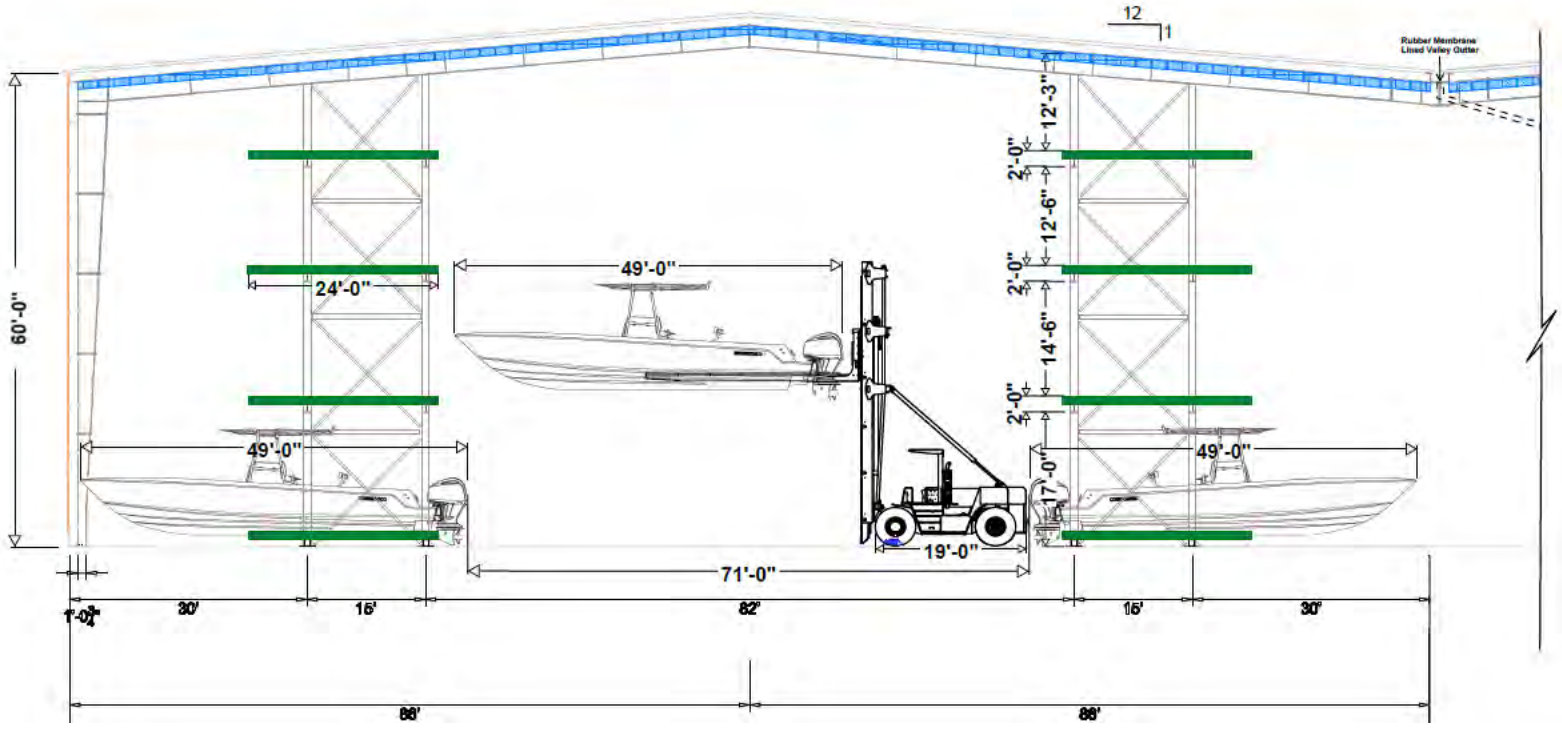


Figure 1

3. ***How will the vessels be launched from the boat storage building into the water?*** Our facility will have state-of-the-art forklifts specifically designed for our marina, able to handle larger outboard motor boats in the harsh marine environment (see Fig 2). Our members will simply request a specific date and time for their vessel to be launched using our phone-based app. When they arrive, their boat will be in the water, ready to go with gas, ice, and any other provisions that has been requested.

Figure 2

4. Will Legendary Marina at Blue Water Cay have marine service available and where will these technicians come from? Our facility will include marine service capabilities. Through our affiliation with OneWater Marine, Inc., a publicly traded company, we will train local Bahamians using a combination of apprenticeship programs and certified manufacture training sessions. In cooperation with BTVI and other area schools, we can create a pipeline of employment opportunities for people wanting to be properly trained in becoming marine service technicians of internationally branded components. This will bring marine repair business to the Bahamas instead of owners taking their boats back to Florida, as many do. Our affiliation also gives us an advantage in getting marine parts. Having in-house marine parts and service technicians at our facility is just another way that our marina will be set apart from others. The ability to obtain repairs by factory certified mechanics in the Bahamas will encourage boat travel to the Bahamas and boost the tourism economy.

5. What other amenities will Legendary Marina Resort at Blue Water Cay offer?
The full development will be much more than a mere marina. The full build out will include gas and diesel sales, a restaurant, pool, hotel, beachfront rental villas, marine store, marine service center and more. Our members can have their boat ready and waiting at one of our docks by simply requesting a launch through our app-based reservation system. Delivery can be arranged through the concierge service. We want to make it as easy as possible for boaters to realize the benefits of owning a boat in the Bahamas by offering all these amenities on one location.

6. What benefits will Legendary Marina Resort at Blue Water Cay bring to the Bahamas? We will ensure a mutually beneficial relationship between the marina Developer and the adjacent neighborhood and more broadly, the Bahamian economy as a whole. The benefits will include, among others, many direct and indirect benefits to the Bahamian economy. For Example:

(i) The ability to store boats in a safe, secure boat storage building will allow many hesitant visitors to now bring and store their boats in the Bahamas wisely and buy boats in the Bahamas. This brings untapped tourism to the Bahamas.
(ii) Job creation in the fields of construction, operations, certified mechanics, hospitality and food & beverage will stimulate the economy in both the short and long term.
(iii) Marine technician training through our affiliation with OneWater Marine will create new long term, highly skilled jobs offering great opportunities to Bahamians for advancement and development of valuable skills.
(iv) Onsite marine parts and service – boaters will have the ability to get their boats serviced locally instead of having to return to Florida, increasing Bahamian revenue.
(v) Hurricane rated storage building – bring and store boats in the Bahamas wisely. This will have a long-term effect on people who are currently hesitant to buy and store a boat in the Bahamas due to storm uncertainty.
(vi) Location – Our location on New Providence is centrally located so that many other island destinations are reachable within 1-2hrs by boat: Staniel, Highborne, Chub Cay, Cape Eleuthera are all just a day's trip away. This amplifies the economic impact of our marina.
(vii) The presence of our facility will bring added security to the Yamacraw area. Many stolen boats have ended up in Yamacraw Lake.
(viii) The additional security and the large investment in the area will have a positive impact on surrounding property values.
(x) The presence of our marina will have an overall very positive impact on the local neighborhood by (1) increasing property values; (2) providing additional security at our facility; (3) provide good jobs including skilled marine technicians, within walking distance of the neighborhood
(xi) The marina will have a very positive impact on the environment in general and the water based plant life in particular by re-establishing the flushing characteristics of the nearby mangrove stand immediately to the west of the development.
(xii) The marina will maintain a program of education for school children to develop their understanding and appreciation for aquatic plant life by sponsoring nature

tours of the necessity and methods of maintaining the health of mangroves and related plants.

(xiii) The project proposes to construct a sandy beach area immediately to the west of the development complete with benches and public access from Fox Hill road.

7. What are the Project Phases and Timelines? Full capital investment is expected to be fully committed in seven (7) years in four phases. Construction on Phase 1 would begin within 12 months of the Project receiving Approval in Principle. A summary of each phase is described below:

Phase 1 is the initial phase required to construct assets appropriate to open a functioning marina:

Commencement: Year 1
Construction duration: 1.5yrs
Capital: $35million

PH1 Employment Figures:
- Construction: 75 persons
- Operations: 40 persons

Description of PH1 Work:
- All site work, infrastructure, seawall reconstruction on main peninsula
- 50% of wet marina
- 50% of boat storage building
- Administration building
- Fuel docks and fuel storage
- Channel and marina basin dredging
- Marine service bays
- Coastal protection
- 50% Parking
- Guard house and fencing-

Revitalization of mangroves

Phase 2 will expand on Phase 1 by completing the marina assets and reconstructing the breakwater into a larger peninsula:

Commencement: Year 3
Construction duration: 2yrs
Capital: $15million

PH2 Employment Figures:
- Construction: 75 persons
- Operations: 40 persons (80 persons total)

Description of PH2 Work:
- Remainder of boat storage building
- Remainder of wet marina
- Remainder of parking
- Construct enhanced peninsula
- Marine service bays
- Mixed use / Retail building

According to this schedule, Phase 1 and Phase 2 of the Project will be constructed by the Developer by the end of year 5, expending an amount in excess of $50 million. As market conditions are evaluated, the Developer is intending to continue developing the site as follows:

Phase 3 brings the hospitality assets online along with the associated amenities and staff housing as required:

Commencement: Year 5
Construction duration: 2.5yrs
Capital: $15million

PH3 Employment Figures
- Construction: 100 persons
- Operations: 90 persons (170 persons total)

Description of PH3 Work:
- Hotel
- Restaurant / Bar
- Lighthouse
- Pool
- Staff housing

Phase 4 brings development to the reconstructed and fortified peninsula that was constructed in Phase 2:

Commencement: Year 7
Construction duration: 2.5yrs
Capital: $15million

PH4 Employment Figures:
- Construction: 80 persons
- Operations: 50 persons (220 persons total)

Description of PH4 Work:
- Oceanfront villas
- Cottages
- Add'l coastal protection areas as needed
- Short/Mid-term lease
- Condominiums
- Beach areas

As shown here, the Developer intends to commit to expend $50 million in the first 36 months on Phase 1 and Phase 2, with construction on Phase 2 being complete approximately by the end of year five (5). With the addition of Phase 3 and Phase 4, the Developer will expend in excess of $80 million in total investment of the project. The dates shown above assume no delay in granting of permits with the Developer agreeing to act in an expeditious and commercially reasonable manner in complying with all permit application requirements, and such dates are subject to alteration for such delays and for Force Majeure.

APPENDIX E – PROPOSED DREDGING PLAN

N

0'
600
1200
1800
2400
3000FT

BRON
POSSIBILITIES UNLIMITED

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

DRAWING NAME:
PROPOSED DREDGE PLAN

DATE:	DRAWING NO.	
APR/2022	C-01	
SCALE:	**DRAWN BY:**	**CHECKED BY:**
AS NOTED	K.S.	B.E.

AREA TO BE DREDGED TO -5FT MLLW

RED CHANNEL MARKER TYP.

1:8 (V:H) SLOPE

AREA TO BE DREDGED TO -12FT MLLW

PROPOSED DREDGE EXTENTS

AREA TO BE DREDGED TO -13FT MLLW

00+00

RED CHANNEL MARKER TYP.

MATCHLINE A

MATCHLINE A

- OBSERVED SHOALS

N

0' 150 300 450 600 750FT

DRAWING NAME: PROPOSED DREDGE PLAN

DATE: APR/2022 | **DRAWING NO.** C-02

SCALE: AS NOTED | **DRAWN BY:** K.S. | **CHECKED BY:** B.E.

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRN
POSSIBILITIES UNLIMITED

MATCHLINE A

MATCHLINE A

GREEN CHANNEL MARKER TYP.

RED CHANNEL MARKER TYP.

05+00

PROPOSED DREDGE EXTENTS

GREEN CHANNEL MARKER TYP.

160FT WIDE CHANNEL TO BE DREDGED TO -13FT MLLW

RED CHANNEL MARKER TYP.

10+00

GREEN CHANNEL MARKER TYP.

RED CHANNEL MARKER TYP.

15+00

- OBSERVED SHOALS

N

0' 150 300 450 600 750FT

MATCHLINE B

MATCHLINE B

DRAWING NAME: PROPOSED DREDGE PLAN

DATE: APR/2022

DRAWING NO. C-03

SCALE: AS NOTED

DRAWN BY: K.S.

CHECKED BY: B.E.

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRN
POSSIBILITIES UNLIMITED

DRAWING NAME: PROPOSED DREDGE PLAN

DRAWING NO. C-04

DATE: APR/2022

SCALE: AS NOTED

DRAWN BY: K.S.

CHECKED BY: B.E.

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS

PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRON
POSSIBILITIES UNLIMITED

MATCHLINE C

MATCHLINE C

GREEN CHANNEL MARKER TYP.

RED CHANNEL MARKER TYP.

35+00

PROPOSED DREDGE EXTENTS

160FT WIDE CHANNEL TO BE DREDGED TO -13FT MLLW

GREEN CHANNEL MARKER TYP.

RED CHANNEL MARKER TYP.

40+00

GREEN CHANNEL MARKER TYP.

RED CHANNEL MARKER TYP.

45+00

OBSERVED SHOALS

N

0' 150 300 450 600 750FT

MATCHLINE C

MATCHLINE C

DRAWING NAME: PROPOSED DREDGE PLAN

DATE: APR/2022

DRAWING NO. C-05

SCALE: AS NOTED

DRAWN BY: K.S.

CHECKED BY: B.E.

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRN
POSSIBILITIES UNLIMITED

MATCHLINE C

MATCHLINE C

RED CHANNEL MARKER TYP.

GREEN CHANNEL MARKER TYP.

50+00

PROPOSED DREDGE EXTENTS

160FT WIDE CHANNEL TO BE DREDGED TO -13FT MLLW

55+00

60+00

- OBSERVED SHOALS

N

0' 150 300 450 600 750FT

MATCHLINE C

MATCHLINE C

DRAWING NAME: PROPOSED DREDGE PLAN

DATE: APR/2022

DRAWING NO. C-06

SCALE: AS NOTED

DRAWN BY: K.S.

CHECKED BY: B.E.

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRN
POSSIBILITIES UNLIMITED

MATCHLINE C

MATCHLINE C

55+00

60+00

65+00

68+40

PROPOSED DREDGE EXTENTS

160FT WIDE CHANNEL TO BE DREDGED TO -13FT MLLW

RED CHANNEL MARKER TYP.

GREEN CHANNEL MARKER TYP.

- OBSERVED SHOALS

N

0' 150 300 450 600 750FT

DRAWING NAME: PROPOSED DREDGE PLAN

DATE: APR/2022

DRAWING NO. C-07

SCALE: AS NOTED

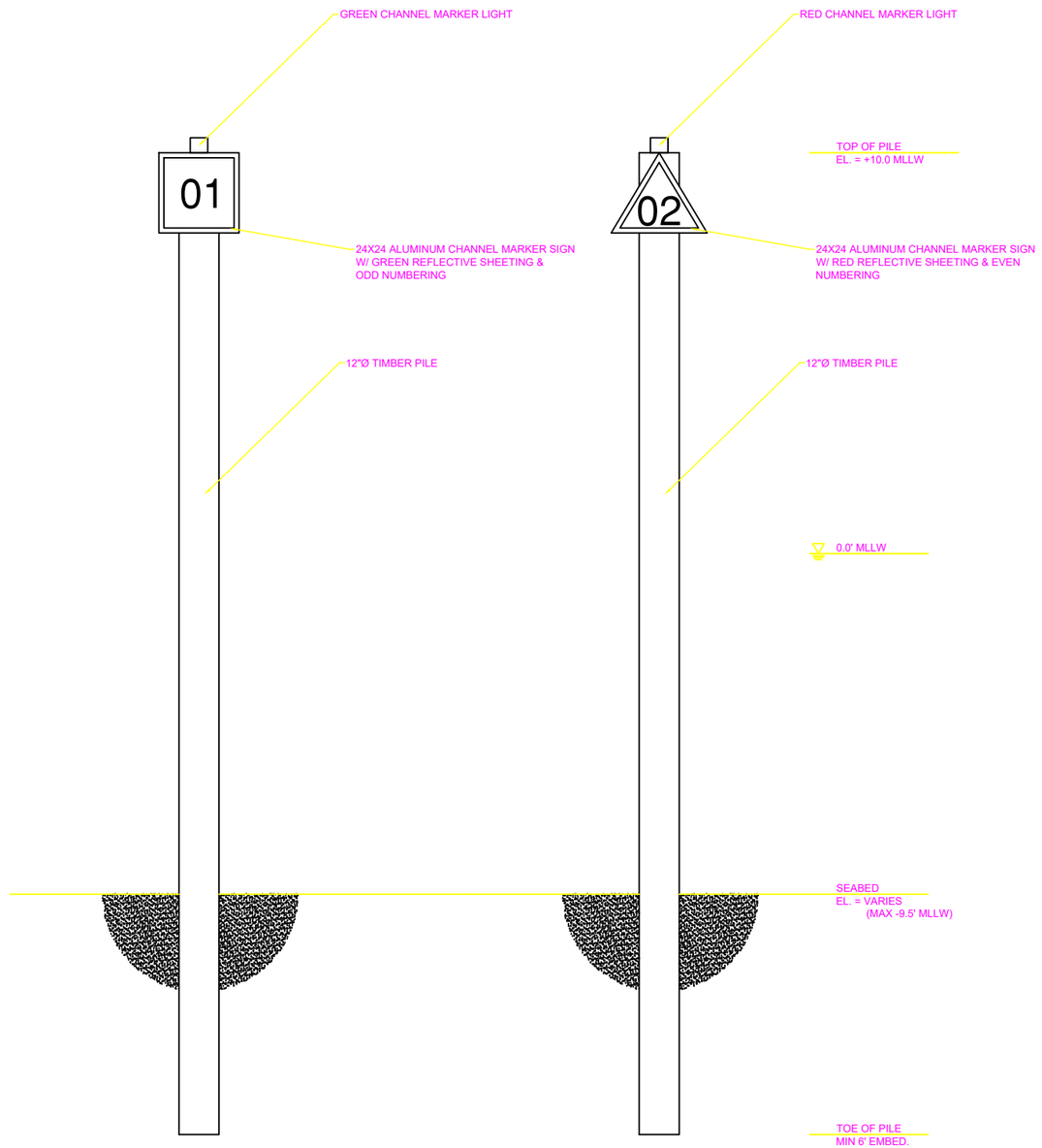
DRAWN BY: K.S.

CHECKED BY: B.E.

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRN
POSSIBILITIES UNLIMITED



TYPICAL CHANNEL MARKER DETAILS

SCALE: N.T.S.

DRAWING NAME: PROPOSED DREDGE PLAN - CHANNEL MARKER DETAILS

DATE:	DRAWING NO.	DRAWN BY:	CHECKED BY:
APR/2022	C-08	K.S.	B.E.

SCALE: AS NOTED

PROJECT NAME:
BLUE WATER CAY MARINA
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS
PROJECT #: 2021.064

REV.	DATE	DESCRIPTION
1	11/05/2022	ISSUED FOR RECORD

BRN
POSSIBILITIES UNLIMITED

APPENDIX F – GEOTECHNICAL INVESTIGATION REPORT

GEOTECHNICAL INVESTIGATION

BLUE WATER CAY

YAMACRAW

NEW PROVIDENCE, THE BAHAMAS

July 8, 2021

Table of Contents

1. Introduction

1.1. Scope

BRON prepared this geotechnical report for design of the proposed boat yard and haul-out facility, located in Yamacraw, New Providence. Legendary Inc. authorized BRON to conduct the scope services outlined below:

- Subsurface Field Exploration
- Soil Classification
- Data Analysis and Conclusions
- Report Preparation

The purpose of the geotechnical investigation was to gain a better understanding of viable wall construction methods for the proposed marina.

This report is intended for the exclusive use of the Legendary Inc. team and their consultants for design of the proposed expansion. Reproduction in whole or in part is prohibited. Written consent must be obtained prior to any quotations or excerpts of its contents.

1.2. Project Location

The project is located within the Yamacraw area, in Eastern New Providence, at the southern end of Fox Hill Road. A vicinity map and borehole location plan can be seen in Figure 1. The site masterplan can be seen in Figure 2.

1.2.1. Site Conditions

The main site is approximately 5 ft – 6ft above Mean Sea Level (MSL), with the southern peninsula having an elevation of approximately 3 ft above MSL. The terrain is relatively flat.

1.2.2. Existing Facilities

The site was formerly slated for a residential development. Existing facilities include a security booth, paved roads, a sewer network, and seawalls.

1.2.3. Climatic Conditions

The Bahamas is located within a temperate climatic zone. The two main seasons are the dry season and the rainy season. Due to the temperate climate, no freeze thaw effects have been considered within this report.

1.2.4. Surface Drainage

The drainage of the site appears to be handled predominantly via seepage into the underlying soil.

2. Geology

The archipelago of The Bahamas is comprised of a series of karst islands. The islands are predominantly low lying, with most of the topography less than 100 ft above sea level. All land higher than 24 ft or so formed through eolian transport processes. Rock formation between sea level and 24 ft above sea level is a mixture of marine, lacustrine and terrestrial limestone. These rock features were formed over periods of fluctuating sea levels (Curran and White, 1995).

2.1. Geologic Hazards

Due to the karst landscape, possible geologic hazards may include subterranean caverns and cavities. The failure of the ceilings of these cavities can create sinkholes.

The island of New Providence is located in an inactive seismic zone. Therefore, seismic hazards are not considered in this report.

3. Subsurface Investigation

3.1. Standard Penetration Test

A total of 12 borings were conducted at the site. At each boring location, a 4" solid flight auger was used to drill from the surface to a depth of 3 ft. Sampling was then conducted from 3 ft to 5 ft. Sampling then progressed at 3 ft intervals with drilling in between to a target depth of 50 ft (sample 3-5 ft, drill from 5-8 ft, sample from 8-10 ft and so forth). The top 3 ft of soil was not sampled as it was assumed that this layer has been altered considerably over time and will be altered during the course of construction and site development.

Sampling entails conducting a Standard Penetration Test (SPT), using 2" inner diameter split spoon. Blow counts were obtained in accordance with ASTM Standard D1586. The spoon was driven by dropping a 140 lb hammer freely over 30" onto the driving rods. The number of blows to progress the tip every 6" was counted and recorded, over an 18" sampling distance (a total of 3 blow count values per sample distance). The full 24" was not sampled to avoid compression of the soil within the split spoon in the event of over-driving. Soil samples were recovered where possible, and the recovery measured, photographed and documented accordingly.

If 50 blow counts failed to advance the tip 6", the penetration blow count was recorded as 50, with the progression in inches recorded. The hole is then drilled to the next sampling depth, and sampling is continued.

The boring logs are included in Appendix B. These values represent the 'raw' blow count values, before any correction factors are applied.

3.2. Test Pits

A total of 9 test pits were conducted at the site. A backhoe was used to excavate pits to a depth at which competent rock was observed. The cut face was observed and photographed, the depth below ground surface measured, and the excavation was backfilled. The results of the test pits are included in Appendix C.

3.3. Subsurface Profile

The upper 3 ft of soil was neglected as it was assumed that this layer has been altered considerably over time and will be altered during the course of construction and site development. The properties of this top layer were therefore not deemed critical in design considerations.

The subsurface was consistently poorly graded sand/sand gravel mixtures. The N values ranged from 5, which signifies loose substrate, to the maximum value of 100 (refusal), signifying very dense substrate.

The Borehole Logs can be seen in Appendix B.

3.4. Groundwater

The depth of the water surface beneath ground elevation was measured at the time of testing, and 24 hours later, for a total of two measurements per hole. This helps to determine whether ground water elevation is being influenced by tides or not. The salinity of the water was not tested. The water surface elevation measurements can be seen in the boring logs in Appendix B. The results were consistently between 4ft and 5ft below ground level at the time of drilling.

Tides in the region occur semidiurnally, meaning 2 high tides and 2 low tides occur over a 24-hour period. The tidal range is on the order of 3 ft on average. Other factors which may affect water surface elevations are the effects of hurricanes or other severe weather events, including heavy rainfall and storm surge.

3.5. Recommended Design Soil Parameters

Table 1. Recommended Design Soil Parameters

Angle of Internal Friction (ϕ,°)	Unit Weight (lb/ft^3)
30	95

4. Retaining Walls

Evaluation of the subsurface conditions encountered during the subsurface investigation indicates that impermeable walls should be constructed to retain the earth at the perimeter of the proposed marina.

The weakly cemented nature of the substrate makes it susceptible to erosion over the years, which could cause failure of the wall. Due to the commercial/industrial nature of the project, erosion could be accelerated as a result of propeller wash from maneuvering vessels.

The density of the substrate suggests that a cantilever wall system could be used for most of the wall length. Such systems include steel sheet piles (SSP) or a king post wall system, which is comprised of steel or concrete cantilevered piles at a specific spacing, with concrete panels between.

The walls may need to be anchored in areas where high surcharge loads are expected, i.e., the location of the travel lift piers. This will depend on the design of the travel lift system, and the anticipated loads induced on the soil within its proximity. The system can be designed to reduce or eliminate active forces on the retaining wall. The proposed design is not known at the time of writing this report.

Due to the commercial/industrial nature of the proposed development, it is recommended that the walls be designed with a minimum surcharge of 200 psf.

5. Foundations

The following sections provide recommendations on the foundation types to be used to construct the various structures proposed at the site. Proposed structures at the site include the following:

- Boat Barn
- Haul Out Facility including Travel Lift Piers
- Storage Lockers Facility
- Building for a Convenience Store and Offices
- Numerous Cottages
- Lodging Apartments/Units
- Restaurant
- Pool

Parking lots and staging areas are also proposed on site.

A combination of shallow and deep foundations will be required for the various structure types.

5.1. Shallow Foundations (Spread Footings)

5.1.1. Scour depth

Due to proximity to the sea, possible scour/undermining of foundations must be considered. The ground elevation is approx. +5'-0" relative to MSL. In severe storms, water levels can exceed +12'-0" above MSL. The post storm withdrawal of this water can cause severe erosion of surficial soils.

The assumed scour depth is 3'-0" below the existing grade.

The bottom of any spread footings should therefore be placed a minimum of 4'-0" below grade.

5.1.2. Lateral Earth Pressures

Proposed finish floor elevations will dictate the lateral earth pressures acting on stem walls, and thus spread footings. The width of the footings will be largely dependent on the finish floor elevations, and transition to existing grade. Footings will need to be sized accordingly to resist overturning and sliding.

5.1.3. Bearing Capacity

The upper soil layer ranges from Loose to Medium Dense. Minimum footing depths is governed by scour. Shallow foundations could be designed with soil contact pressures

on the order of 2,000 psf. Settlements on the order of 3/4 inches to 1 inch are estimated.

Minimum footing widths should be 24".

5.2. Deep Foundations

5.2.1. Axial Compression Resistance

Piles were designed in accordance with Design and Construction of Continuous Flight Auger (CFA) Piles/ACIP piles, Geotechnical Engineering Circular No. 8. Calculations were conducted for 16" – 24" diameter ACIP piles. The results of the calculations can be seen in Appendix C. Axial capacity of piles are dependent on both end bearing of the pile tip, and friction at the concrete-soil interface, for the embedded length of the pile.

The design axial loads are not known at the time of writing this report. Depths greater than 20 ft would provide a pile capacity greater than 45 tons for the 16" diameter piles and 92 tons for the 24" diameter piles.

Note that the design pile capacities provided above include an increased F.S. of 2.8 to account for site specific variables such as calcareous sands and potential voids associated with the karst topography and potential scour of surficial soils.

Additionally, the design capacities have been limited to reduce the dependence of the piles on end bearing, in accordance with industry best practice.

5.2.2. Uplift Resistance

Uplift capacity of piles are primarily dependent on the friction at the concrete-soil interface, for the embedded length of the pile. It is recommended that compression values be factored by 0.6 – 0.65 to estimate uplift resistance in cohesionless soils.

6. Earth Work

6.1. Site Preparation

The following sections provide recommendations regarding footing geometry, bearing elevations and bearing capacities.

6.2. Fill Placement and Compaction

Based on the existing ground elevations, fill material will likely be required to backfill the foundation within the footprint of the proposed buildings.

Fill material should consist of inorganic granular soils free from deleterious materials and should be approved by our firm. Backfill should have a maximum particle size of 3 inches. Limestone fill material should be placed in lifts not thicker than 12 inches. Lifts should be moisture conditioned as required. Each lift should be compacted to field dry densities of not less than 95 percent of the material's maximum dry density as determined by the Modified Proctor Compaction Test (ASTM D-1557).

The fill and backfill material must be placed under qualified engineering inspection and each lift must be tested to ensure conformance with the project specifications. In restricted areas where a small compactor must be used, the lift thickness should be reduced to 6 inches.

6.3. Trenches

Utility trenches should be located such that the bottom of the trench does not intersect a 1:1 slope projected downward from nearby footing bearing surfaces. Trench backfill should be compacted as described in Section 5.2.

6.4. Spread Footings

Where spread footings are to be constructed, the footing excavation should be evaluated by a qualified engineering inspection to confirm that recently placed fill materials have been compacted according to the project specifications and to evaluate variations in the natural subgrade materials.

6.5. Deep Foundations

ACIP piles are proposed for deep foundations. The installation of ACIP piles must be monitored by a qualified engineer to confirm drilling conditions, pile tip depths, and that grout head is maintained throughout the depth of the pile.

Special attention in karst regions must be given to the potential for grout loss during the installation of ACIP piles. If grout loss is experienced during installation, other methods may need to be considered.

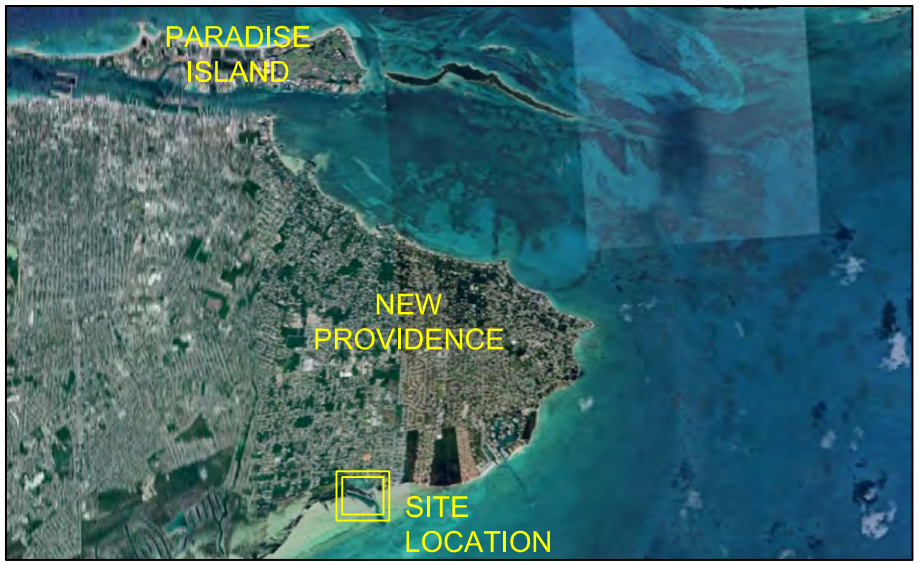
Additionally, the grout should be tested on site during installation of the piles and compressive strength specimens should be made and tested in a geotechnical laboratory to confirm the design grout strength.

Additional considerations for the ACIP piles include:

- The impact of salinity in the groundwater should be considered in developing the grout mix. The salinity levels have not been evaluated within the scope of this investigation.
- The piles should include appropriate reinforcing steel for lateral stresses and uplift according to the structural design.
- Potential for scouring of substrate around piles during severe storm events, which would reduce the length of pile in contact with surrounding soils, thus decreasing the overall capacities.

7. Appendix A

Figure 1: Site Location and Boring Location Plan
Figure 2: Site Masterplan



VICINITY MAP

SCALE: N.T.S.

BORING LOCATION PLAN

SCALE: N.T.S.

BRON
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#57 Raphia Close East
Airport Industrial Park
NASSAU, BAHAMAS
p 242-327-5348 f 242-327-4981

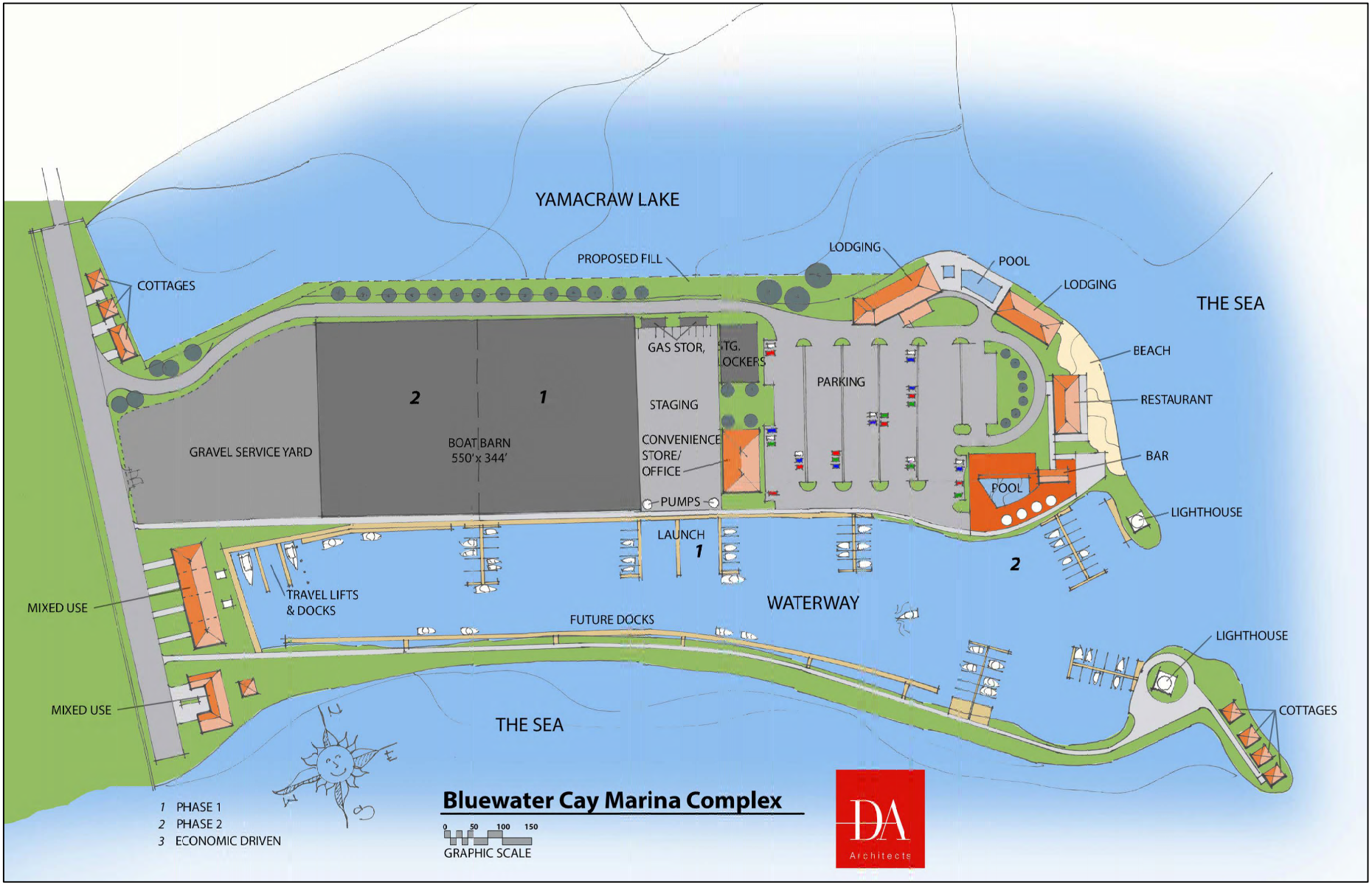
email. info@bebron.com
website.www.bebron.com

PROJECT NAME:
BLUE WATER CAY GEOTECHNICAL INVESTIGATION
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS

PROJECT #: 2021.064

DRAWING NAME:
VICINITY MAP AND BORING LOCATION PLAN

DATE:	FIGURE:	
07-07-2021	01	
SCALE: AS NOTED	DRAWN BY: K.S.	CHECKED BY: S.B.



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PROJECT NAME:
BLUE WATER CAY GEOTECHNICAL INVESTIGATION
YAMACRAW, NEW PROVIDENCE
THE BAHAMAS

PROJECT #: 2021.064

DRAWING NAME:
SITE MASTERPLAN

DATE:	FIGURE:	
07-07-2021	02	
SCALE: AS NOTED	DRAWN BY: K.S.	CHECKED BY: S.B.

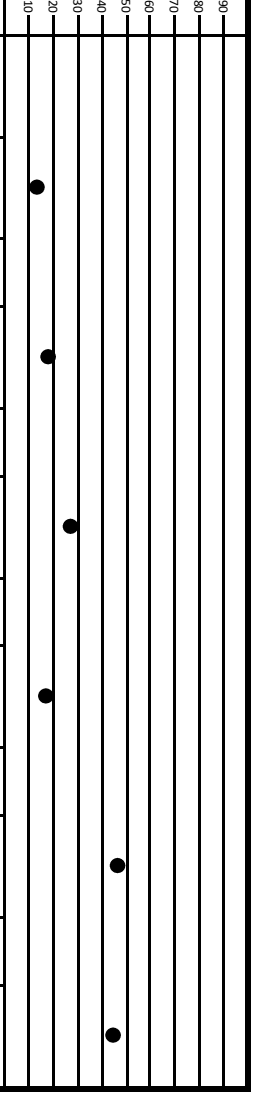
8. Appendix B

Boring Logs

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B1
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		June 7th 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded sand with gravel, beige, moist	14	7-5-6	11
5				
	SP - Poorly graded sand with gravel, beige, wet	21	8-9-9	18
10				
	SW - Well graded sand, beige and grey, wet	13	10-12-14	26
15				
	SW - Well graded sand, beige and grey, wet	19	2-2-14	16
20				
	SW - Well graded sand, beige and grey, wet	16	20-25-21	46
25				
	SW - Well graded sand, beige and grey, wet	16	9-18-26	44
30				

N Value Plot

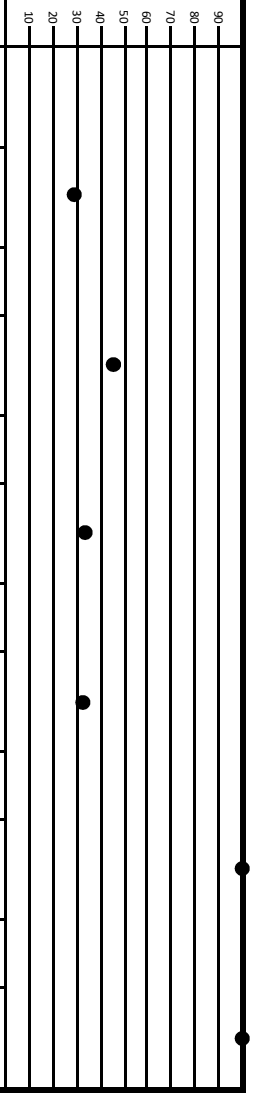


Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B2
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		June 3rd, 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	GW - Well graded gravel with silt and sand, beige moist	12	4-20-8	28
5				
	GW - Well graded gravel with silt and sand, beige moist	16	8-16-29	45
10				
	GP - Poorly graded gravel with sand, beige, wet	15	24-19-14	33
15				
	GP - Poorly graded gravel with sand, beige, wet	17	8-8-24	32
20				
	GP - Poorly graded gravel with sand, beige, wet	24	31-50/3	100
25				
	Auger Refusal - Boring Terminated	-	-	100
30				

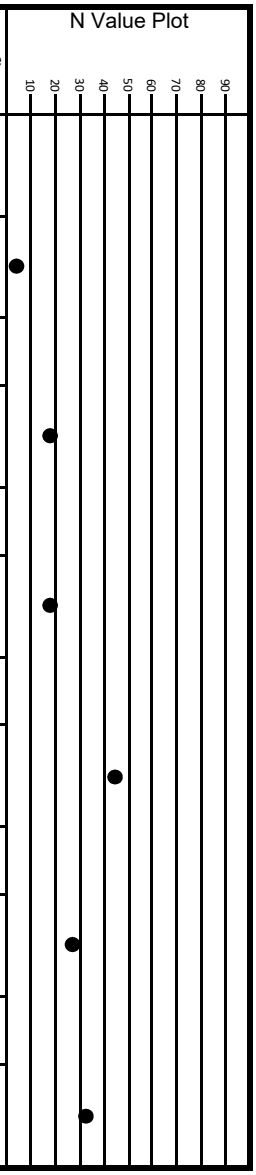
N Value Plot



Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B3
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		4
Drilling Contractor and Rig		Date
BRON B61		June 8th 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded sand, beige, moist	14	2-3-1	4
5				
	SP - Poorly graded sand with gravel, beige, wet	18	9-910	19
10				
	SP - Poorly graded sand with gravel, beige, wet	22	8-1008	18
15				
	SP - Poorly graded sand with gravel, beige, wet	21	11-17-27	44
20				
	SP - Poorly graded sand with gravel, beige, wet	17	10-10-16	26
25				
	SP - Poorly graded sand with gravel, beige, wet	24	9-15-18	33
30				

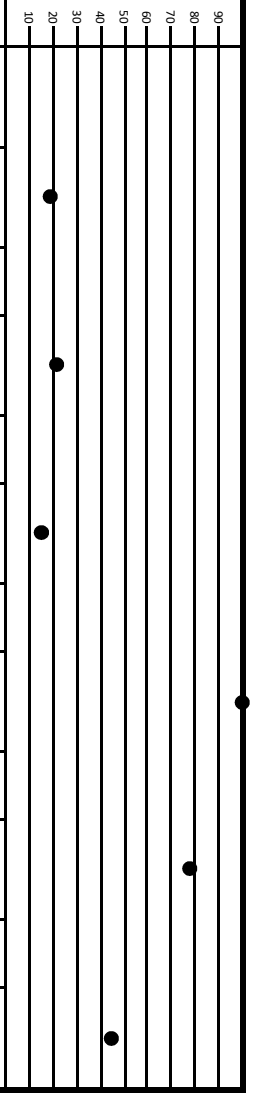


Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B4
Address		**Logged By**
Yamacraw, N.P.		D.B.
Boring Location		**Depth to Water Table**
		6
Drilling Contractor and Rig		**Date**
BRON B61		June 1st, 2021

BRON POSSIBILITIES UNLIMITED

Depth	Description	Recovery	Blow Counts	N Value	N Value Plot
0					
	SP - Poorly graded silty sand with gravel, beige, moist	15	5-7-12	19	
5					
	SP - Poorly graded silty sand with gravel, beige, wet	16	6-9-12	21	
10					
	GP - Poorly graded gravel with sand, beige, wet	24	7-8-7	15	
15					
	GP - Poorly graded gravel with sand, beige, wet	20	8-50/1	100	
20					
	GP - Poorly graded gravel with sand, beige, wet	24	5-27-40	67	
25					
	GP - Poorly graded gravel with sand, beige, wet	24	10-20-24	44	
30					

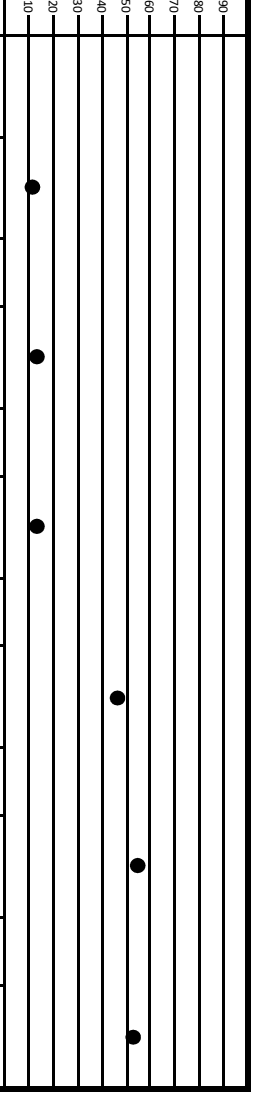


Soil Density		**Soil Consistency**	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B5
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		June 9th, 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded silty sand with gravel, beige, moist	24	7-4-7	11
5				
	SP - Poorly graded silty sand with gravel, beige,wet	14	17-8-5	13
10				
	SP - Poorly graded silty sand with gravel, beige,wet	14	7-7-7	14
15				
	GW - Well graded gravel with silt and sand, beige moist	21	12-18-26	44
20				
	GW - Well graded gravel with silt and sand, beige moist	24	23-23-32	55
25				
	GW - Well graded gravel with silt and sand, beige moist	17	12-19-33	52
30				

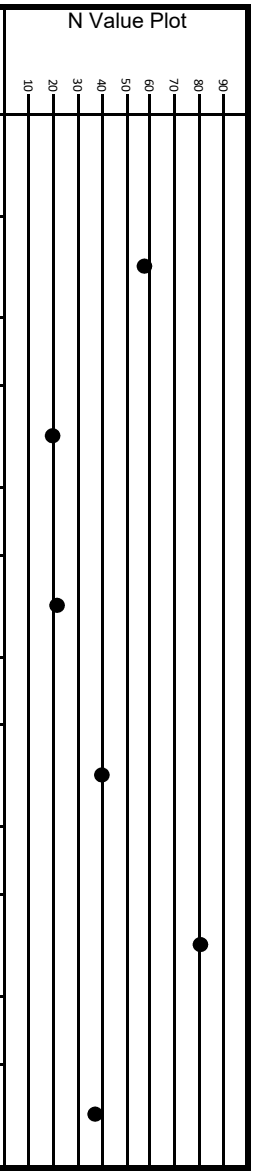
N Value Plot



Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B6
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		May 31st 2021

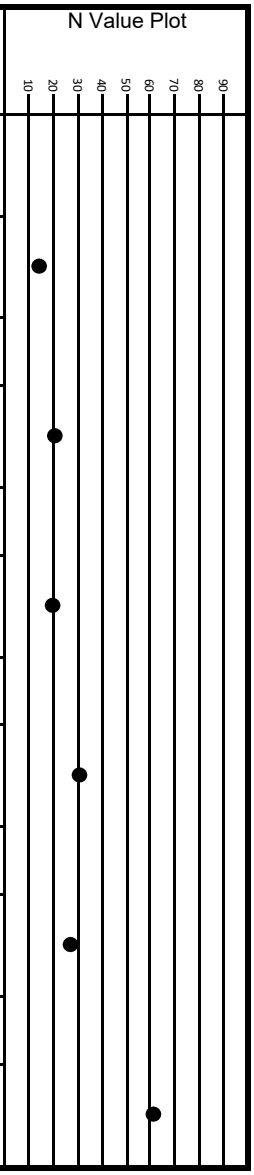
Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded sand with gravel, beige, moist	6	15-34-23	57
5				
	SP - Poorly graded sand with gravel, beige, wet	18	8-8-12	20
10				
	SW - Well graded sand, beige and grey, wet		9-11-12	23
15				
	SW - Well graded sand, beige and grey, wet		11-14-26	40
20				
	SW - Well graded sand, beige and grey, wet		5-33-48	81
25				
	SW - Well graded sand, beige and grey, wet		8-21-16	37
30				



Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B7
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		June 10th, 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	GW - Well graded gravel with silt and sand, beige moist	20	6-10-3	13
5				
	GW - Well graded gravel with silt and sand, beige moist	24	9-10-11	21
10				
	GP - Poorly graded gravel with sand, beige, wet	8	11-8-12	20
15				
	GP - Poorly graded gravel with sand, beige, wet	24	6-10-21	31
20				
	GP - Poorly graded gravel with sand, beige, wet	24	9-19-7	26
25				
	GP - Poorly graded gravel with sand, beige, wet	24	23-23-39	62
30				

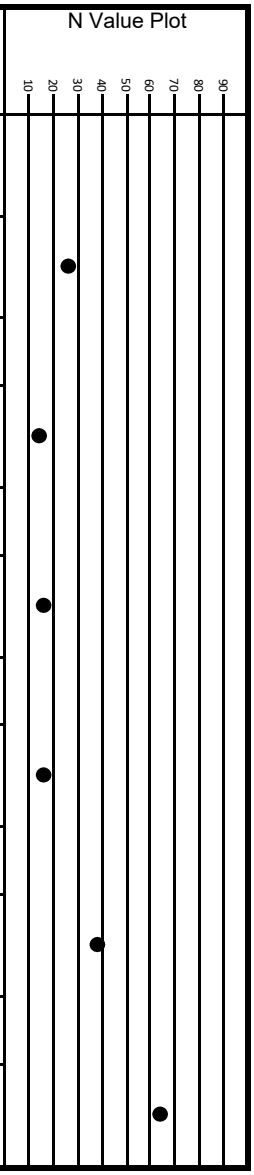


Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B8
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		6
Drilling Contractor and Rig		Date
BRON B61		May 28th 2021

BRON POSSIBILITIES UNLIMITED

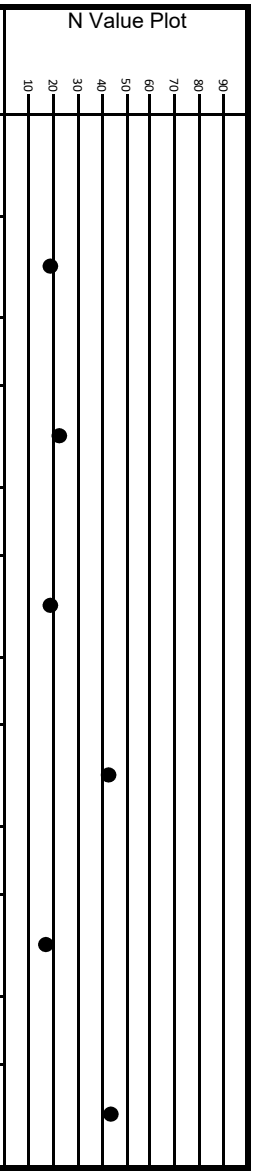
Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded sand, beige, moist	16	8-9-16	25
5				
	SP - Poorly graded sand with gravel, beige, wet	14	2-6-8	14
10				
	SP - Poorly graded sand with gravel, beige, wet	24	5-8-8	16
15				
	SP - Poorly graded sand with gravel, beige, wet	24	4-4-12	16
20				
	SP - Poorly graded sand with gravel, beige, wet	24	20-14-23	37
25				
	SP - Poorly graded sand with gravel, beige, wet	20	19-28-35	63
30				



Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B9
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		6
Drilling Contractor and Rig		Date
BRON B61		May 26th 2021

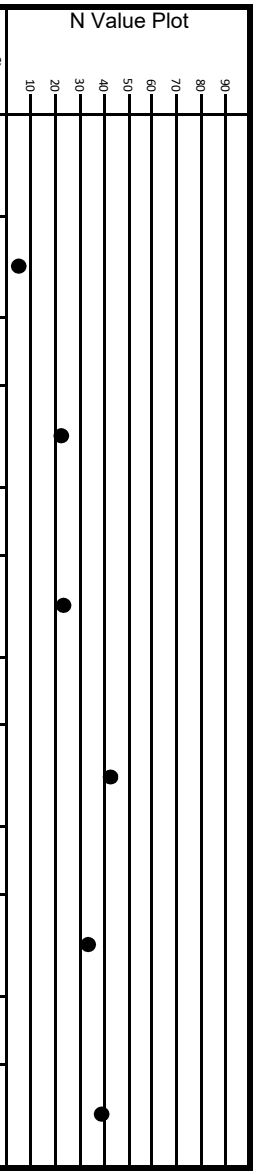
Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded sand with gravel, beige, moist	18	8-7-11	18
5				
	SP - Poorly graded sand with gravel, beige, wet	18	10-11-10	21
10				
	SW - Well graded sand, beige and grey, wet	12	3-6-11	17
15				
	SW - Well graded sand, beige and grey, wet	19	7-16-26	42
20				
	SW - Well graded sand, beige and grey, wet	24	13-9-7	16
25				
	SW - Well graded sand, beige and grey, wet	16	12-22-22	44
30				



Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B10
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		May 27th 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	GW - Well graded gravel with silt and sand, beige moist	6	4-1-4	5
5				
	GW - Well graded gravel with silt and sand, beige moist	18	11-11-11	22
10				
	GP - Poorly graded gravel with sand, beige, wet		7-7-17	24
15				
	GP - Poorly graded gravel with sand, beige, wet		15-18-24	41
20				
	GP - Poorly graded gravel with sand, beige, wet		16-12-21	33
25				
	GP - Poorly graded gravel with sand, beige, wet		14-13-26	39
30				

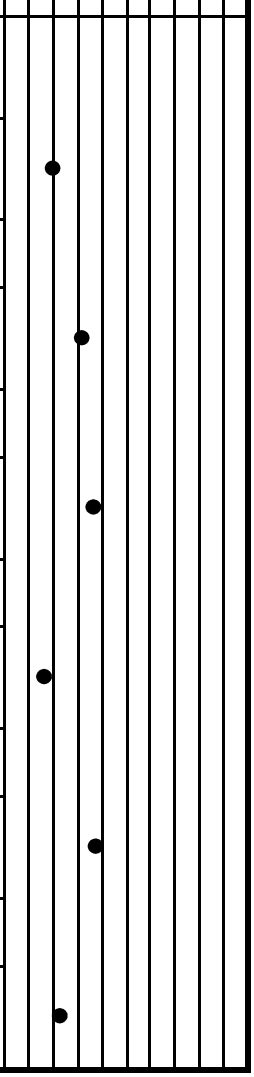


Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B11
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		May 26th 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	SP - Poorly graded sand with gravel, beige, moist	6	8-7-13	20
5				
	SP - Poorly graded sand with gravel, beige, wet	18	11-14-18	32
10				
	SW - Well graded sand, beige and grey, wet		16-17-19	36
15				
	SW - Well graded sand, beige and grey, wet		5-5-11	16
20				
	SW - Well graded sand, beige and grey, wet		14-18-19	37
25				
	SW - Well graded sand, beige and grey, wet		11-11-11	22
30				

N Value Plot



Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

Project	Job Number	Boring Number
Blue Water Cay Marina	2021.064	B12
Address		Logged By
Yamacraw, N.P.		D.B.
Boring Location		Depth to Water Table
		5
Drilling Contractor and Rig		Date
BRON B61		May 27th 2021

Depth	Description	Recovery	Blow Counts	N Value
0				
	GW - Well graded gravel with silt and sand, beige moist	6	4-6-11	17
5				
	GW - Well graded gravel with silt and sand, beige moist	18	5-7-5	12
10				
	GP - Poorly graded gravel with sand, beige, wet		6-10-12	22
15				
	GP - Poorly graded gravel with sand, beige, wet		11-16-32	48
20				
	GP - Poorly graded gravel with sand, beige, wet		23-21-25	46
25				
	GP - Poorly graded gravel with sand, beige, wet		5-22-17	39
30				

N Value Plot

10 20 30 40 50 60 70 80 90

Soil Density		Soil Consistency	
N = 0-4	Very Loose	N = 0-2	Very Loose
N = 4-10	Loose	N = 2-4	Loose
N = 10-30	Medium Dense	N = 4-8	Medium Dense
N = 30-50	Dense	N = 8-15	Dense
N >50	Very Dense	N = 15-30	Very Dense
		N >30	Hard

9. Appendix C

Test Pit Results

Project	Job Number	Test Pit Number	
Blue Water Cay	2021.064	TP01	
Address			
Yamacraw, N.P.		D.B.	
Test Pit Location		Depth to Water Table	
		N/A	
Contractor and Rig		Date	
BRON BACKHOE		May 26th 2021	

Depth	Description of Face	Notes
0 1 2 3	Clean limestone fill - tan	Walls relatively stable @ vertical
4 5 6 7 8 9 10 15 20 25 30	4'-4" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP02
Address		
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

Depth	Description of Face	Notes
0 1 2 3 4 5 6 7 8 9	Clean limestone fill - tan Clean limestone fill - dark brown	Walls relatively stable @ vertical Water @ 10'
10 15 20 25 30	10'-5" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP03
Address		
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

Depth	Description of Face	Notes
0 1 2	Clean limestone fill - tan	Walls relatively stable @ vertical
3 4 5 6	Clean limestone fill - dark brown	
7 8 9 10 15 20 25 30	6'-0" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP04
Address		
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

BRON POSSIBILITIES UNLIMITED

Depth	Description of Face	Notes
0 1 2	Clean limestone fill - tan	Walls relatively stable @ vertical
3 4 5 6	Clean limestone fill - dark brown	
7 8 9 10 15 20 25 30	6'-4" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP05
Address		
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

Depth	Description of Face	Notes
0 1 2 3 4	Clean limestone fill - tan	Walls relatively stable @ vertical
	Clean limestone fill - grey/dark brown	
5 6 7 8 9 10 15 20 25 30	4'-5" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP06
Address		Logged By
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

BRON
POSSIBILITIES UNLIMITED

Depth	Description of Face	Notes
0 1 2 3 4 5	Clean limestone fill - tan	Walls relatively stable @ vertical. Water @ 5' depth
6 7 8 9 10 15 20 25 30	5'-2" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP07
Address		Logged By
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

Depth	Description of Face	Notes
0 1 2	Clean limestone fill - tan	Walls relatively stable @ vertical
3 4 5 6 7 8 9 10 15 20 25 30	3'-0" total depth (refusal)	

Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP08
Address		Logged By
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

Depth	Description of Face	Notes
0 1 2 3 4 5	Clean limestone fill - tan	Walls relatively stable @ vertical
6 7 8 9 10 15 20 25 30	5'-4" total depth (refusal)	

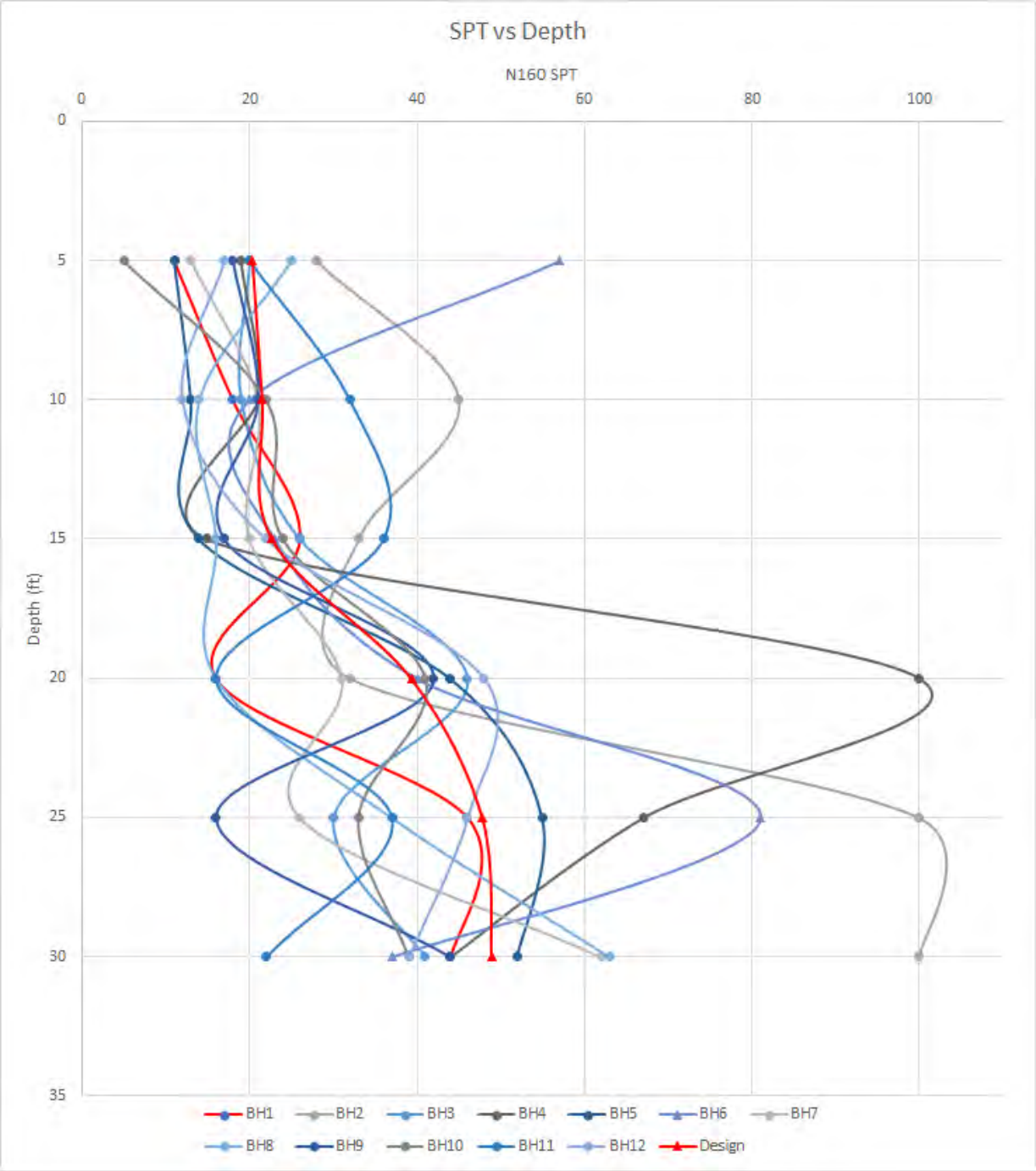
Project	Job Number	Test Pit Number
Blue Water Cay	2021.064	TP09
Address		Logged By
Yamacraw, N.P.		D.B.
Test Pit Location		Depth to Water Table
		N/A
Contractor and Rig		Date
BRON BACKHOE		May 26th 2021

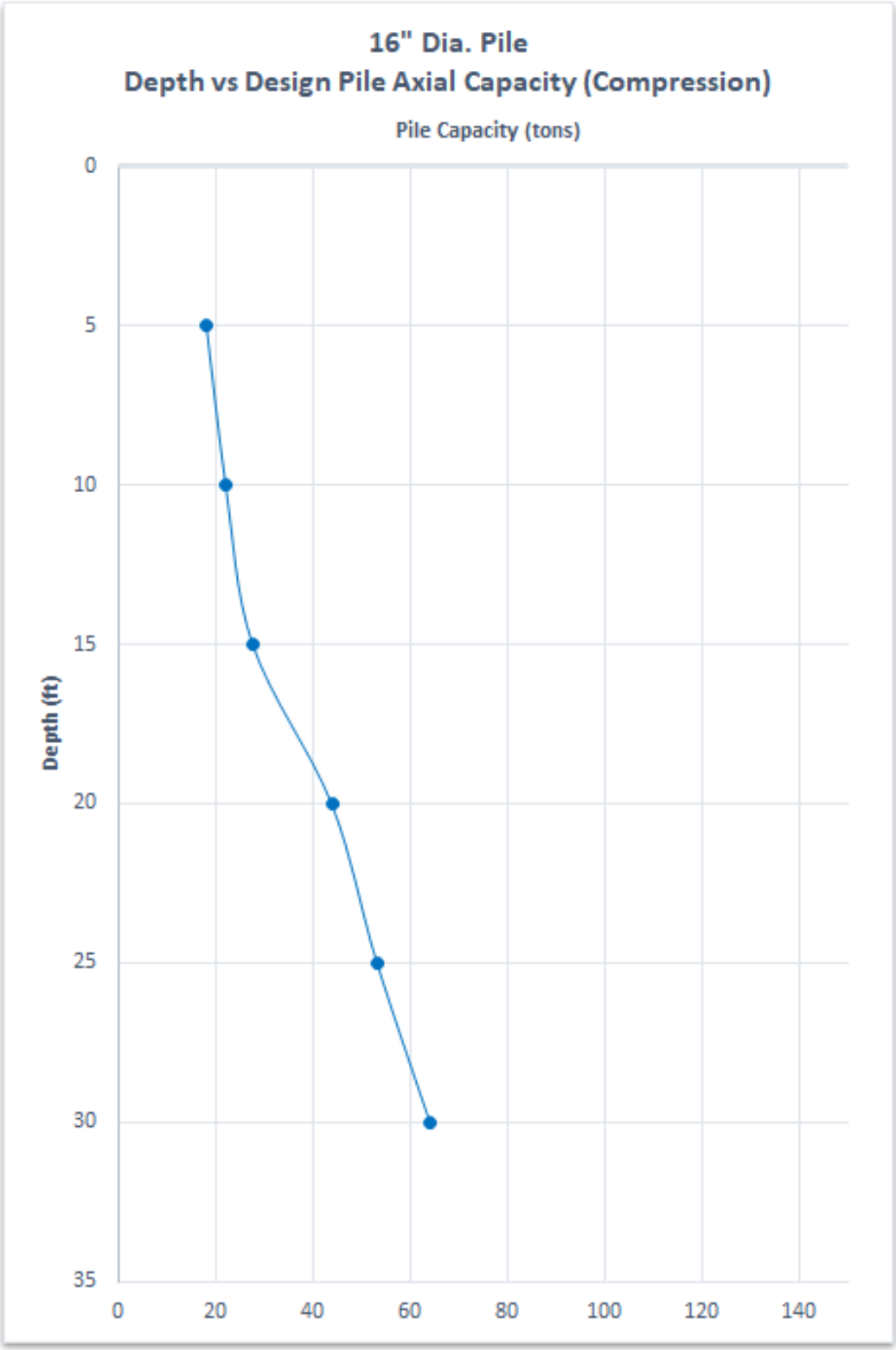
BRON
POSSIBILITIES UNLIMITED

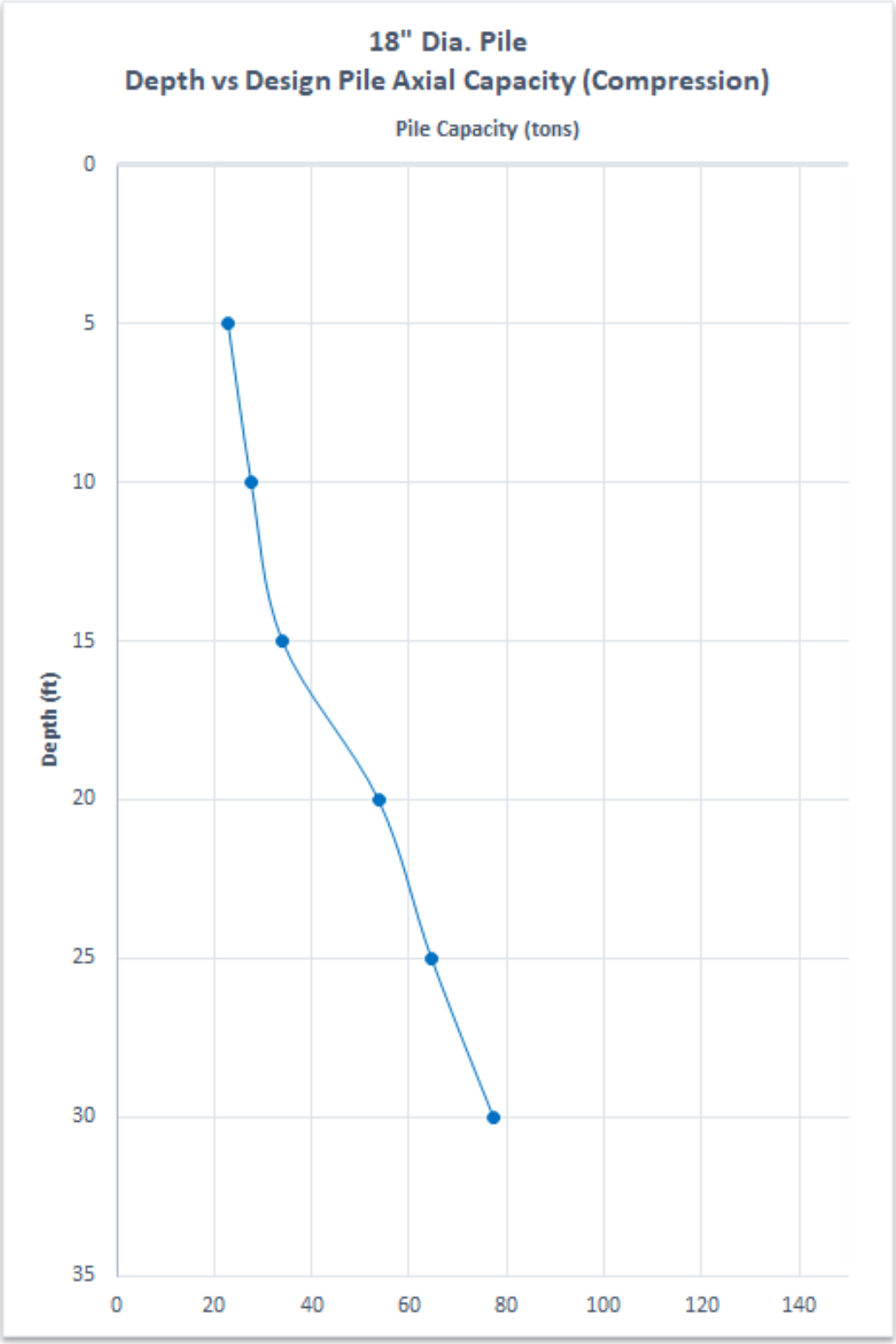
Depth	Description of Face	Notes
0 1 2 3	Clean limestone fill - tan	Walls relatively stable @ vertical
4 5 6 7 8 9 10 15 20 25 30	3'-4" total depth (refusal)	

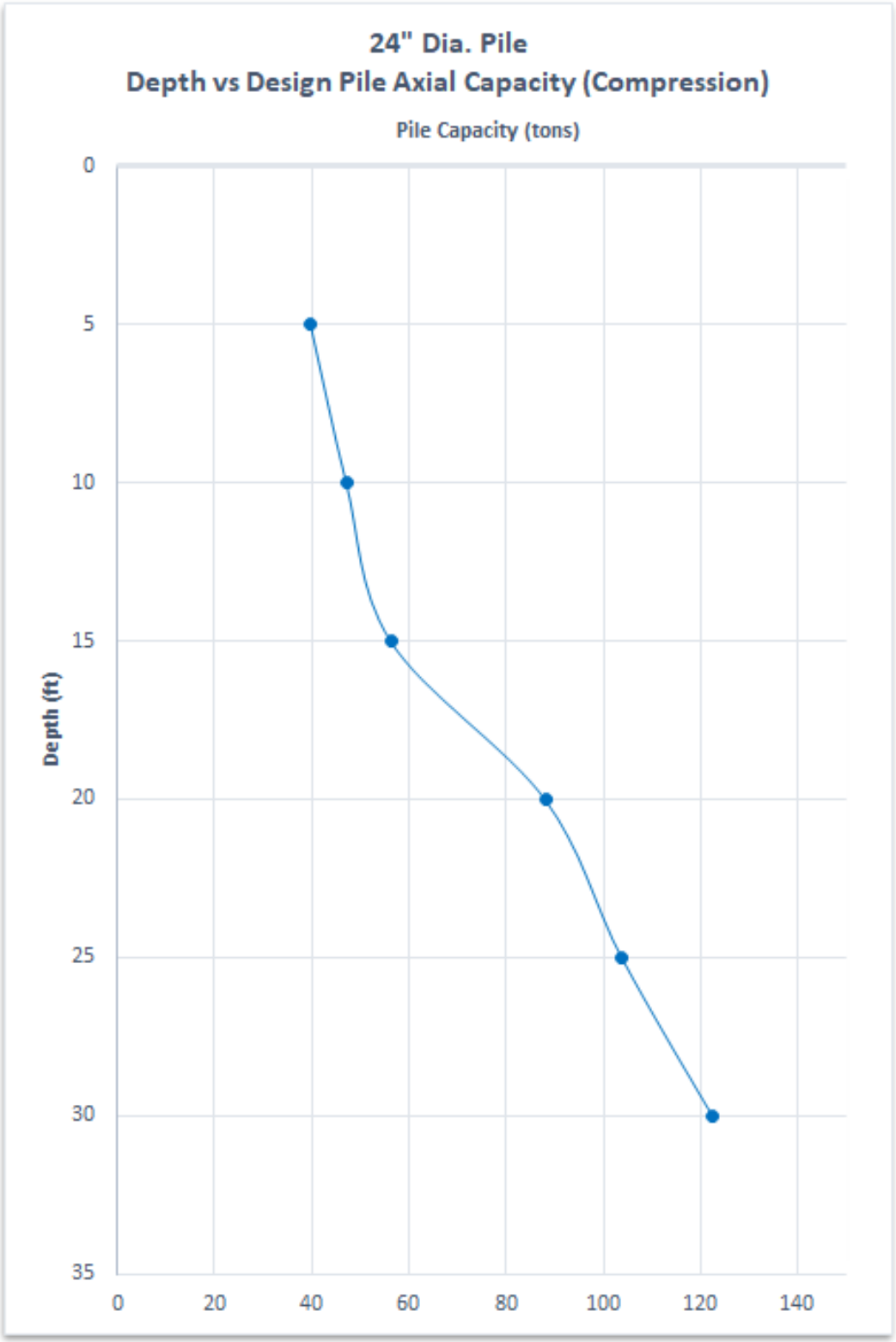
10. Appendix D

Pile Calculations


SPT vs Depth
N160 SPT
0
20
40
60
80
100
0
5
10
15
20
25
30
35
Depth (ft)
BH1
BH2
BH3
BH4
BH5
BH6
BH7
BH8
BH9
BH10
BH11
BH12
Design


16" Dia. Pile
Depth vs Design Pile Axial Capacity (Compression)
Pile Capacity (tons)
Depth (ft)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140


18" Dia. Pile
Depth vs Design Pile Axial Capacity (Compression)
Pile Capacity (tons)
Depth (ft)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140


24" Dia. Pile
Depth vs Design Pile Axial Capacity (Compression)
Pile Capacity (tons)
Depth (ft)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140

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APPENDIX G – MARINA FLUSHING ANALYSIS REPORT

MARINA FLUSHING ANALYSIS REPORT

LEGENDARY MARINA RESORT AT BLUE WATER CAY

YAMACRAW

NEW PROVIDENCE, THE BAHAMAS

Prepared By:
BRON Limited

Prepared For:
Legendary Marine Bluewater Cay Ltd.

BRON File No.: 2021-117

April 27, 2022

TABLE OF CONTENTS

1 INTRODUCTION

BRON Ltd. (BRON) was contracted to conduct a flushing analysis for the proposed Bluewater Cay Marina (Figure 1-1). The objective of this study is to investigate the flushing performance of the proposed marina under various tide and wind conditions in the case of accidental spills within the confines of the proposed marina, as well as to ensure that the marina and associated facility does not experience stagnation and water quality degradation, which could be harmful to marine life in the marina basin.

Figure 1-1 Location Map of the Proposed Bluewater Cay Marina, New Providence, Bahamas.

Figure 1-2 shows the configuration of the proposed marina. The southwest marina boundary is to be extended seaward, with shore protections installed along the renourished beach and the removal of the existing southwest rock ridge breakwater. Rubble mound groynes are proposed to be installed along the southern shoreline and the beach nourished.

The proposed north marina basin will be bound by a seawall (sheet-pile bulkhead) that follows the green line in the layout (Figure 1-2).

A breakwater is also proposed to be constructed offshore east of the marina entrance as shown in Figure 1-2.

Figure 1-2 Configuration of the Proposed Bluewater Cay Marina overlaid with Aerial.

BRON was contracted to lead the project, including field investigation, data collection, modelling, and a comprehensive desktop site investigation to supplement the modelling. The goal of the modelling was to investigate the flushing capacity of the marina under operational (i.e., day-to-day) conditions to support operations and permitting activities. Modelling was undertaken using DHI's MIKE21 FM numerical model to simulate the mass transport (advection / dispersion) of a conservative constituent (tracer) in the basin and its dispersion patterns under tidal and wind conditions. Several cases were tested to check the sensitivity of the tracer behavior to variables such as tracer placement and prevailing wind conditions.

The model was verified by comparing the results to actual recorded tide and current data.

Table 1.1 Tidal Benchmarks near the Proposed Project Site

Tide Levels	Tide Level (m-MSL)	Tide Level (ft-MSL)
Mean Higher High Water (MHHW)	0.48	1.57
Mean High Water (MHW)	0.39	1.28
Mean Sea Level (MSL)	0.00	0.00
Mean Low Water (MLW)	-0.40	-1.31
Mean Lower Low Water (MLW)	-0.41	-1.35

2 MARINA FLUSHING PERFORMANCE CRITERIA

The modeling results were compared to published criteria by the Department of Environmental Planning and Protection (DEPP), formerly the Bahamas Environmental Science and Technology (BEST) Commission and the United States Environmental Protection Agency (EPA).

Hydrodynamic modeling is required by DEPP for the approval of new marinas. The requirement set forth by DEPP is that new marinas should flush 90% within a 24-hour period. However, DEPP does not provide further guidance literature related to the design or extent of these investigations. Pertinent guidance and supporting information relating the design and approval of new marinas is found below, as extracted from http://water.epa.gov/polwaste/nps/czara/ch5-2a.cfm:

- The EPA management measure is intended to be applied to new and expanding marinas.
- Maintaining water quality within a marina basin depends primarily on flushing as determined by water circulation within the basin (Tsinker, 1992);
- The objective of the marina siting and design management measures is to ensure that marinas and ancillary structures do not cause direct or indirect adverse water quality impacts or endanger fish, shellfish, and wildlife habitat both during and following marina construction.
- Circulation and flushing play important roles in the distribution and dilution of potential contaminants.
- In areas where tidal ranges do not exceed 1 meter, as in the southeastern United States, a flushing reduction (the amount of a conservative substance that is flushed from the basin) of 90 percent over a 24-hour period has been recommended. (The same as the DEPP requirement).

3 GENERAL SITE OBSERVATIONS

The site is located on the southeastern shores of New Providence. There is a very shallow bar that outcrops approximately 100 m – 200 m seaward, running almost parallel to the shoreline. The seabed slopes gently seaward, with a consistent seabed depth of 1m – 2m up to approximately 400m offshore.

The trade winds vary between the E and SE in the summer months. In the winter months, when cold fronts arrive, the wind blows out of the NW - NE.

4 MODEL SETUP

Bathymetric data was obtained by BRON and supplemented with data extracted from digital nautical charts. The bathymetric data was used in combination with both chart data and the proposed basin and navigation channel depths to create the bathymetry within the model domain. The model domain extended approximately 6 km offshore from the basin location. Figure 4-1 shows an overview of the model domain and MIKE21 fine-grid mesh, while Figure 4-2 presents the model mesh of the proposed marina including the proposed entrance channel and marina configuration.

The hydrodynamic model was validated using tidal gauge and current meter measurements from September to October 2014. The MIKE21 Global Tide model that contains height and phase for each tidal constituent was used for the offshore boundary conditions. Figure 4-3 shows the locations of the tide gauge and current meter, which are close to the project site. Figure 4-4 and Figure 4-5 present

comparisons of the modeled and measured water surface elevation and current, respectively. The results show that representative tidal amplitudes were in the range of 0.5 m and local (tidal) currents were at the order of 0.05 to 0.1 m/s oscillating in line with the shoreline orientation.

For the flushing study, the model was primarily driven by a combination of neap tide and wind forcing. The neap tide produces the smallest current velocities in the harbor and therefore yields a conservative assessment of the marina flushing time. A constant wind speed was specified to the whole domain to accurately simulate the effects of wind set-up and wind-driven current. The hydrodynamic model was first run for 12 hours to initiate the tidal currents before introducing the tracer. Each simulation lasted for 3 days using 1-minute time steps.

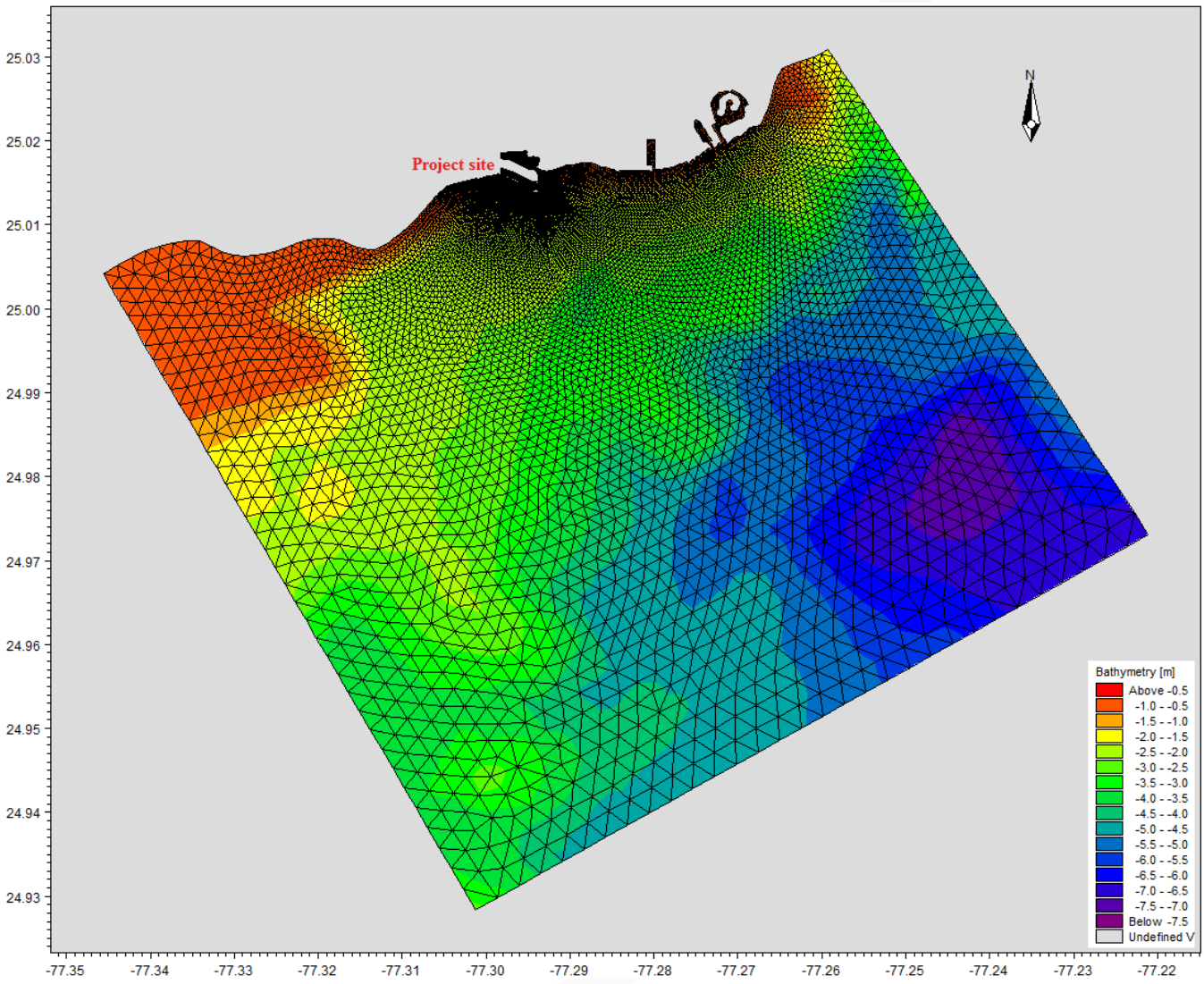


Figure 4-1 Mike21 FM model mesh and bathymetry.

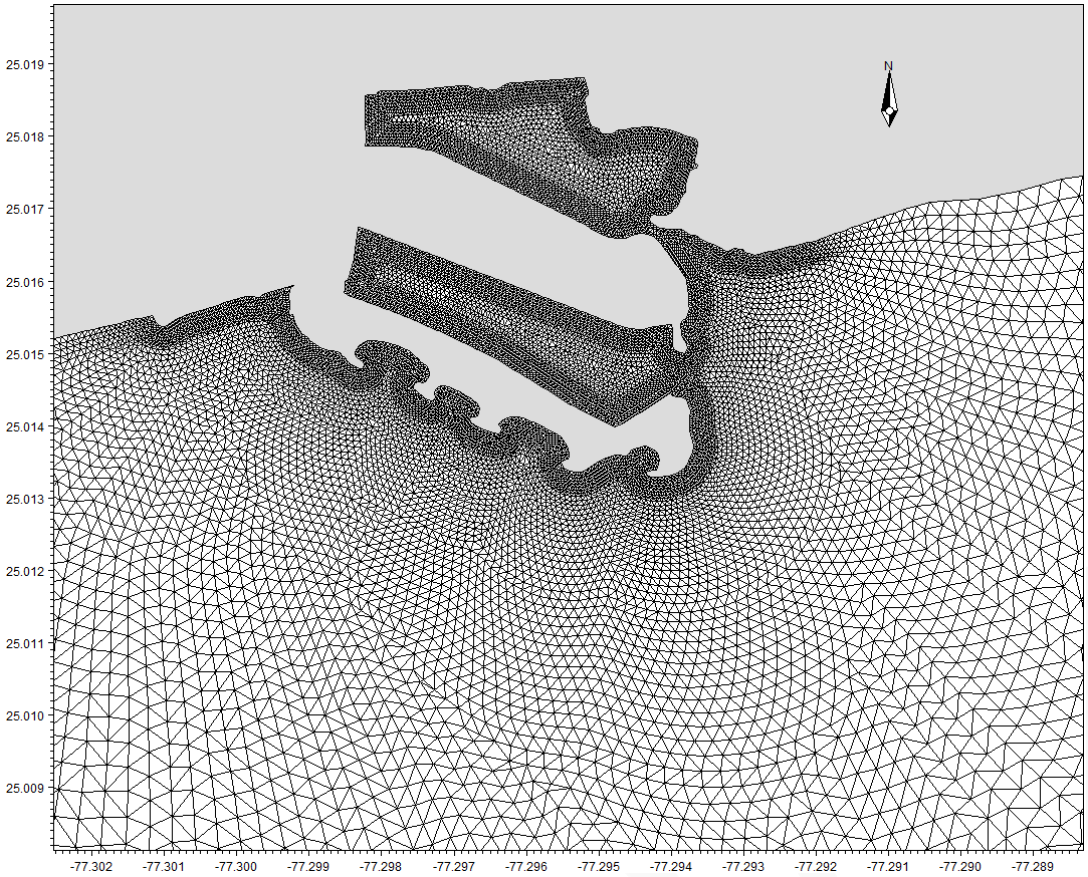


Figure 4-2 Mike21 FM model mesh of the proposed marina.

Figure 4-3 Locations of the Tide Gauge and Current Meter.

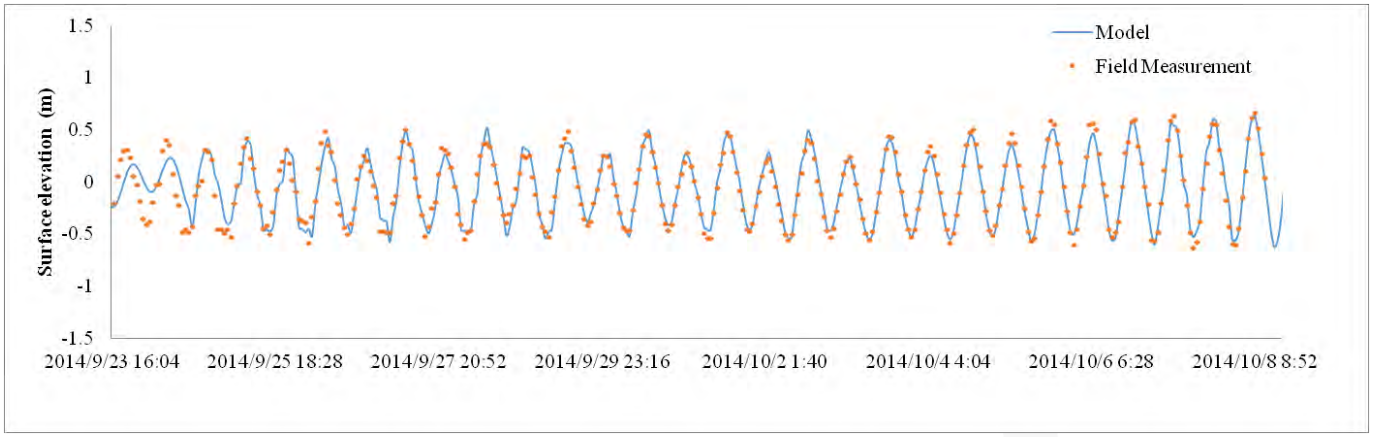
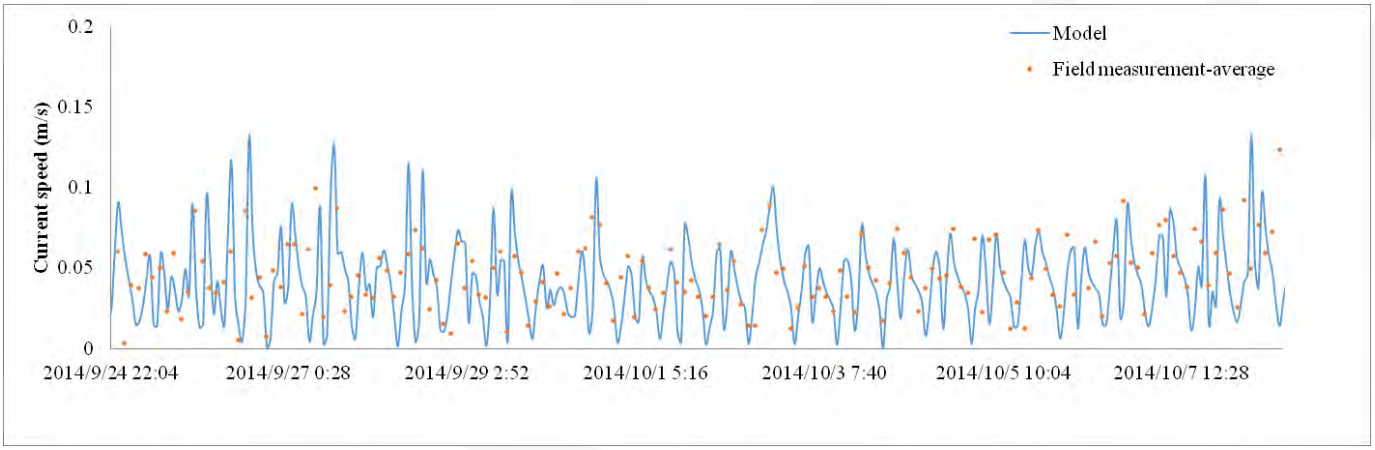


Figure 4-4 Modelled and Measured Tidal Water Level (m-MSL).



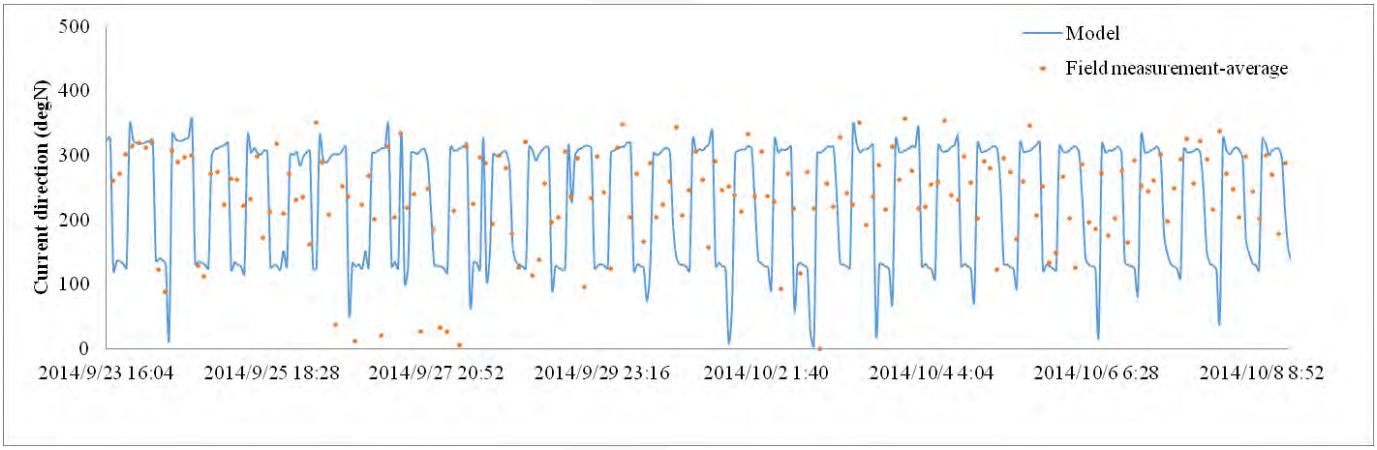


Figure 4-5 Modelled and Measured Current Speed (Top) and Direction (Bottom)

5 TEST CONDITIONS

Various test conditions were simulated in the model to compare to a 'base case' condition that involved filling the entire marina basin with an initial tracer concentration of 100 mg/L. The location of the tracer was then varied, and typical winds (from a previous report using data from Nassau Airport data) were applied to investigate the effect on basin flushing and contaminant dispersion. Although the location and extent of the tracer was varied throughout the test program, the initial concentration was 100 mg/L in all the simulations. The following test conditions were investigated in the MIKE21 FM model:

Table 5.1 Model Tests Settings

Case	Tracer location	Wind conditions	
		Speed (m/s)	Direction (deg)
Base Case	Full Basin	4.2	130
Case 1	NW Corner	4.2	130
Case 2	SW Corner	4.2	130
Case 3	SE Corner	4.2	130
Case 4	NE Corner	4.2	130

6 RESULTS AND OBSERVATIONS

I. Base Case:

Figure 6-1 shows the variations of the tracer concentration distribution from Day 0 to Day 3. As the figure shows dispersion pattern over the model run, the NW and SW corners are the most critical corners in the basin.

Figure 6-2 shows the locations of the four sampling points where the time series of tracer concentration (Figure 6-3) was extracted. At the end of the first 24 hours, the concentration at the northeast and southeast corners varied between 20 mg/L to 40 mg/L, while the northwest and southwest corners formed contaminant stagnation with unchanged concentration (Figure 6-3).

The conclusion is that the basin did not flush entirely under this condition. However, this case is not realistic because it is unlikely that a contaminant would be released over the entire area and over the full depth of water column simultaneously. A more realistic case with a corner of the marina contaminated was investigated in Case 1.

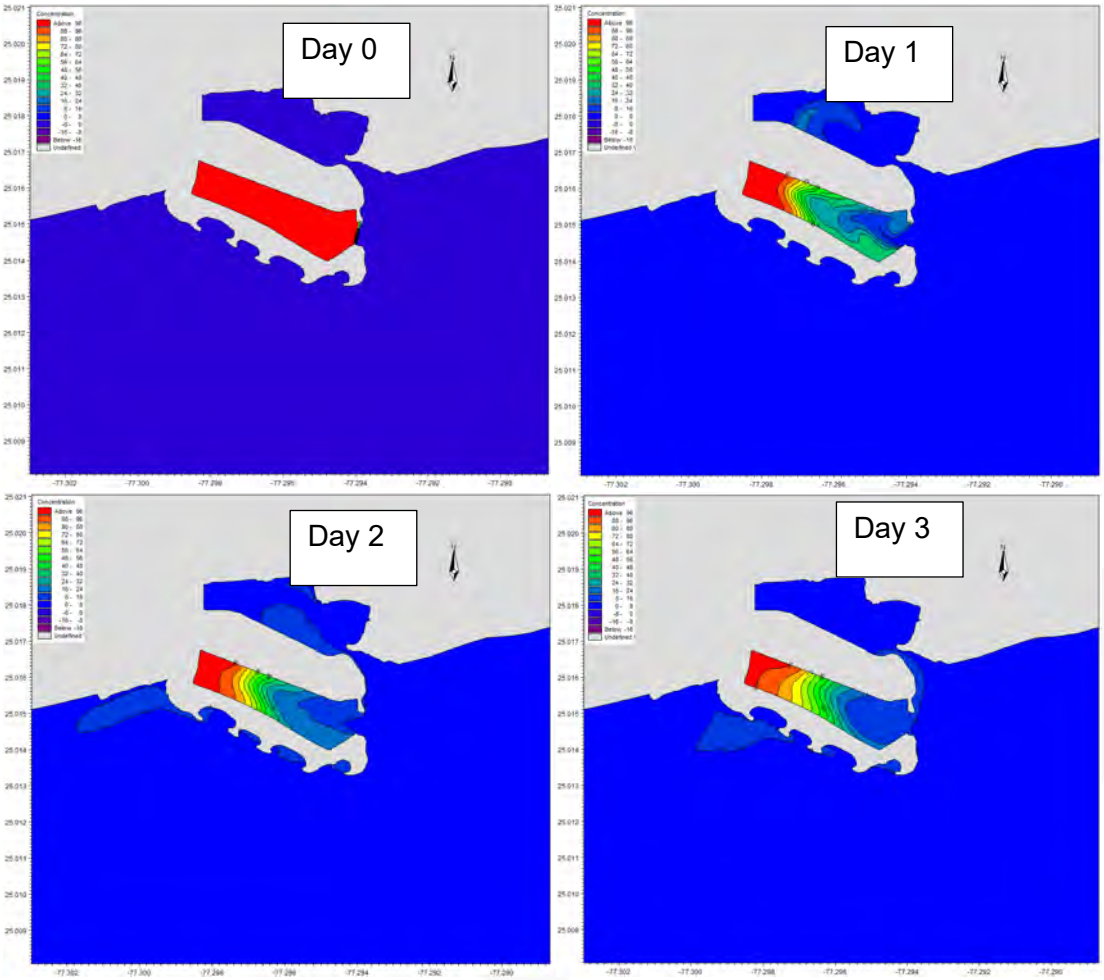


Figure 6-1 Tracer Concentrations at Various Time Steps – Base Case.

Figure 6-2 *Sample locations in the marina for the model results.*

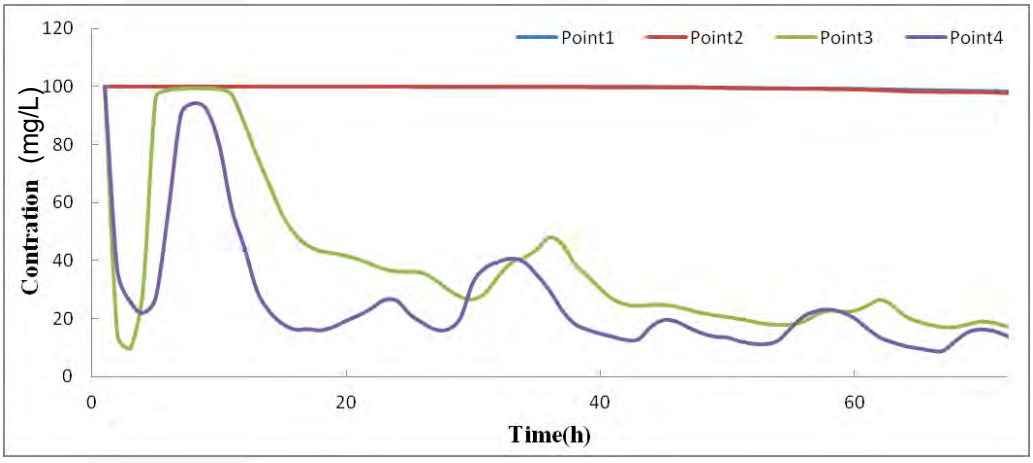


Figure 6-3 *Time series of tracer concentrations for Case 1 at four sampling locations.*

II. Case 1:

It is more likely that a contaminant would be released in high concentration in a localized area within the basin (e.g., a fuel spill). Case 1 simulates the case in which the tracer was released in the NW corner of the basin (Figure 6-4). The contaminated area is 350 m²; and the same area will be used for Cases 2 to 4. It was found that the highest concentration within the basin (at Point 1 as shown in Figure 6-2) after 24 hours of tracer release was below 10 mg/L (Figure 6-5). This shows that the basin would meet EPA standards for a localized spill, under a tide with mild wind condition. Noticeably, the concentration at point 1 decreased fast in the first 24 hours then remained around 10mg/L until the end of the simulation. If the initial contaminated area is greater than 350 m², the EPA standard may not be satisfied.

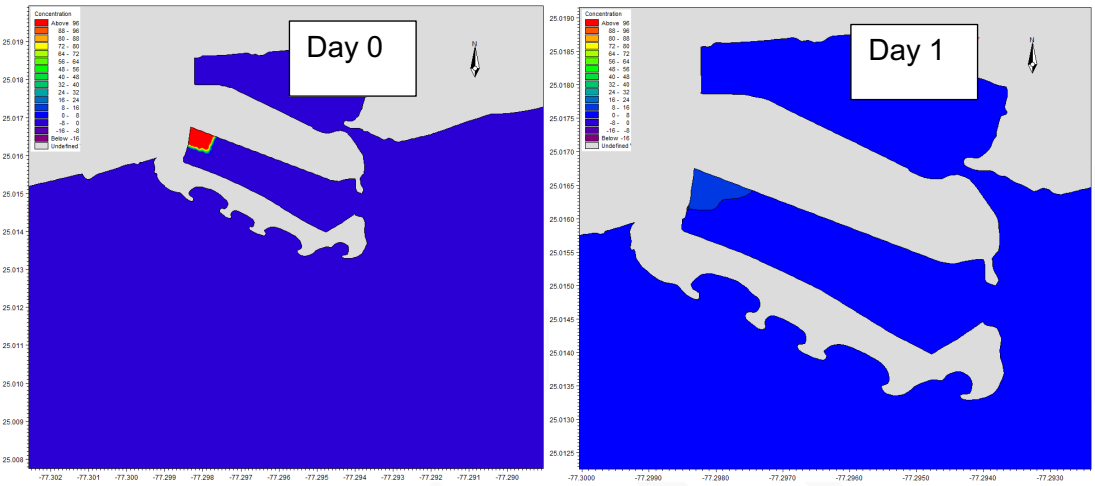


Figure 6-4 Tracer Concentrations at Various Time Steps – Case 1.

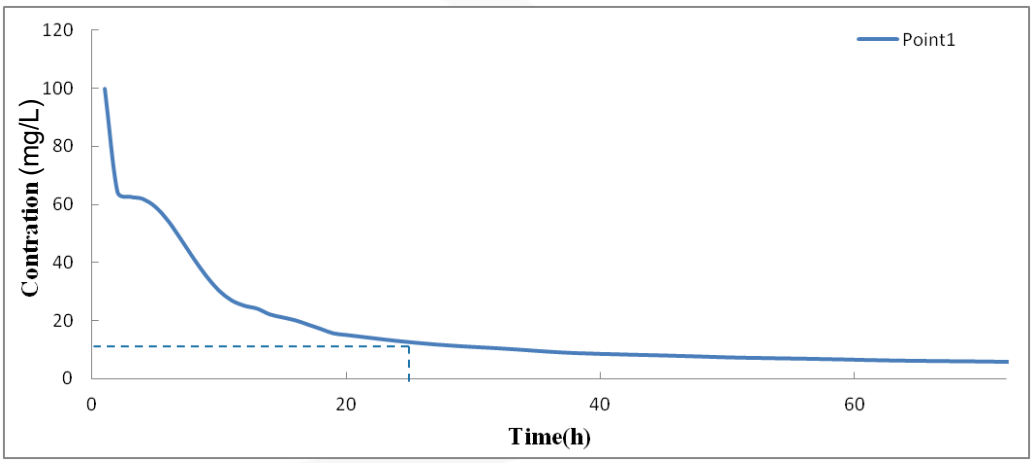


Figure 6-5 Time series of tracer concentrations for Case 1 at sampling point 1 where the greatest tracer concentration was observed.

III. Case 2:

This case demonstrates a typical wind condition with placement of the tracer in the southwest corner. As Figure 6-6 shows that the basin circulation direction with typical wind is clockwise; therefore, contaminants in the SW corner travel the longest distance to be flushed out of the basin. As such, this case represents the worst-case scenario for localized contamination. Similar to Case 1, the concentration recorded at Point 2 within the basin after 24 hours reduces below 10 mg/L (Figure 6-7). The concentration decreased much slower after 24 hours till the end of the simulation. The basin meets EPA standards when the contaminated area is 350 m² or under but could fail if a larger area was contaminated. Cases 1 and 2 show that the flushing performance of the NW and SW corners is weak such that the concentration remained a noticeable amount (around 10 mg/L) after 72 hours.

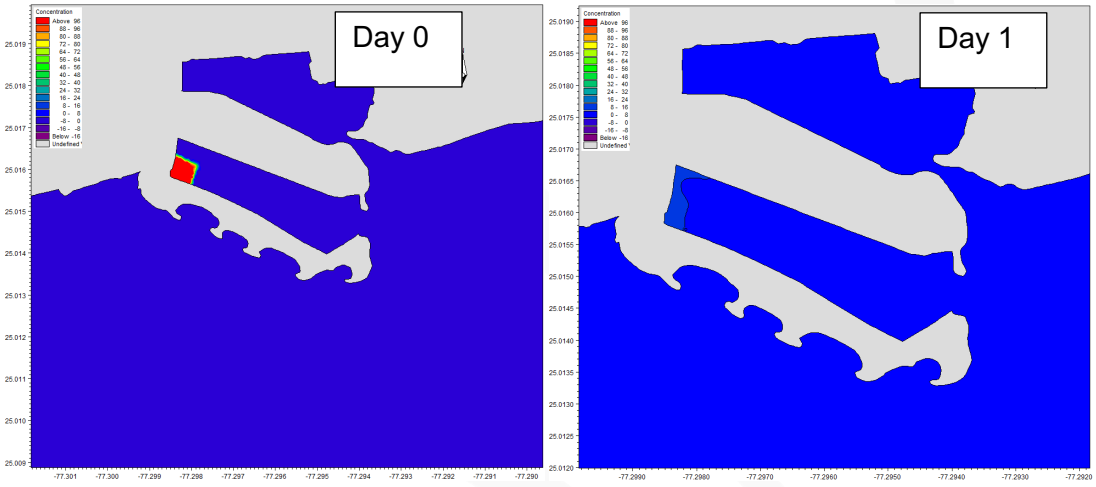


Figure 6-6 Tracer Concentrations at Various Time Steps – Case 2.

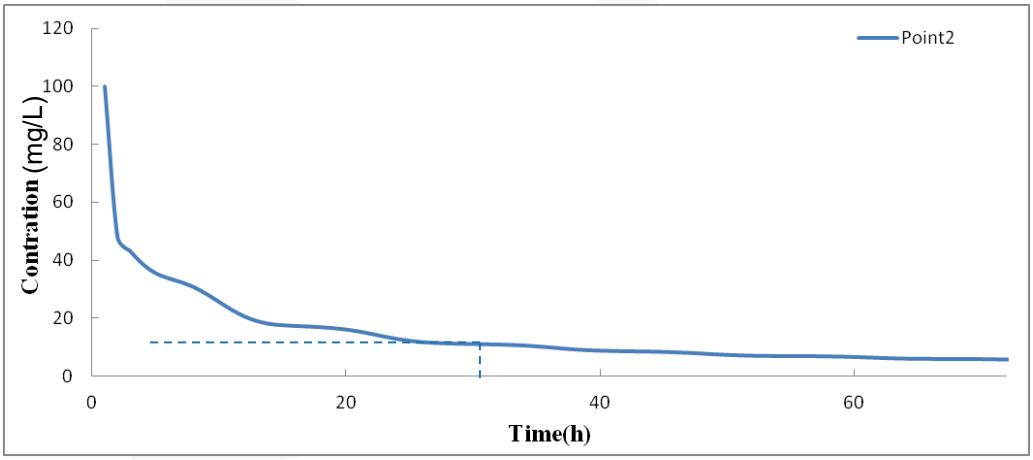


Figure 6-7 Time series of tracer concentrations for Case 2 at sampling point 2 where the greatest tracer concentration was observed.

IV. Case 3 and 4:

These two cases (Figure 6-8) demonstrate a typical wind condition with placement of the tracer in the southeast and northeast corners, respectively. Unlike the previous two cases, the average concentration recorded within the basin after 24 hours reduces to nearly 0 mg/L (Figure 6-9). The basin meets EPA standards for a localized spill under moderate conditions.

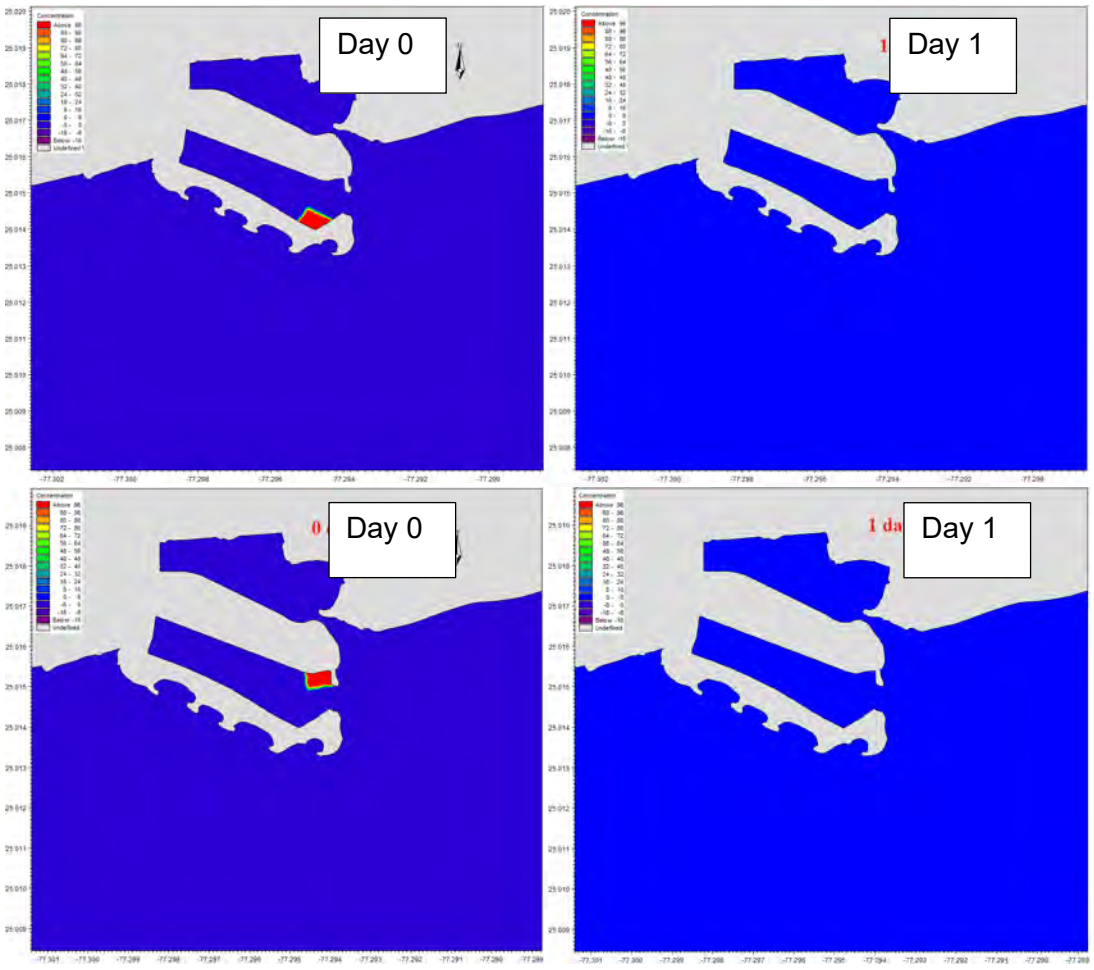


Figure 6-8 Tracer Concentrations at Various Time Steps – Case 3 and 4.

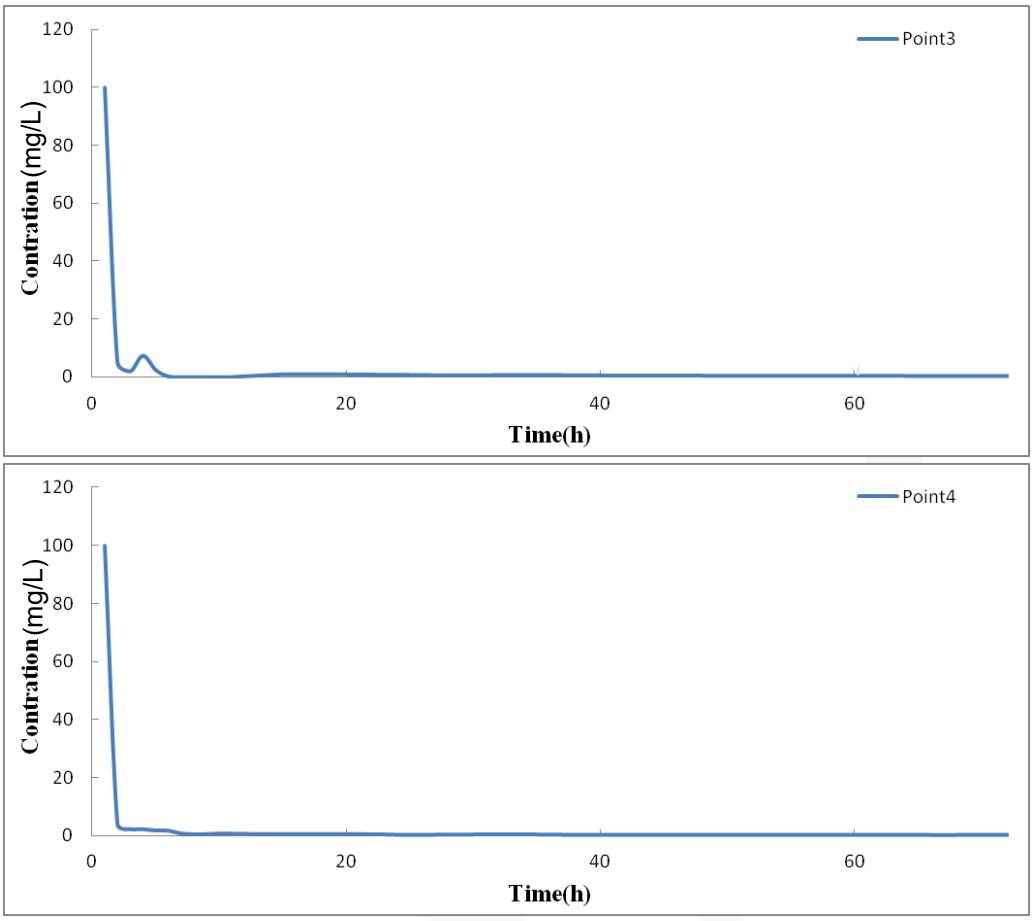


Figure 6-9 Time series of tracer concentrations for Cases 3 (Upper) and 4 (Lower) at sampling points where the greatest tracer concentration was observed.

7 CONCLUSION AND COMMENTS

Numerical simulations were carried out on the proposed Bluewater Cay Marina development using DHI's MIKE21 FM model. The model was constructed using a combination of collected field data and other available existing data. Model results were compared with DEPP and EPA guidelines for new marina design that recommend a minimum 90% flushing reduction in the basin within 24 hours.

Five model cases were investigated involving tracer placement, typical (regional) wind, and neap tide conditions. A tracer with a concentration of 100 mg/L was used in all cases. The following conclusions were noted:

If a contaminant is applied over the entire basin (from the surface to the basin floor) then it is unlikely that the concentration of the substance within the basin area will reduce by 90% over a 24-hour period.

However, this situation is extremely unlikely to occur, and a point-source release of contaminant (such as a fuel spill) is a more likely scenario.

If the northwest or the southwest corner of the basin is contaminated, the DEPP/EPA criteria can be met if the contaminated area is equal to or under 350 m^2. However, the contaminant concentration decreased much more slowly after 24 hours and would remain at a notable concentration (nearly 10 mg/L) after 72 hours.

If the northeast or the southeast corner near the entrance of the marina basin is contaminated, the DEPP/EPA criteria would be easily met. Moreover, the results also suggest that the typical regional wind generally improves basin flushing. It is likely that this effect is underestimated in the model and more mixing will occur in reality because of wind induced current shear in the water column.

It should be noted that the model is limited in its application and ability to replicate the true physical mixing and flushing processes. However, the results found during this investigation are likely conservative in nature and that the basin will flush more readily than the model demonstrates.

Some additional comments relating to the marina are as follows:

- Increasing the depth and the width of the entrance channel would allow more flow into the basin thus improving flushing.
- The construction of a flushing channel at the marina's southwest corner would improve the flushing performance at the marina's northwest and southwest corners.
- Although circulation and flushing play important roles in the distribution and dilution of potential contaminants, there are also practical active means of spill management and remediation such as containment with booms, and pumping/absorption and disposal of the contaminant.

This report is respectfully submitted by:

BRON Limited

Kenneth Scott, PE
Associate Principal – Coastal Engineering
kscott@bebron.com

APPENDIX H – BATHYMETRIC SURVEY

HYDROGRAPHIC SURVEY NOTES:

1. THE SOUNDING DATUM IS MLLW
2. THE HORIZONTAL DATUM IS WGS84 UTM ZONE 18N
3. DEPTHS ARE SHOWN IN INTERNATIONAL FEET AND TENTHS OF A FOOT. POSITIVE DEPTH VALUES. NEGATIVE VALUES INDICATE HEIGHT ABOVE THE SOUNDING DATUM.
4. SOUNDINGS WERE OBTAINED USING A SONARMITE SINGLE BEAM ECHOSOUNDER
5. HORIZONTAL POSITIONING WAS ESTABLISHED UTILIZING A LEICA GS14 SERIES RTK BASE STATION AND ROVER.
6. SOUNDING DATA WAS COLLECTED ON 03 JUL 2021.

- OBSERVED SHOALS

N

0' 100 200 300 400 500FT

BRON
POSSIBILITIES UNLIMITED

BWC BATHYMETRIC SURVEY

YAMACRAW, N.P.

THE BAHAMAS

DRAWING DESCRIPTION:
BATHYMETRIC SURVEY

DRAWN BY:	CHECKED BY:	APPROVED BY:	SHEET:
K.S.	K.S.	S.B.	V-01
DATE: 13/07/2021	REVISION: 00	PROJECT NO:	

MATCHLINE A

MATCHLINE A

HYDROGRAPHIC SURVEY NOTES:

1. THE SOUNDING DATUM IS MLLW
2. THE HORIZONTAL DATUM IS WGS84 UTM ZONE 18N
3. DEPTHS ARE SHOWN IN INTERNATIONAL FEET AND TENTHS OF A FOOT, POSITIVE DEPTH VALUES. NEGATIVE VALUES INDICATE HEIGHT ABOVE THE SOUNDING DATUM.
4. SOUNDINGS WERE OBTAINED USING A SONARMITE SINGLE BEAM ECHOSOUNDER
5. HORIZONTAL POSITIONING WAS ESTABLISHED UTILIZING A LEICA GS14 SERIES RTK BASE STATION AND ROVER.
6. SOUNDING DATA WAS COLLECTED ON 03 JUL 2021.

- OBSERVED SHOALS

N

0' 100 200 300 400 500FT

BRON
POSSIBILITIES UNLIMITED

BWC BATHYMETRIC SURVEY

YAMACRAW, N.P.
THE BAHAMAS

DRAWING DESCRIPTION:
BATHYMETRIC SURVEY

DRAWN BY:	CHECKED BY:	APPROVED BY:	SHEET:
K.S.	K.S.	S.B.	V-02
DATE: 13/07/2021	REVISION: 00	PROJECT NO:	

HYDROGRAPHIC SURVEY NOTES:

1. THE SOUNDING DATUM IS MLLW
2. THE HORIZONTAL DATUM IS WGS84 UTM ZONE 18N
3. DEPTHS ARE SHOWN IN INTERNATIONAL FEET AND TENTHS OF A FOOT, POSITIVE DEPTH VALUES. NEGATIVE VALUES INDICATE HEIGHT ABOVE THE SOUNDING DATUM.
4. SOUNDINGS WERE OBTAINED USING A SONARMITE SINGLE BEAM ECHOSOUNDER
5. HORIZONTAL POSITIONING WAS ESTABLISHED UTILIZING A LEICA GS14 SERIES RTK BASE STATION AND ROVER.
6. SOUNDING DATA WAS COLLECTED ON 03 JUL 2021.

- OBSERVED SHOALS

N

0' 100 200 300 400 500FT

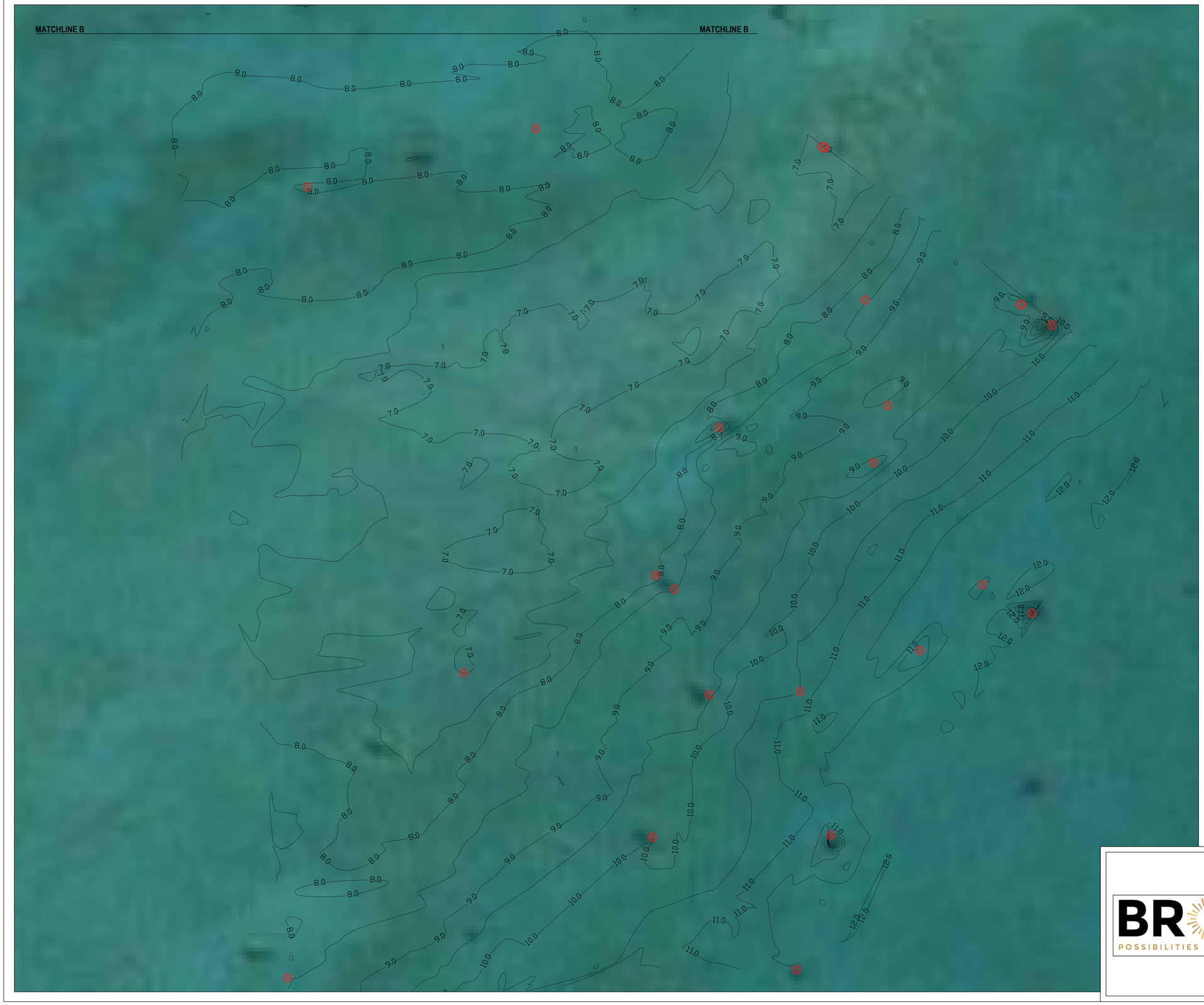
BRON POSSIBILITIES UNLIMITED

BWC BATHYMETRIC SURVEY

YAMACRAW, N.P.
THE BAHAMAS

DRAWING DESCRIPTION:
BATHYMETRIC SURVEY

DRAWN BY:	CHECKED BY:	APPROVED BY:	SHEET:
K.S.	K.S.	S.B.	V-03
DATE: 13/07/2021	REVISION: 00	PROJECT NO:	



HYDROGRAPHIC SURVEY NOTES:

1. THE SOUNDING DATUM IS MLLW
2. THE HORIZONTAL DATUM IS WGS84 UTM ZONE 18N
3. DEPTHS ARE SHOWN IN INTERNATIONAL FEET AND TENTHS OF A FOOT. POSITIVE DEPTH VALUES. NEGATIVE VALUES INDICATE HEIGHT ABOVE THE SOUNDING DATUM.
4. SOUNDINGS WERE OBTAINED USING A SONARMITE SINGLE BEAM ECHOSOUNDER.
5. HORIZONTAL POSITIONING WAS ESTABLISHED UTILIZING A LEICA GS14 SERIES RTK BASE STATION AND ROVER.
6. SOUNDING DATA WAS COLLECTED ON 03 JUL 2021.

- OBSERVED SHOALS

N

0' 100 200 300 400 500FT

BRON
POSSIBILITIES UNLIMITED

BWC BATHYMETRIC SURVEY

YAMACRAW, N.P.

THE BAHAMAS

DRAWING DESCRIPTION:
BATHYMETRIC SURVEY

DRAWN BY:	CHECKED BY:	APPROVED BY:	SHEET:
K.S.	K.S.	S.B.	V-04
DATE: 13/07/2021	REVISION: 00	PROJECT NO:	

APPENDIX I – BLUE WATER CAY ECONOMIC IMPACT STUDY REPORT

ECONOMIC IMPACT OF LEGENDARY MARINA RESORT AT BLUE WATER CAY

Prepared for:
Legendary Marine Bluewater Cay LTD

April 2022

TOURISM ECONOMICS

WWW.TOURISMECONOMICS.COM

SUMMARY

INTRODUCTION

The Legendary Marine Bluewater Cay Ltd vision is for a premiere, luxury hotel and resort destination development, featuring relaxation, sophistication, and marine-focused recreational amenities, located at Blue Water Cay.

The proposed development will include:

- Drystack boat storage buildings with 500 dry slips
- Marina basin with 80-100 slips, mostly in the 40-50ft range with slips up to 150ft
- Marine service center, with ability to haul out up to 130ft vessels, small parts inventory
- Six-story hotel with 120 rooms and an Oceanfront hotel with 30 rooms
- On-site dinning and bar with indoor and outdoor eating area
- General store with marine supplies and other sundry items
- Secure, indoor personal storage units for marina members
- A total 22 of rental housing units, including 2- and 3-bedroom units

The complex would also include on-site employee housing facilities.

ECONOMIC IMPACTS

This analysis assesses the potential economic impact of the proposed resort development at Blue Water Cay proposed by Legendary Marine Bluewater Cay Ltd. The development is proposed to start construction in 2022 and continue through 2030, for a nine-year construction period. With partial marina operations beginning in 2023, hotel operations in 2028, this analysis covers 24 years of on-going operations and a total time horizon of 25 years.

Over a 25-year study time horizon, the economic impacts of the proposed project would include:

- Cumulative total economic on The Bahamas economy of **B$789 million (in B$2022).**
- Cumulative boost to national GDP of **B$483 million (in B$2022).**
- A total of **B$154 million (in B$2022)** in additional income earned by Bahamian workers over 25 years.
- An average of **375 additional full-time equivalent jobs** per year.
- Government revenues from the additional economic activity would total **B$158 million (in B$2022)** and would outweigh proposed concessions by a factor of **2.4**.

ECONOMIC IMPACTS

Table 1. Summary Economic Impacts of the Legendary Resort Development at Blue Water Cay (25 years)

Cumulative	Direct	Indirect	Induced	Total
Development phase (Years 1-9)				
Output (B$2022, mils)	57.6	18.1	31.3	**107.0**
Value added (B$2022, mils)	41.4	10.8	19.7	**71.8**
Income (B$2022, mils)	8.2	3.3	6.6	**18.0**
Employment (avg annual)	75	19	43	**137**
Operations (Years 2-25)				
Output (B$2022, mils)	397.5	133.5	151.0	**682.1**
Value added (B$2022, mils)	236.1	81.5	94.0	**411.6**
Income (B$2022, mils)	78.4	25.9	31.9	**136.2**
Employment (avg annual)	208	57	75	**339**
Project total (Years 1-25)				
Output (B$2022, mils)	455.1	151.6	182.4	**789.1**
Value added (B$2022, mils)	277.5	92.2	113.7	**483.4**
Income (B$2022, mils)	86.6	29.2	38.5	**154.3**
Employment (avg annual)	226	61	88	**375**
Total Gov't Revenues (B$2022, mils)				158.0
Total Concessions (B$2022, mils)				66.3
Revenues / concessions multiple				**2.4**
GDP / concessions multiple				**7.3**

Source: Tourism Economics

PROPOSED DEVELOPMENT

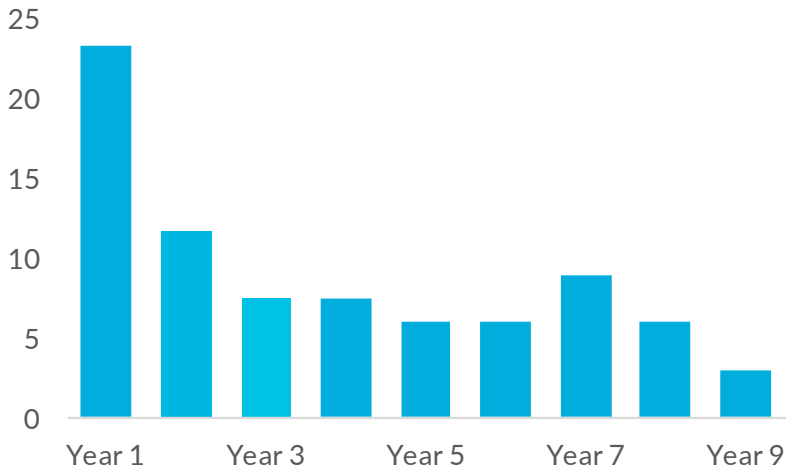
NEW INVESTMENT

Capital expenditures will occur over a nine-year development period

Project managers expect B$80 million in total project investment.

Total investment will amount to B$80 million spread out over nine years. The investment includes construction of rental villas and the hotel, boat storage facility, marina, marine service center and store, fine dining options, and on-site employee living facilities. Only local expenditures are included in the modeling for economic impact purposes.

Schedule of Capital Expenditures, B$2022, mils



Sources: Legendary Marine Bluewater Cay Ltd, Tourism Economics

NEW INVESTMENT

Capital expenditures will be spread across hospitality and marina components, and support and staffing facilities

Table 2. Development Plan in B$2022 mils

Hospitality units	22.0
Amenities and common areas	3.0
Staff areas and utlities	5.0
Marina	50.0
Total	**80.0**

Source: Legendary Marine Bluewater Cay Ltd

VISITOR VOLUME

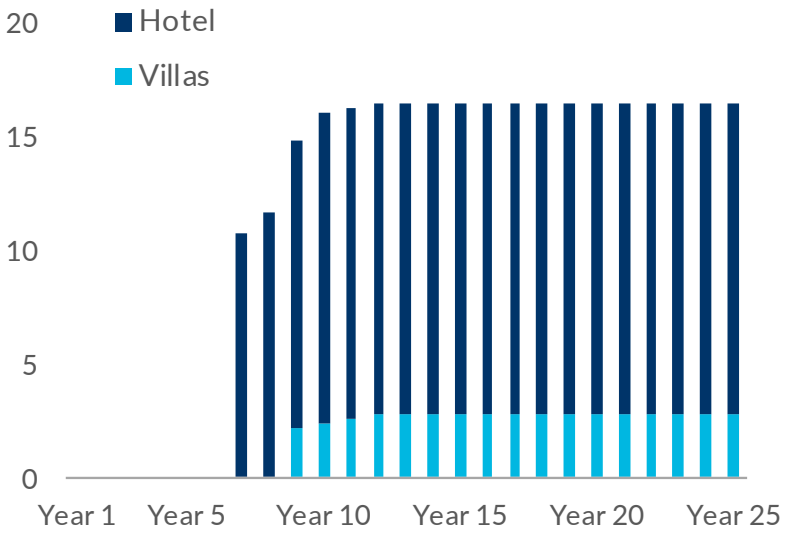
Additional capacity to host visitors

New visitor volume will stabilize at 16,500 annual visitors.

Partial marina operations will begin in Year 2 and partial hotel operations in Year 7, with the villa component operational in Year 9.

Project managers expect initial occupancy of the rental units and the hotel to be 55% and ramp up to 70% at stabilization after 4 years of operations for both hospitality components. The new capacity and projected occupancy would correspond to a stabilized volume of 16,500 annual visitors to The Bahamas.

Incremental Visitor Volume, thousands



Sources: Legendary Marine Bluewater Cay Ltd, Tourism Economics

VISITOR SPENDING

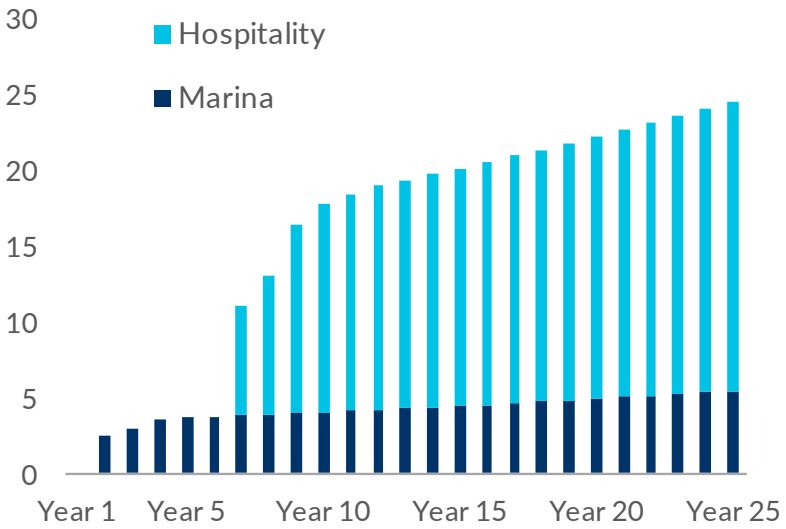
New visitors bring additional spending

Visitors will spend in several sectors, both on-site and off-site.

Visitors to the resort will spend primarily on-site on lodging, food and beverage, with some off-site spending on transportation, retail, and recreation and excursions.

Spending estimates were based on project management's pro forma projections and estimated off-site spending generated by Tourism Economics. Including both marina and hospitality operations, the total expenditures in The Bahamian economy would amount to between B$20 and B$25 million per year at stabilized occupancy.

Incremental Visitor Spending, B$2022, mils



Sources: Legendary Marine Bluewater Cay Ltd, Tourism Economics

VISITOR SPENDING

Spending details and projections

Table 3. Legendary Marina Resort at Blue Water Cay: Five Years of Hospitality Operations

	Year 7	Year 8	Year 9	Year 10	Year 11
Visitor volume	10,754	11,732	14,918	16,097	16,297
Rooms/units rented	30,113	32,850	40,004	43,143	43,545
Lodging	3.6	4.6	6.3	6.9	7.1
Food and beverage	1.8	2.3	3.1	3.4	3.6
Recreation revenues	1.1	1.4	1.9	2.1	2.1
Retail	0.4	0.5	0.6	0.7	0.7
Local transportation	0.4	0.5	0.6	0.7	0.7
Total visitor spending in B$2022, mils	**7.2**	**9.2**	**12.5**	**13.8**	**14.3**

Sources: Legendary Marine Bluewater Cay Ltd, Tourism Economics

SOURCES OF NEW SPENDING

The Legendary Resort at Blue Water Cay will generate benefits through two channels.

Capital expenditures

The initial investment of B$80 million over nine years.

Boosted visitor spending

Incremental visitor spending from visitors to the site over 24 years of operations.

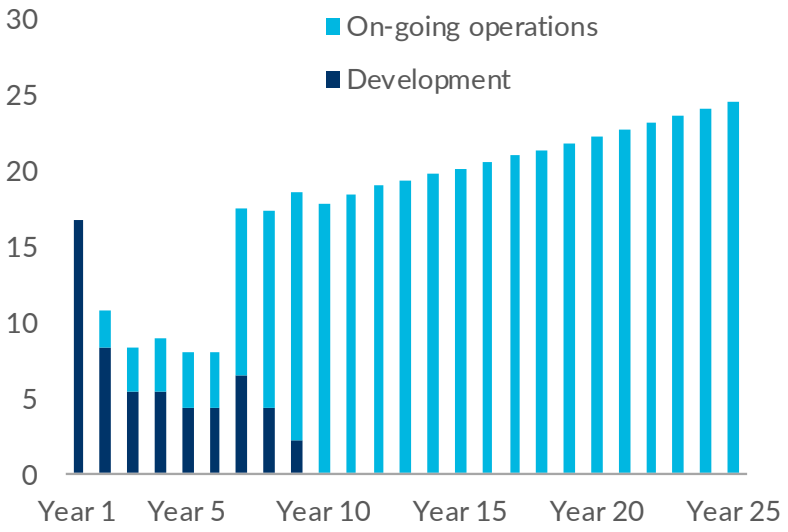
MODEL INPUTS

Total direct spending

Direct spending would include the initial investment and visitor spending during on-going operations.

Model inputs were developed by including both the capital expenditures during the development phase from Year 1 to Year 9, and visitor spending during on-going operations, beginning in Year 2 out to Year 25. The analysis covers nine years of development overlapping eight years of operations, and then 16 years of post-development operations.

Total Direct Spending for Model Inputs, B$2022, mils



Sources: Legendary Marine Bluewater Cay Ltd, Tourism Economics

ECONOMIC IMPACTS

ECONOMIC IMPACTS

How direct spending generates employment and income

Our analysis of the economic impacts begins with sources of incremental direct spending, then considers the downstream effects of this injection of spending into The Bahamas economy. To determine the total economic impacts, we analyze direct spending within a model of The Bahamas national economy using on a proprietary input-output model based on government produced data. This process calculates three distinct types of impact: direct, indirect, and induced.

The impacts on business sales (gross output), value added, jobs, and wages, are calculated for all three levels of impact.

1. **Direct Impacts**: Direct spending creates direct economic value within a discrete group of sectors, for example visitors spend on recreation, lodging, and transportation. This supports jobs and income in each sector.
2. **Indirect Impacts:** Each directly affected sector also purchases goods and services as inputs (e.g. food wholesalers, utilities) into production. These supply chain impacts are called indirect impacts.
3. **Induced Impacts**: Lastly, the induced impact is an income effect, generated when employees whose wages are generated directly or indirectly, spend those wages in the local economy.

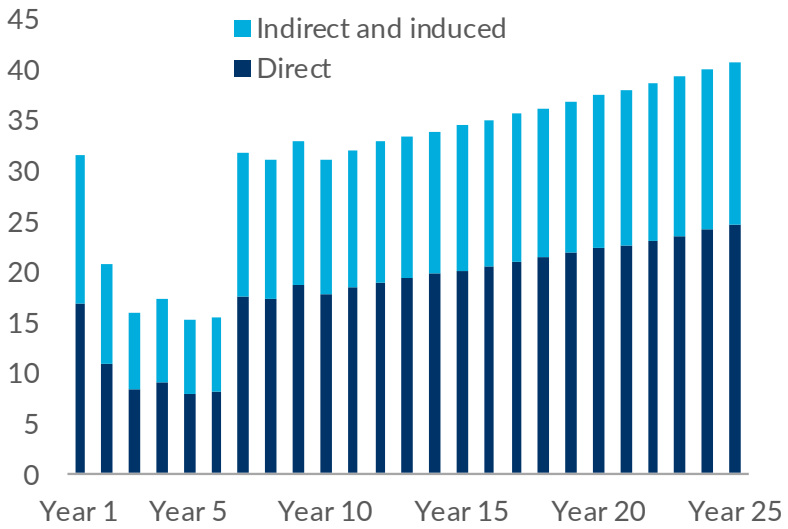
ECONOMIC IMPACTS

Direct spending drives benefits in other industries

Direct spending generates demand for supplier industries and drives employees to spend.

Direct spending generates upstream demand for supplier industries. Employees that earn income also turn around and spend some of their wages in the local economy. A complete accounting of the total economic impact includes the direct spending plus indirect and induced benefits. Total impacts in The Bahamas economy would amount to between B$30 and $40 million per year at stabilized operations.

Total Economic Impacts, B$2022 mils



Source: Tourism Economics

ECONOMIC IMPACTS

Construction

Over nine years of construction and development, the economic impacts would include:

- Cumulative total economic on The Bahamas economy of **B$107 million (in B$2022).**
- Cumulative boost to national GDP of **B$72 million (in B$2022).**
- A total of **B$18 million (in B$2022)** in additional income earned by Bahamian workers over seven years.
- An average of **137 additional full-time equivalent jobs** per year.

Table 4. Summary Economic Impacts of the Legendary Resort at Blue Water Cay: Construction (9 years)

Cumulative	Direct	Indirect	Induced	Total
Development phase (Years 1-9)				
Output (B$2022, mils)	57.6	18.1	31.3	**107.0**
Value added (B$2022, mils)	41.4	10.8	19.7	**71.8**
Income (B$2022, mils)	8.2	3.3	6.6	**18.0**
Employment (avg annual)	75	19	43	**137**

Source: Tourism Economics

ECONOMIC IMPACTS

Operations

Over 24 years of operations, the economic impacts would include:

- Cumulative total economic on The Bahamas economy of **B$682 million (in B$2022).**
- Cumulative boost to national GDP of **B$412 million (in B$2022).**
- A total of **B$136 million (in B$2022)** in additional income earned by Bahamian workers over 24 years.
- An average of **208 direct, full-time equivalent jobs** per year (220 direct jobs on a full-time and part-time basis).

Table 5. Summary Economic Impacts of the Legendary Resort at Blue Water Cay: Operations (24 years)

Cumulative	Direct	Indirect	Induced	Total
Operations phase (Years 2-25)				
Output (B$2022, mils)	397.5	133.5	151.0	**682.1**
Value added (B$2022, mils)	236.1	81.5	94.0	**411.6**
Income (B$2022, mils)	78.4	25.9	31.9	**136.2**
Employment (avg annual)	208	57	75	**339**

Source: Tourism Economics

IMPACT ON GOVERNMENT

GOVERNMENT IMPACT

Incremental economic activity will generate new government revenues that will offset concessions.

Key sources of incremental government revenues will be Value Added Tax revenues, import duties during operations, and National Insurance. These revenues would be driven by the on-site spending and incremental business activity in the broader Bahamas economy.

Concessions likely to be requested by project managers include an exemption of Real Property taxes and import duties exemption for construction and maintenance materials and equipment, such as for marine parts and forklift parts.

Total revenues are estimated to sum to B$158 million over 25 years, and concessions to B$66.3 million. Revenues would outweigh concession by a factor of 2.4.

Table 6. Government Revenues

Total revenues (B$2022, mils)	**158.0**
Stamp duties	74.0
National insurance	15.1
Import duties during operations	10.0
Departure tax	5.4
Annual business license	5.6
Value added tax	47.8
Total concessions (B$2022, mils)	**66.3**
Import duties on constr/materials	28.1
Real property tax	38.2
Revenues / concessions multiple	2.4
GDP / concessions multiple	7.3

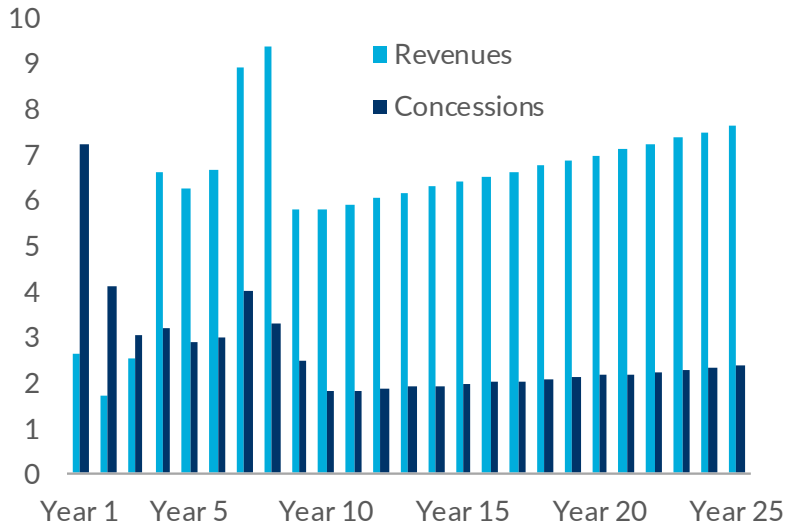
Source: Tourism Economics

GOVERNMENT IMPACT

Government revenues would outweigh concession over time

Taking a 25-year view of the project, estimated government revenues and likely concessions, total revenues would outweigh concessions over the study time horizon.

Impact on Government, B$2022 mils



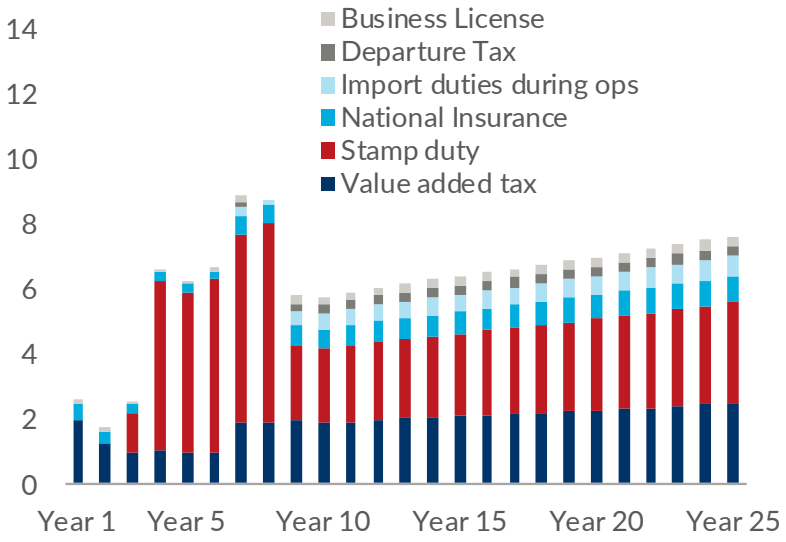
Source: Tourism Economics

GOVERNMENT REVENUES

Government revenues in detail

The boost to spending in The Bahamas economy would drive government revenues throughout the study time horizon, with the key revenue sources as the VAT, import duties during operations, and National Insurance.

Revenues to Government, B$2022 mils



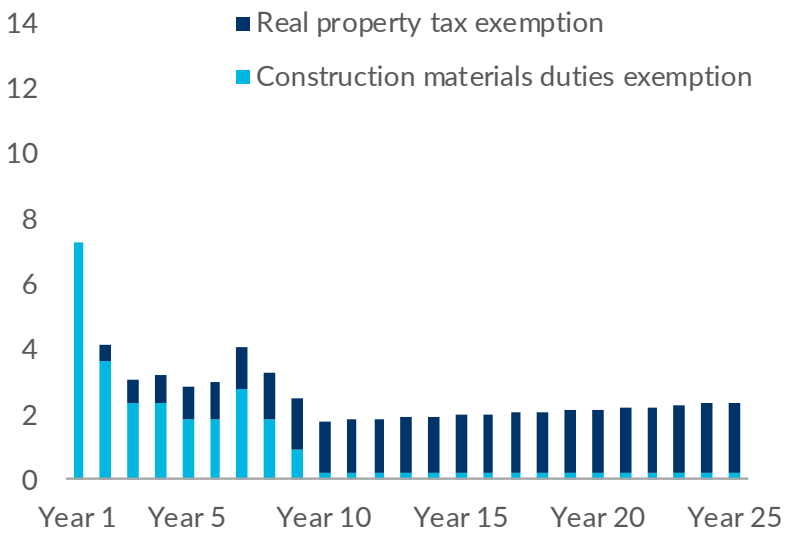
Source: Tourism Economics

GOVERNMENT CONCESSIONS

Government concessions in detail

Concessions likely to be requested by project managers include an exemption of Real Property taxes, and import duties exemption for construction and maintenance materials and equipment, such as for marine parts and forklift parts.

Concessions from Government, B$2022 mils



Source: Tourism Economics

KEY ASSUMPTIONS AND DATA SOURCES

Inputs into the economic impact model were generated from several sources, including developer pro forma financial projections of capital expenditures by type, and projections for the operations phase of the project. Key metrics taken from pro forma included on-site revenue projections by project component and the number of units and rooms to be constructed, and projected occupancy. Oxford Economics used a proprietary input-output model to complete the economic impact modeling. The model is based on industry output, value added, income, and employment data generated by The Bahamas Department of Statistics and the Bahamas Ministry of Finance. All dollar figures are reported in B$2022 constant terms.

Key assumptions were developed by Tourism Economics in conjunction with project managers including:

1. Average persons per room of 3.5 for rental villas and 2.5 for the hotel.
2. Average length of stay of 7 days.
3. Occupancy starting at 55% and ramping up to 70% after 4 years of respective operations in each component, with hotel operations starting in Year 7 and the Villas in Year 9.
4. Average visitor spending of B$122 per person per day in Year 10 of the project, which is the first year of post-development operations. Per person spending escalates at 2% per year.
5. Tax revenues generated by the project were estimated by Tourism Economics based on current tax and fee rates. Assumptions include National Insurance at 9.8%, a VAT of 10%, an average Business License fee 0.75%, an average import duty of 35%, Real Property tax rate of 2% for commercial property, and a stamp duty for real estate transactions of 10%.

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TECHNICAL APPENDIX

THE BAHAMAS INPUT-OUTPUT MODEL

CONTEXT AND RATIONALE

According to the most recent Tourism Satellite Account (TSA) for The Bahamas, completed for 2012, visitors represent an integral part of the economy. Direct tourism GDP accounted for $1.6 billion or 15% of Bahamian GDP in 2012.
By monitoring the visitor economy, policymakers can inform decisions regarding the funding and prioritization of the sector's development. They can also carefully monitor its successes and future needs.

The TSA measures the direct effects of tourism. That is, the immediate effects of the additional tourism demand on the production processes and supply of goods and services within an economy—in terms of additional goods and services that are produced, and the additional value added and jobs that are supported.
However, it is also important to consider the impacts of such increased economic activity on the country as a whole. This includes not only the impact of actual spending by tourists but also the downstream effects of this injection of spending into the Bahamian economy. These additional channels of activity can be grouped into two core channels of impact: indirect and induced effects.

- **Indirect effects** stem from supply chain spending, where each directly affected sector also purchases goods and services as inputs (e.g. food wholesalers, utilities) into production.
- **Induced effects** are generated when employees, whose wages are generated either directly or indirectly by travel and tourism, spend those wages in the local economy.

Considering the direct, indirect and induced impacts together equates to the total economic impact of tourism.

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THE BAHAMAS INPUT-OUTPUT MODEL

MODEL OBJECTIVES

Tourism Economics were asked by The Bahamas Ministry of Tourism and Aviation to develop a functioning input-output (I-O) tourism impact model for The Bahamas to calculate the indirect and induced impact of tourism. This appendix presents a summary of the technical steps we worked through in order to develop this model.

The following pages explain these the steps taken in order to transform SUTs and build a functioning I-O model in more detail. To develop the theoretical aspects of these chapters we drew from the following sources:

- Office of National Statistics, Input-output analytical tables: methods and application to UK National Accounts, 2017
- Office of National Statistics, United Kingdom Input-Output Analytical Tables, 2010
- Eurostat, Manual of Supply, Use and Input-Output Tables, 2008
- UNWTO, OECD, Eurostat, the United Nations Statistics Division, Tourism Satellite Account: Recommended Methodological Framework, 2008
- OECD, Understanding National Accounts, 2014

THE BAHAMAS INPUT-OUTPUT MODEL

SUPPLY AND USE TABLES

Supply and use tables (SUTs) provide a detailed picture of the processes of production, the use of goods and services and the income generated from production within an economy. SUTs are presented as two matrices—one for supply and one for use. The supply table shows the supply of goods and services by type of product of an economy for a given period of time. Supply is shown from domestic industries at basic prices plus imports as well as valuation matrices for distributors' trade margins attached to products and taxes less subsidies on products. Summing across these categories gives the total supply of products at purchasers' prices.

Fig. 1 presents the basic framework of a supply table.

Figure 1. Supply Table

<table>
<tr><th rowspan="2">Products</th><th colspan="3">Output of industries</th><th rowspan="2">Imports CIF</th><th rowspan="2">Total supply at basic prices</th><th colspan="2">Valuation</th><th rowspan="2">Total supply at purchasers' prices</th></tr>
<tr><th>Industry 1</th><th>Industry 2</th><th>Etc.</th><th>Total domestic output at basic prices</th><th>Trade and transport margins</th><th>Taxes less subsidies on products</th></tr>
<tr><td>Product 1</td><td colspan="3" rowspan="3">Production matrix</td><td rowspan="3">Domestic output</td><td rowspan="3">Import matrix</td><td rowspan="3">Total supply at basic prices</td><td colspan="2" rowspan="2">Valuation matrix</td><td rowspan="3">Total supply at purchasers' prices</td></tr>
<tr><td>Product 2</td></tr>
<tr><td>Etc.</td></tr>
<tr><td>Total</td><td colspan="3">Total output of industries at basic prices</td><td colspan="4">Total</td></tr>
</table>

For more information:

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THE BAHAMAS INPUT-OUTPUT MODEL

SUPPLY AND USE TABLES

The second matrix within SUTs is the use table which shows the use of goods and services within an economy. Specifically, the table details the input structure of each industry within an economy by showing the use of goods and services by product and type of use for intermediate consumption by industry, i.e. demand for goods and services to be used up or altered in the production processes of businesses. The use table also shows the value of the products and services absorbed by the components of the final demand including consumption expenditure, gross capital formation and exports—details of household consumption and labour costs (mentioned in the below bullet) are essential for estimating the wage-financed consumption (or induced) impact . Also included in the use table are the components of gross value added by industry, including labour costs, taxes less subsidies on production, profits etc—gross value added reflects the factor costs for primary inputs of each industry. Figure 2 below presents the basic framework of the use table.

Figure 2. Use Table

	Input of industries				Final uses								
Products	Industry 1	Industry 2	Etc.	Total	Final consumption expenditure by households	Final consumption expenditure by non-profit organisations	Final consumption expenditure by government	Gross fixed capital formation	Changes in valuables	Changes in inventories	Exports	Total	Total use at purchasers' prices
Product 1	Intermediate consumption at purchasers' prices				Final demand at purchasers prices								
Product 2													
Etc.													
Total													
Compensation of employees	Gross value added at basic prices												
Other net taxes on production													
Consumption of fixed capital													
Operating surplus, net													
Gross value added at basic prices													
Output at basic prices													

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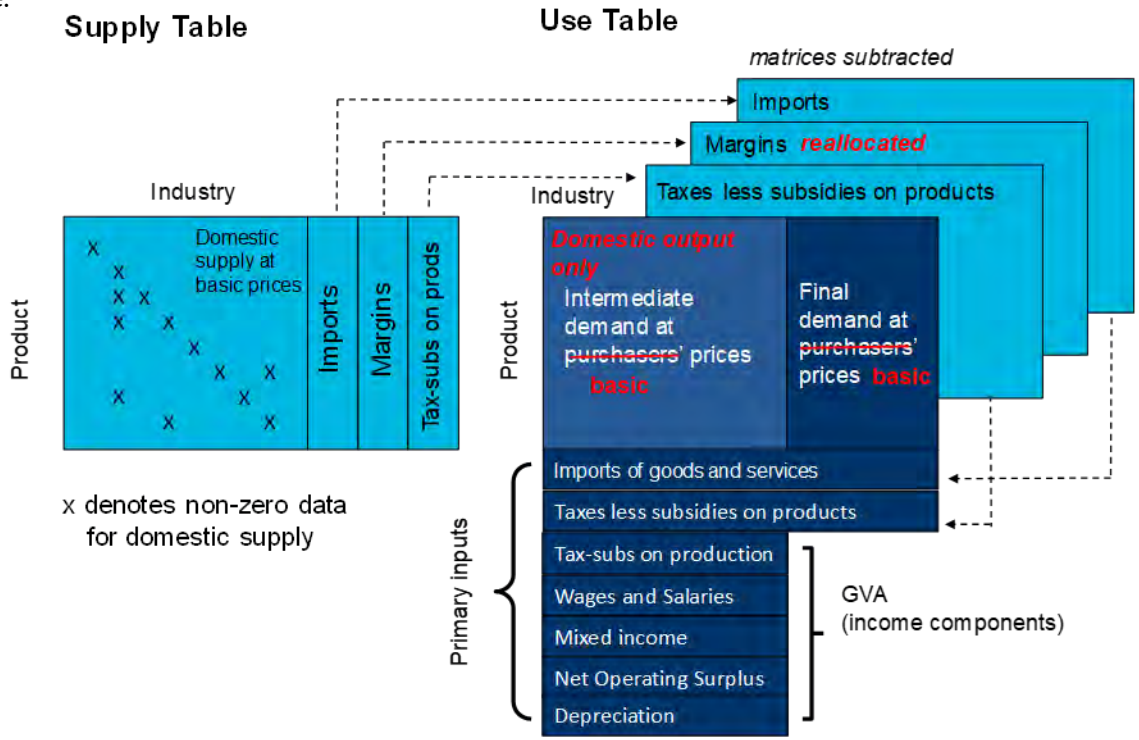
THE BAHAMAS INPUT-OUTPUT MODEL

TRANSFORMATION OF SUTS TO A DOMESTIC I-O MODEL

SUTs can be used to develop a symmetric IO table. The first step in developing the IO table is to transform SUTs from purchasers' prices into domestic basic prices by adjusting for imports, taxes and subsidies on products, and distributor trading margins. We use the supply table to remove imports from the use table's product by industry matrix, remove subsidies and taxes from the use table's product by industry matrix, and redistribute trading margins within the use table. Once imports—which account for 23% of supply in The Bahamas—and net taxes are removed from the use table, separate rows for each these components are created in the primary inputs, leaving the industry output totals unchanged. Fig. 3 below demonstrates the process described above.

Figure 3. Transformation



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THE BAHAMAS INPUT-OUTPUT MODEL

INPUT-OUTPUT FRAMEWORK

The above steps result in a functional input-output model for The Bahamas economy. The model allows for the tracing of money through the national economy as a result in a change in final demand driven by a project or event. The model uses inputs as the change in final demand, and estimates the changes in the economy in terms of :

- GDP, or more specifically, tourism's gross value-added contribution to GDP
- employment, measured on a headcount basis
- compensation of employees, which includes the gross wages paid to workers but also includes benefits in kind and employer social security contributions (including pensions).

Adding together direct, indirect and induced impacts across the metrics above provides an estimate of the total economic impact in The Bahamas. In Figure 4 below, reading across horizontally illustrates the distribution of each industry's output, split between intermediate demand from other industries (used as an input to production) and final demand (consumer spending, exports and other government consumption). Therefore, Industry 2 in Fig. 4 purchases an amount, C2,1 from Industry 1 as an input to their production process. Reading down vertically indicates what each industry purchases from other industries in the national economy by way of inputs which, when combined with imports from abroad (leakages), employment costs, operating surplus and any additional taxes or subsidies to production, gives total inputs and will equal total outputs. In the model illustrated in Fig. 4, C8,1 will equal C1,8.

This framework helps to develop an understanding of how an increase in activity and spending in one area filters throughout the rest of the economy. For example, an increase in consumer spending on the output of one industry will require input purchases from other industries as well as new labour inputs (employment and wages). In turn, these additional impacts will further filter through the economy with additional purchases from other industries.

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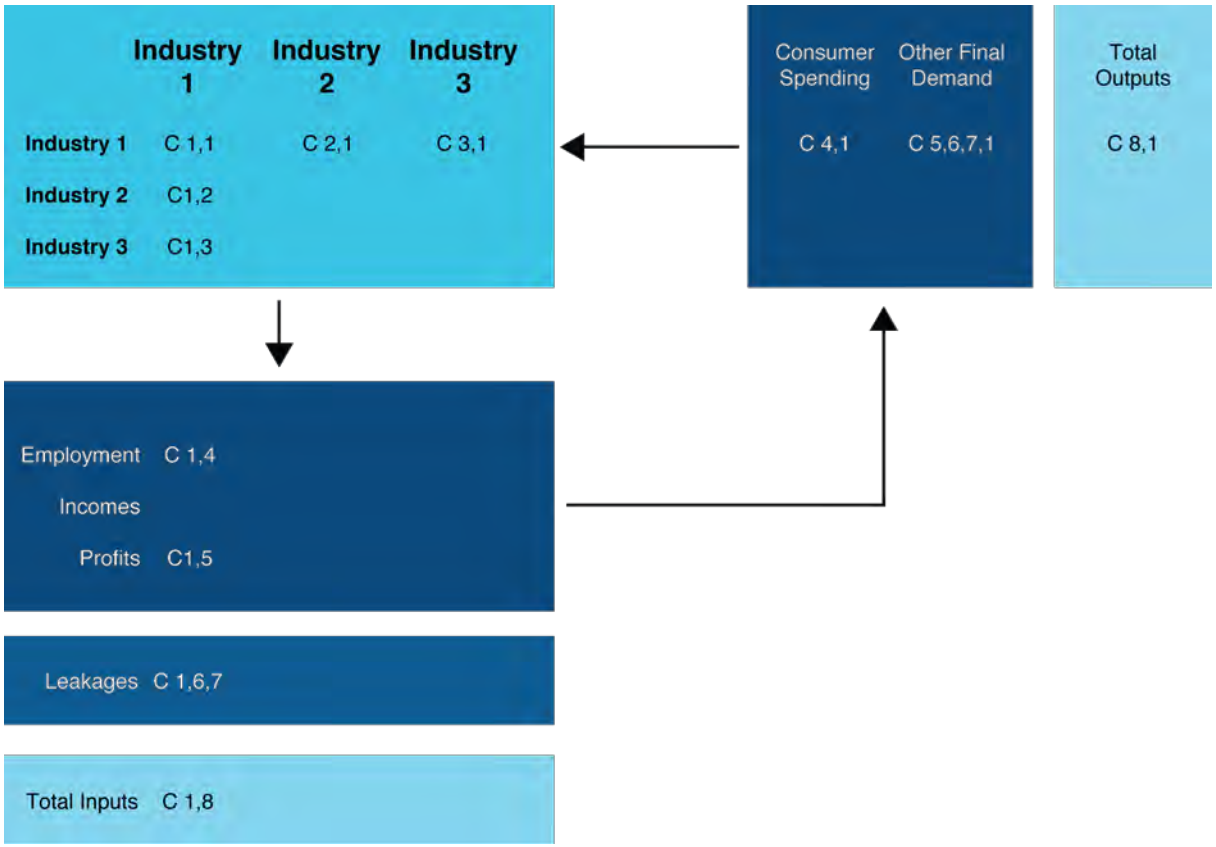
THE BAHAMAS INPUT-OUTPUT MODEL

Figure 4. Input-Output Framework



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ABOUT TOURISM ECONOMICS

Tourism Economics is an Oxford Economics company with a singular objective: combine an understanding of the travel sector with proven economic tools to answer the most important questions facing our clients. More than 500 companies, associations, and destination work with Tourism Economics every year as a research partner. We bring decades of experience to every engagement to help our clients make better marketing, investment, and policy decisions. Our team of highly-specialized economists deliver:

- Global travel data-sets with the broadest set of country, city, and state coverage available
- Travel forecasts that are directly linked to the economic and demographic outlook for origins and destinations
- Economic impact analysis that highlights the value of visitors, events, developments, and industry segments
- Policy analysis that informs critical funding, taxation, and travel facilitation decisions
- Market assessments that define market allocation and investment decisions

Tourism Economics operates out of regional headquarters in Philadelphia and Oxford, with offices in Belfast, Buenos Aires, Dubai, Frankfurt, and Ontario.

Oxford Economics is one of the world's foremost independent global advisory firms, providing reports, forecasts and analytical tools on 200 countries, 100 industrial sectors and over 3,000 cities. Our best-of-class global economic and industry models and analytical tools give us an unparalleled ability to forecast external market trends and assess their economic, social and business impact. Headquartered in Oxford, England, with regional centers in London, New York, and Singapore, Oxford Economics has offices across the globe in Belfast, Chicago, Dubai, Miami, Milan, Paris, Philadelphia, San Francisco, and Washington DC, we employ over 250 full-time staff, including 150 professional economists, industry experts and business editors—one of the largest teams of macroeconomists and thought leadership specialists.

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APPENDIX J – SITE PHOTOS

Photo 1. Flattop Bristle brush - Halimeda

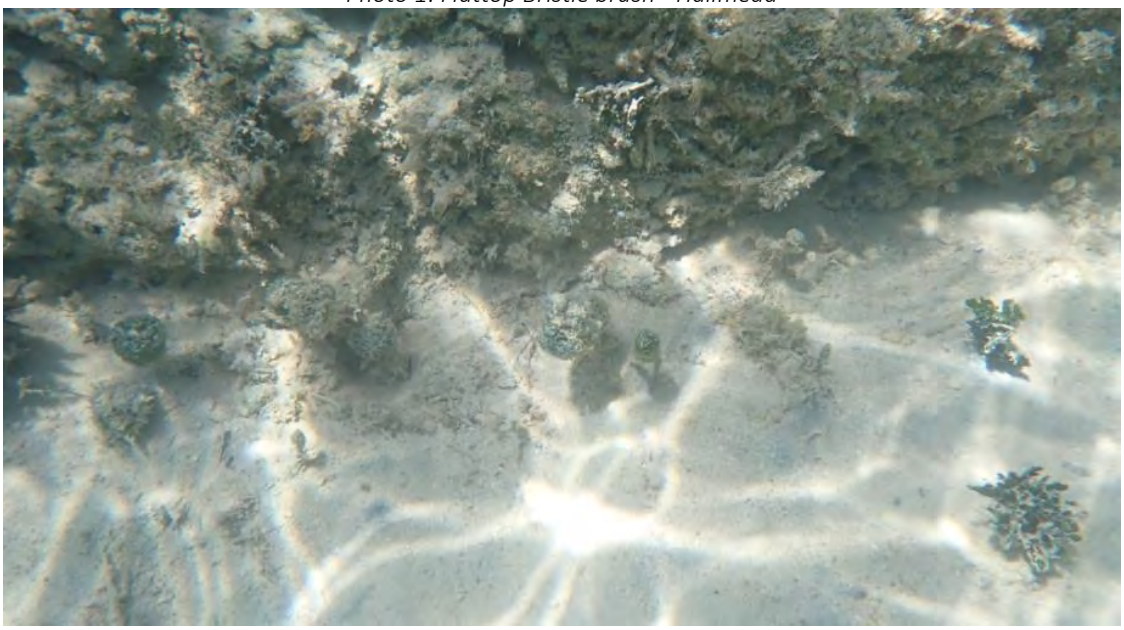

Photo 2. Brown Tube Sponge

Photo 3. Atlantic Spadefish

Photo 4. Great Barracuda

Photo 5. Beaugregory, Turtle Weed

Photo 6. Agelas sp.

Photo 7. Bluehead Wrasse

Photo 8. Bubble Algae

Photo 9. Four Eyed Butterflyfish

Photo 10. Upside Down Jellyfish

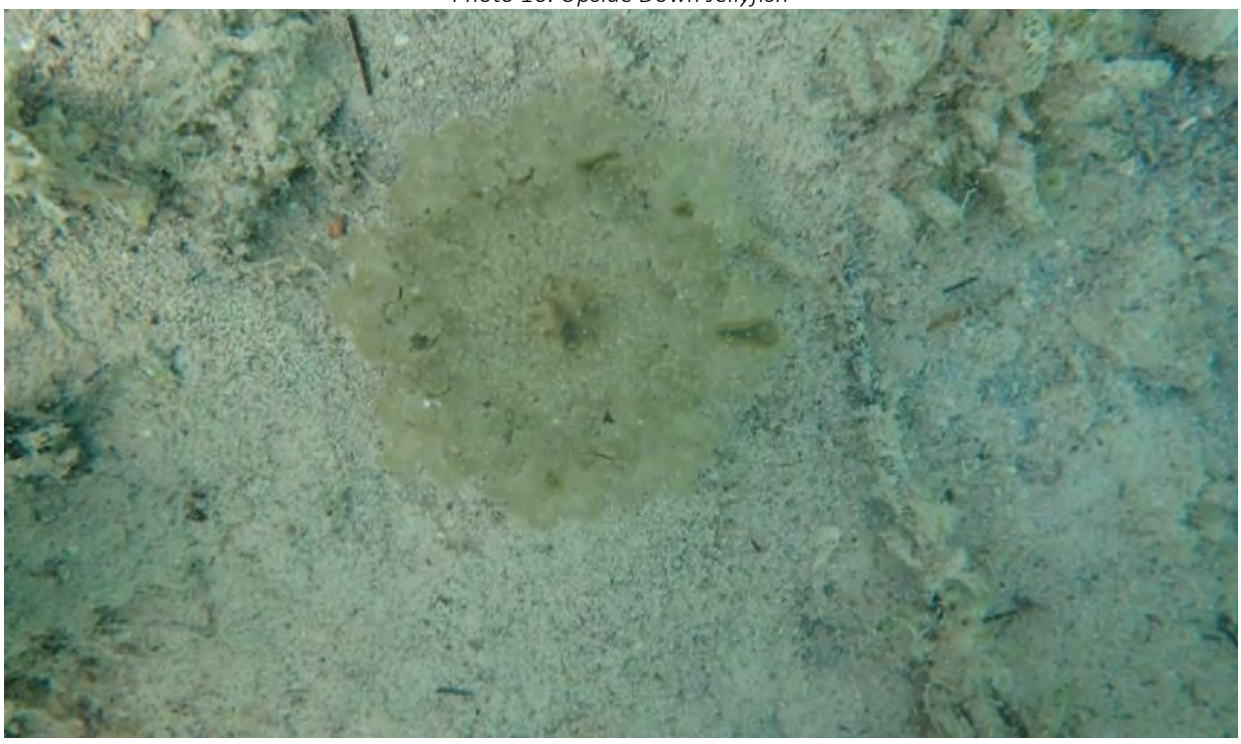

Photo 11. Red Snapper, Dusky Damselfish

Photo 12. Bluestriped Grunt

Photo 13. Clubtip Finger Coral

Photo 14. Golfball Coral

Photo 15. French Angelfish, Great Sea Anemone

Photo 16. School Master Snapper

Photo 17. Marine debris

Photo 18. Nassau Grouper

Photo 19. Princess Parrotfish, Mottled Morjarra

Photo 20. Gray Snapper

Photo 21. Lesser Starlet Coral

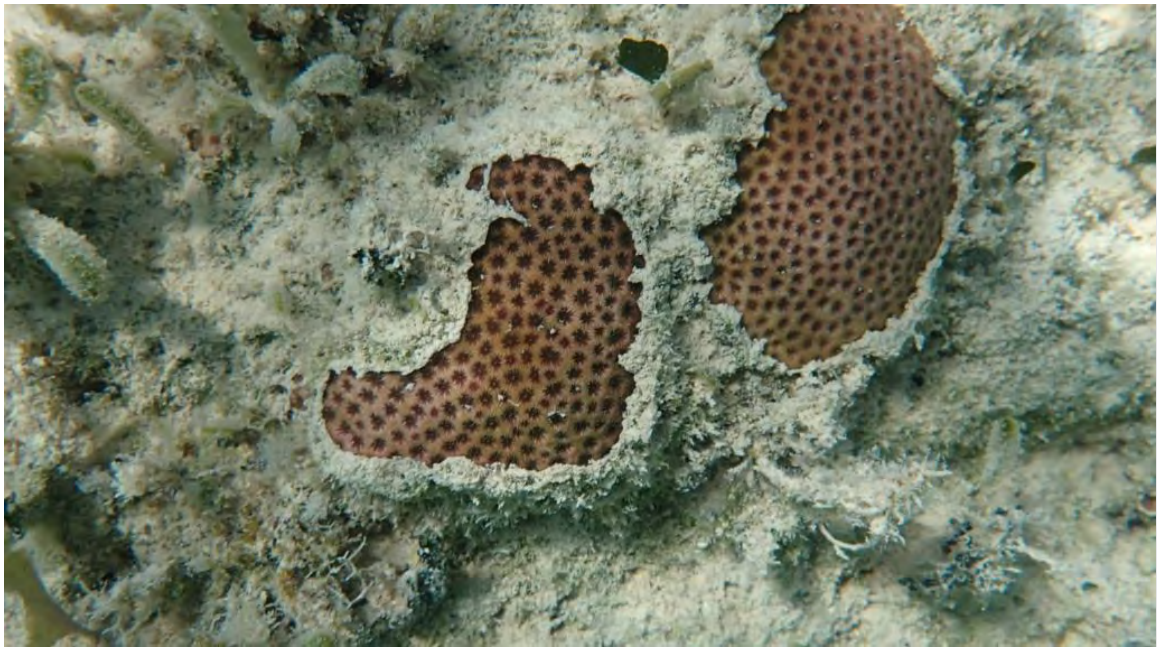

Photo 22. Longfin Damselfish

Photo 23. Mangrove Tunicate

Photo 24. Bluestriped Grunt

Photo 25. Mottled Mojarra

Photo 26. Mustard Hill Coral

Photo 27. Rose Coral

Photo 28. Sargassum

Photo 29. School Master Snapper

Photo 30. Fuzzy Sea Cucumber

Photo 31. Atlantic Silverside, Sergeant Major

Photo 32. Slippery Dick

Photo 33. Southern Stingray

Photo 34. Stinker Sponge

Photo 35. True Tulip

Photo 36. Casuarina with notable erosion.

Photo 37. Green buttonwood

Photo 38. Existing habitat on the peninsula (notable erosion).

Photo 39. Native Mahogany surrounded by invasives

Photo 40. Existing infrastructure.

Photo 41. Nesting Antillean Nighthawk and Egg.