CL ENVIRONMENTAL

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PALLADIUM HOTEL GROUP

PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM JAMAICA & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER

ENVIRONMENTAL IMPACT ASSESSMENT

FINAL DRAFT REV.2

DOCUMENT TITLE	**Environmental Impact Assessment for the Proposed Phase 2 Expansion of Grand Palladium Jamaica & Lady Hamilton Resort & Spa, Lucea, Hanover**
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1.0 EXECUTIVE SUMMARY

INTRODUCTION

The objective of the project is to augment the Grand Palladium Jamaica Resort & Spa through the proposed Phase II development and enhancement of existing hotel facilities. This expansion initiative entails the establishment of a complex comprising two distinct hotels, namely the Grand Palladium (475 rooms) and TRS (473 rooms), resulting in a combined total of 948 rooms. The new TRS hotel, is a Palladium brand exclusively for adults, with several already established in the Caribbean.

The proposed Phase 2 development adjoins the existing Phase 1 hotel, Grand Palladium Jamaica Resort & Spa, to its south, along northern coastal highway. The site is located in the district of Point, approximately 3.8 km east of the capital of Hanover, Lucea. Additionally, it is approximately 1.4 km southwest of the Oceanpointe Housing development and approximately 34.8 km west of the Sangster International Airport, in Montego Bay.

The planned Phase 2 expansion encompasses around 28 acres (113,310 m2) and adjoins the existing Phase 1 hotel, Grand Palladium Jamaica Resort & Spa, on its southern boundary. Its eastern boundary runs parallel to the northern coastal highway, while the western boundary follows the shoreline.

The project site features urban tree cover, buildings, unpaved roadways, various infrastructure, and areas used for the temporary storage of furniture, construction materials, supplies, and solid waste. The current vegetation is primarily secondary growth and is characterized as degraded coastal forest. The shoreline is predominantly composed of cliffs, with occasional small sandy areas interspersed along its length. Seaward, a variety of benthic habitats exist, including seagrass beds, coral reef communities, pavement/hard bottom areas, and rocky shores/intertidal communities, which are protected within the bounds of the Lucea Fish Sanctuary.

This project is consistent with the government's initiative to stimulate tourism arrivals by expanding tourism infrastructure beyond traditional areas like Negril, Ocho Rios, Montego Bay, Port Antonio, and Kingston, thereby broadening the scope of tourism offerings. As tourism arrivals surge, there is a corresponding demand to increase hotel room capacity to accommodate the expected influx of visitors. Moreover, the project aligns with Vision 2030, Jamaica's strategic blueprint for positioning itself as a premier destination for visitors and businesses. By expanding the island's accommodations through this development, the project aims to fuel the growth of clientele and enhance the overall quality of Jamaica's tourism offerings. With a diverse range of hotels, attractions, and activities available in Jamaica, the country is well-equipped to consistently meet and exceed visitor expectations, providing unmatched experiences and excellent value for money.

PROJECT DESCRIPTION AND FEATURES

Grand Palladium Hotel

GP01- This building stands at six stories tall and takes on a rectangular form. On each floor, hotel rooms are situated along the side facing the sea, while the back of the building accommodates access points, back-of-house spaces, stairs, and elevators. Notably, the ground-level rooms feature swim-up pools. This building is linked with GP02 at the ground, 2nd, 3rd, 4th, and 5th floors.

GP02- This serves as the central edifice of the hotel, taking on a trapezoidal shape. Within its confines, you'll find key communal areas, such as the basement-floor buffet, and the ground-floor reception, lobby, lobby bar, shop, bathrooms, and courtesy rooms. Noteworthy is that both the basement and ground floor boast double height. On the third through fifth floors, the rooms offer scenic views of the sea. The rooms on the third level are equipped with swim-up pools. This building is interlinked with GP01 across the ground, 1st, 2nd, and 3rd floors. Furthermore, it is connected with GP03 on the basement, ground, 1st, and 2nd floors.

GP03- This six-story structure boasts a rectangular design, featuring hotel rooms on each floor overlooking the sea. At the rear, you'll find access points, back-of-house areas, stairs, and elevators. Notably, the ground-level rooms come complete with swim-up pools. Additionally, the building is linked with GP02 on the ground, 2nd, 4th, and 5th floors.

GP04- Rising to six stories, this structure boasts a rectangular configuration. On the side facing the sea, hotel rooms adorn each floor, while the back of the building accommodates access points, back-of-house spaces, stairs, and elevators. Notably, the ground-level rooms feature enticing swim-up pools.

GP05- Standing at six floors, this building accommodates hotel rooms across all levels. Positioned with a front and two sides, the family rooms offer captivating views of the sea. Towards the rear, just preceding the front rooms, you'll find access points, back-of-house spaces, stairs, and elevators. Notably, the ground-level rooms come complete with enticing swim-up pools.

GP06 and GP07- These buildings are one-story villas, each featuring two bedrooms, a living room, a terrace, and a swim-up pool.

GP08 - This building is a single-story villa encompassing three bedrooms, a living room, terrace, and a swim-up pool.

TRS Hotel

TRS01 - This structure comprises six floors, each featuring hotel accommodations. The building has a front facade and two sides, with rooms offering scenic views of the sea. Towards the rear, just preceding the front rooms, you'll find entrances, back-of-house areas, stairs, and elevators.

TRS02 - This six-story building features a rectangular design and hosts hotel rooms spanning from the ground to the fifth floor, all oriented towards the sea. Positioned at the rear of the building are access points, back-of-house spaces, stairs, and elevators. The basement floor is home to a thematic restaurant with a double-height level. Notably, the third-level rooms come equipped with swim-up pools.

TRS03- This serves as the central structure within the hotel, showcasing a trapezoidal design. Among its features are the primary common areas, including a basement-floor buffet, and a ground-floor reception, lobby, lobby bar, shop, bathrooms, and courtesy rooms. The main entrance to the building is centrally positioned on the main facade, accessible from the motor lobby on the ground floor.

TRS04 - This six-story structure adopts a rectangular configuration. Featuring hotel rooms from the ground to the fifth floor that offer scenic views of the sea, the building's rear section houses access points, back-of-house spaces, stairs, and elevators. The basement floor accommodates two thematic restaurants with a double-height level. Noteworthy is the presence of swim-up pools in the rooms on the second level.

TRS05 - Standing at six floors, this rectangular building features hotel rooms on each floor along the side that overlooks the sea. The rear portion of the building is dedicated to access points, back-of-house spaces, stairs, and elevators.

TRS06 - Ascending six stories, this rectangular building is adorned with hotel rooms on every floor along the side that opens up to the sea. Positioned at the rear of the structure are the access points, back-of-house spaces, stairs, and elevators.

TRS07 - At six stories, this rectangular building boasts hotel rooms on every floor along both the long and short facades that offer captivating views of the sea. At the rear of the structure, you'll find access points, back-of-house spaces, stairs, and elevators.

TRS08 and TRS09 - Consisting of two buildings, each villa is a single-story residence featuring two bedrooms, a living room, terrace, and a swim-up pool. The villas are crafted from multiple parallel rectangular prisms, creating both the interior and exterior spaces.

Beach Club - This single-story building adopts a square shape, encompassing a buffet area, a sea-view restaurant with a terrace, restrooms, and a kitchen. A bar on one side caters to the pool area. There are separate access points for customers and employees, with one leading directly through the kitchen.

Additional Structures - Additional small structures, including pool bars, towel huts, restrooms, and a food corner, are present to enhance the support for the pool area. All of these structures are single-story and primarily open in design.

Gourmet Square

The gourmet square serves as a recreational space offering cafes, shops, bars, and restaurant services. It is structured across two distinct levels: 19.50 m and 12.50 m. The upper level provides a connection to the convention centre access and the two restaurant buildings. Meanwhile, the lower-level grants access to the ground floor of the restaurant buildings and the space beneath the square, which encompasses back-of-house areas.

Overwater Rooms

Comprising 16 small, single-story, rectangular bungalows, each approximately 228.95 m^2. Each unit includes a living room, bedroom, bathroom, and a terrace area featuring a swim-up pool. Access to each bungalow is provided via a path at the rear.

Auxiliary Project Activities

Access to Hotels and Connections - The existing primary entrance to Phase 1 of the complex remains operational and is accessible to guests from both Phase I and Phase II. This entrance is secured by a 24/7 private security gate with a control point. Adjacent to the entrance is a welcoming motor lobby area for the Phase I hotel, featuring a traditional Colonial architectural style with an open-air design. Furthermore, a new service access point from the main road to the new industrial area will be established. This access point is also secured by a 24/7 private security gate with a control point. The connection from the industrial area to the complex will be facilitated through a new tunnel under the main road in the Phase II area. The Phase II new roads proposal includes connecting all the room buildings at the back, allowing motorized access for guests similar to Phase I hotels. These roads will be designed to accommodate emergency services such as firefighters or ambulances, with a minimum width of 4 meters and load-bearing capacity for these vehicles.

Services and Energy - The hotel expansion's electricity, heat, and cooling requirements in Phase II are based on consumption patterns from Phase I and comparable resorts. The project adheres to the existing trigeneration plant's design, operating off-grid and utilizing engine heat sources for efficient electricity and thermal energy generation. Conventional equipment supplements the trigeneration system for continuous energy production. The plant uses stationary reciprocating internal combustion engines powered by natural gas, with an absorption chiller using exhaust gases for chilled water and heat plate exchangers for sanitary hot water. These diverse energy sources will be applied throughout various areas within the hotel.

Electricity - The hotel expansion's power generation relies on natural gas gensets, each with a nominal power output of 1,500 kWe, in conjunction with a solar plant. In the event of emergencies, failures, or maintenance requirements for these systems, backup diesel generators will ensure a dependable and uninterrupted power supply under any circumstances. To facilitate effective management of the hybrid power system involving photovoltaic and gas engines, a Battery Energy Storage System (BESS) will be implemented.

Chilled Water Production - The primary unit for chilled water production in the HVAC system of the hotel expansion will be an absorption chiller. This technology is highly efficient and utilizes the thermal energy found in the exhaust gases of the natural gas engines (Figure 4 16). To complement chilled water production, water-cooled centrifugal chillers will also be employed.

Sanitary Hot Water Production - The provision of sanitary hot water for the hotel expansion will be generated through the recoverable heat from the cooling circuits of the engines, supplemented by gas boilers as a backup system.

Each engine features two distinct cooling circuits: high temperature (HT) and low temperature (LT). The primary objective of the engine's cooling system is to cool the HT circuit (engine jackets, lube oil, and the first stage of the intercooler) and the LT circuit (second stage of the intercooler).

Potable Water - The hotel complex will obtain its drinking water from a Reverse Osmosis (RO) seawater desalination plant situated in the industrial area. The potable water system originates from the trigeneration plant situated in the industrial area in Phase I. From the desalination plant, the drinking water is conveyed to tanks in Phase II, situated near the Phase II parking area on the opposite side of the road. Seawater will be collected through abstraction wells and conveyed to raw water tanks within the RO facility. The entire RO system comprises three units, each boasting a nominal capacity of 900 m3/day. The design and execution of abstraction and rejection wells will adhere to Jamaican standards and regulations. These newly installed water storage tanks are designed to cater to the water needs of both Phase I and Phase II. Adjacent to the tanks, a machine room has been incorporated to house the water booster pump system for both hotel phases, ensuring a continuous water supply to the entire complex. The brine produced by the water treatment system will be released through PVC pipes into rejection wells.

A storage water tank capacity for Phase 2 has been planned to meet the overall water needs of the hotel premises, ensuring that the cisterns can consistently meet the maximum demands throughout the project's lifespan. These tanks are designed not only to accommodate regular water usage but also to handle potential interruptions in the water supply from the desalination plant and any damages to the cistern filling lines.

Sewage System - The wastewater treatment facility currently situated in Phase I Hotel will extend its service to the new Phase II hotel, necessitating an augmentation in line with the updated requirements. Presently, the hotel complex features a wastewater treatment plant with a capacity of 1,500 m3/day. The treated water is utilized for irrigation purposes and the maintenance of the irrigation ponds.

Drainage - The existence of paved and covered areas of buildings, (roofs), as well as the proximity to the ocean coastline, requires specific treatment of storm water, so that the discharge of solids and debris is minimized, and the natural purification effect is optimized. The drainage system must align with the characteristics of a luxury hotel project, taking into consideration the need for shallow drainage elements due to high-water tables to minimize visual impact. Additionally, the number of discharge points into the ocean should be minimized to reduce the impact on the coastline. Two designated points are specified, each equipped with a flow lamination braking system in accordance with sustainable construction standards. The natural slopes of the land are utilized to establish a water collection area, known as a Retention Buried Pond, featuring landscaping that facilitates water filtration into the subsoil. In the event of saturation and sedimentation of suspended solids, the water is then discharged into the sea. Close ducting pipes are employed to channel rainwater into this retention pond. For areas where the natural soil slope does not permit water to reach the retention point, stormwater drainage wells are essential.

Firefighting System - In accordance with the International Fire Code (IFC) and International Building Code (IBC), the design of fire protection systems is contingent upon the occupancies and characteristics of the building. Considering these regulations, the following fire protection facilities are proposed for each building:

1. Portable extinguishers will be installed in all hotel buildings.
2. Automatic Sprinkler Systems
3. Standpipe systems will be installed in all buildings, except GP6, GP7, GP8, TRS8, TRS9, Overwater Bungalows, Travel Club, and Beach Club.
4. Fire alarm and detection systems will be installed in all buildings, except GP6, GP7, GP8, TRS8, TRS9, Overwater Bungalows, and Travel Club.
5. Every commercial cooking equipment used in processes producing smoke or grease-laden vapours will be protected by an automatic fire-extinguishing system.

Telecommunication Services - Will be provided by either Columbus Communications Jamaica Limited (Flow Jamaica Ltd) or Digicel Jamaica.

Solid Waste - Solid waste from the rooms and blocks, will be separated by the housekeeping into food waste and recyclables using different bags. These bags are then transported from the villas to the Waste Management Area located in Phase 1, where further separation takes place. Food waste is packaged for the animal farmer program, and the remaining waste is placed in a compactor. Recyclables are sorted and compressed into bales for pick-up by the recycling company. Waste from the kitchen and other areas is handled similarly, except for metals, chemicals, waste oils, and electronics, which are stored and removed by an approved contractor. Garbage collection and disposal will also be done by an approved solid waste company will have regularly schedule pickups. Disposal will be at the Retirement Disposal Site.

Operations

Energy and Water Conservation – The hotel will rely on the following strategies and technologies:

<u>Energy Conservation</u>

- Thermal energy demand reduction
- Control systems BMS
- High efficiency equipment
- Renewable energy

<u>Water Conservation</u>

- Reduction on demand
- BMS. Scan and control
- Irrigation strategy

Employment - At its peak, the workforce at the site is expected to reach around 1,500 skilled labourers, with numbers fluctuating between 700 and 1,500 throughout the construction phase. This is anticipated to generate approximately 2,660 to 5,700 indirect and induced job opportunities. Fiesta Jamaica´s aim is to prioritize the utilization of local talents and labour for both the construction and operation of the hotel, wherever feasible.

Decommissioning - Decommissioning of the construction site involves a series of steps to ensure the site is safely and effectively cleared and the area is restored to a suitable condition. This process includes addressing all aspects of the construction site, such as the batching plant, prefab areas, and any other temporary structures or facilities. The decommissioning steps include:

- Site Assessment and Planning
- Dismantling of Structures
- Waste Management
- Site Clean-Up
- Stakeholder Communication and Notifications

Phasing and Scheduling

Grand Palladium comprises two phases, Phase 1 of the hotel is already constructed and operating:

- Phase 1 (already constructed)
    - Hotel GP (family resort) – 1,054 rooms
    - **Total Rooms - 1,054 rooms**
- Phase 2
    - Hotel GP (family resort) – 475 rooms
    - Hotel TRS (adults only) – 474 rooms
    - **Total Rooms – 949 rooms**

The construction of the Phase 2 hotel is expected to last 18 to 24 months.

POTENTIAL IMPACTS AND RECOMMENDED MITIGATION

Site Clearance and Construction Phase

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
Physical	***Water Quality***	Increased levels of suspended solids from raw materials stored on-site, heightened turbidity and sedimentation from runoff, and potential contamination from leaks and spills of fuels, lubricants, and hazardous substances.	Primary Mitigation Measures (repeated throughout) i. Erosion and Sediment Control: a. During construction, the project site should include sediment control measures such as turbidity barriers/silt screens and should be erected around the entire work area to prevent the dispersion of sediments and contaminants throughout the water column. These should be placed so as to reduce/contain the resultant sediment plume during the activities. Construction activities should only continue when these barriers are fully operational, that is; placed correctly; calm to moderate sea conditions; without damage. These barriers are particularly important when operations occur near or may influence sensitive ecosystems and species such as coral reefs and seagrass beds and or filter feeding organisms and fish. It may be necessary to have multiple layers of sediment barriers around work areas b. Erosion Control Mats: Use erosion control mats and geotextiles on exposed soil to reduce erosion. c. Conduct sediment dispersal calculation rates on coral reefs and seagrass beds within 200 meters of the proposed villas and other marine works and at control stations, on a monthly basis, for comparison to background levels. Pre-construction sedimentation rates should therefore also be conducted and used as a baseline for comparison. d. All activities should be limited to the minimal working area, and as such reducing the extent of the footprint. No activities and or placement of anchors or materials should be done placed outside the approved area. ii. Stormwater Management: a. Retention Ponds: Construct retention ponds or sediment basins to capture and treat stormwater runoff before it enters water bodies. b. Drainage Systems: Design and implement efficient drainage systems to direct stormwater away from vulnerable areas and into treatment facilities. iii. Proper Storage and Handling of Hazardous Materials: a. Raw Materials: i. Designate a central area for the storage of raw materials. ii. Area should be lined in order to prevent the leakage of chemicals into the sediment. iii. Stockpile fine grained materials (sand, marl, etc.) away from drainage channels and low berms should be placed around the piles, which themselves should be covered with tarpaulin to prevent erosion. iv. Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne. b. Hazardous Substances: i. Storage of fuels and oils, and hazardous substances should be in clearly marked containers (tanks/drums etc.) indicating the type and quantity being stored. ii. Containers should be surrounded by bunds to contain the volume being stored in case of accidental spillage. iii. Equipment should be stored on impermeable hard stands surrounded by berms to contain any accidental surface runoff. iv. Vehicle refuelling facilities must be situated on impermeable surfaces served by an oil trap, run-off collection system. Sediment basins and oil water separators should be constructed to intercept storm water before it is discharged. v. Refuelling of boats should only be done at anchor out at sea if the sea conditions are calm, otherwise, all refuelling should be done when docked at land. Appropriate refuelling equipment (such as funnels) and techniques should always be used. c. Transport: i. In terms of transporting equipment, utilise the paths of the planned roadways rather than creating temporary pathways just for equipment access. ii. Raw materials such as marl and sand should be adequately covered within the trucks to prevent any escaping into the air and along the roadway. d. Spill Response Plan: i. Develop and implement a spill response plan, including spill kits and training for workers to handle and clean up spills promptly and effectively. ii. Appropriate minor spill response equipment (for containment and clean- up) will kept on site, including oil absorbent pads and disposal bags. e. Construction Equipment Maintenance: i. Regular Inspections: Conduct regular inspections and maintenance of construction equipment to prevent leaks and ensure optimal functioning. ii. Designated Maintenance Areas: Perform equipment maintenance in designated areas with proper containment measures to prevent contamination of soil and water. iv. Natural Environment a. Relocation of sensitive species should be done if; they are suitable for relocation (that is suitable substrate, health and over all viability), those species fall within the potential impact area; and if mobile invertebrates are in or around the potential impact area. Sensitive organisms and systems in and outside the impact area include; hard and soft corals, sponges, seagrass and mobile invertebrates such as urchins, sea cucumbers, starfish and conch. Detailed Seagrass and Coral Mitigation Plans must be prepared for approval by NEPA.
		Runoff from site, use of boulders for coastal structures, and construction activities for overwater villas and beach works can increase water turbidity and sedimentation. Natural hydrodynamic forces can further spread sediments and pollutants.	
	Benthic Sediment	Disturbance during coastal construction activities can lead to sediment displacement, increased turbidity, and the release of pollutants trapped in the sediment,	

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			b. Alternative mitigations should be proposed when relocation is unlikely to be successful. c. Where possible, as little of the natural environment should be relocated or removed. Habitat fragmentation and species displacement should be temporary, with the placement of silt screens, construction materials and equipment as well as general human activity in the area. d. Structures placed on the seafloor may cause habitat fragmentation and displace some species, however they may also serve to add ecological volume, providing substrate for organisms to settle and colonize and eventually may serve some ecosystem functions. e. Any temporary floating structures and /or vessels should be placed in areas with less sensitive species where possible. Floating structures anchored or moored over seagrass beds or coral. v. Monitoring and Compliance: a. Weekly monitoring of water quality parameters such as temperature, salinity, pH, Dissolved Oxygen, light irradiance, turbidity and Total Suspended Solids (TSS) in and around the project area should be conducted during construction for the first 3 months of construction. Monitoring can be conducted fortnightly thereafter. b. Adaptive management, including stoppage of works during adverse weather conditions and using monitoring data to adapt and refine mitigation measures as needed to address any emerging issues promptly.
	Noise	Use of heavy equipment significantly increase noise levels, impacting the noise climate and potentially affecting nearby residents, wildlife, and the overall soundscape.	i. Scheduling and Planning: a. Restrict construction activities to regular working hours (7 am – 6 pm) to avoid disturbances during nighttime. b. Schedule particularly noisy activities during times when they will cause the least disruption, avoiding early mornings, late evenings, and weekends. c. Minimize engine idling when equipment is not in use to reduce unnecessary noise. d. Where possible, position noisy equipment and staging areas as far from sensitive receptors e. Restricting noisy activities like construction and seismic surveys during breeding and migration seasons ii. Equipment Management: a. Use equipment that has low noise emissions as stated by the manufacturers, and properly equip machinery with noise reduction devices, such as effective mufflers and silencers to reduce noise emissions. Newer models of construction equipment are typically designed to operate more quietly and should be considered. b. Ensure equipment is maintained to prevent excessive noise from worn or faulty parts. iii. Worker Protection and Training: a. Construction workers operating noise-generating equipment should be provided with appropriate hearing protection. Workers handling equipment that produces continuous noise levels of 80 dBA or more for 8 hours or longer should use earmuffs. Those exposed to prolonged noise levels between 70 - 80 dBA should wear earplugs. b. Train construction workers on the importance of noise control and encourage best practices to minimize noise generation. iv. Monitoring and Compliance: a. Conduct regular noise monitoring (monthly) at various points around the construction site to ensure compliance with noise standards. b. Adhere to the 24-hour construction noise guidelines as stated in the environmental permit (usually 70 dBA or 75 dBA). v. Community Engagement: a. Provide advance notice to neighbouring businesses about upcoming noisy activities and expected durations.
	Air Quality	Emissions from construction equipment and transportation, as well as fugitive dust emissions, potentially affect local air quality, health, and vegetation.	i. Dust Control: a. Areas, including roads, should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter, more windy days, this frequency should be increased. b. Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne; this includes those being transported on trucks. c. Minimize cleared areas to those that are needed to be used. d. Ensure material stockpiles and construction debris are stored away from the roadway ii. Equipment Emissions: a. Utilize construction machinery and vehicles that meet stringent emission standards. b. Ensure equipment is regularly maintained to operate efficiently with minimal emissions. c. Implement policies to reduce unnecessary idling of construction vehicles and machinery. iii. Monitoring and Compliance: a. Implement a monthly air quality monitoring program to regularly assess the levels of particulate matter and other pollutants. b. Ensure all activities comply with local air quality regulations and standards. iv. Worker Protection: a. Provide construction workers with appropriate Personal Protective Equipment (PPE), such as masks and N95 respirators, to protect against dust and emissions. v. Community Engagement:

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			a. Keep local business informed about construction activities and potential air quality impacts. b. Provide a contact point for concerns and complaints.
Biological	***Terrestrial Flora and Fauna***	Vegetation clearance may lead to a reduction in local biodiversity, affecting ecological balance and leading to habitat loss. Loss of ecosystem services Potential relocation of endemics, such as Morass Royal (*Roystonea princeps*) and Broom Thatch (*Thrinax parviflora*). Fauna may experience temporary displacement and some habitat loss. Loss of roosting/nesting sites for Brown Pelicans (*Pelecanus occidentalis*).	The proposed project plans include the reforestation of gardens and access roads using indigenous plant species. Further, it is proposed that any tree that must be removed during construction will be replaced through a comprehensive replanting effort. A detailed landscaping plan will be presented to the NEPA for review and approval. In addition to these efforts, the following are recommended: i. In instances where possible, some of the larger trees (> 25cm) within the project area should be retained as part of the landscaping plans for the development. This will help to maintain some of the habitat for fauna within the areas. ii. Establish protective zones around significant trees that cannot be moved to minimize disturbance. iii. Endemic plant species identified and logged during the flora assessment should be relocated or placed in a nursery, prior to land clearance. If and when other endemic seedlings or trees are identified, whether Morass Royal (*Roystonea princeps)*, Broom Thatch (*Thrinax parviflora*) or other species, these should also be relocated. iv. The planting of representative native tree species (including endemics) that were recorded during the flora assessment as a part of the landscaping when the development is completed, is being encouraged. This initiative will improve the flora diversity, as bolster the habitat for fauna. v. The preservation of any active Brown Pelican (*Pelecanus occidentalis*) nests should be a priority. An experienced ecologist should be engaged by the developers to assess the roosting area a minimum of 1 month before land clearance in this zone. Weekly assessments should be done by the ecologist up to the commencement of land clearance of this space. The ecologist should ensure that all nests are clear (no eggs or hatchlings) before land clearance begins. The possibility of nest relocation should be explored by the ecologist just before the land clearance stage begins.
	Benthic Habitats	Habitats and their resident biota could potentially be affected. Loss of ecosystem services.	See **Primary Mitigation Measures** previously listed
	Seagrass Communities	Approximately 12,630.46 m² of seagrass may be impacted, with 1,758.43 m² within the buffer area and 10,872.03 m² directly affected. Loss of carbon sequestration (stored and ability to sequester additional carbon).	See **Primary Mitigation Measures** previously listed. In addition, Seagrass Relocation can be employed - Approximately 4,902.41m2 of seagrass which has the potential to be impacted by the proposed project was found to be suitable for relocation.
	Coral Communities	Marine construction activities may result in colony loss (for corals which cannot be relocated)	See **Primary Mitigation Measures** previously listed. In addition: i. Coral nurseries should be established. These nurseries will support the cultivation and rehabilitation of various coral species, offering a scientifically grounded approach to preserving and restoring the impacted coral communities. ii. Coral nurseries are structures or areas specifically designed to cultivate and propagate corals for restoration purposes. They offer several benefits in the conservation and restoration of coral reef ecosystems.: iii. Coral Reef Restoration: Coral nurseries provide a means to propagate and grow coral fragments in controlled environments. This allows for the production of a large number of healthy coral colonies that can be used for reef restoration projects. By transplanting these nursery-grown corals onto degraded reefs, the nurseries contribute to the recovery and resilience of coral reef ecosystems. (Bayraktarov, n.d.). iv. Genetic Diversity Preservation: Coral nurseries can enhance genetic diversity in restored reefs by cultivating and propagating multiple coral genotypes. By selecting diverse parent colonies and incorporating different genotypes, nurseries can contribute to the overall genetic health and resilience of coral populations. (Consortium, 2017) v. Climate Change Resilience: Coral nurseries can assist in developing coral populations that are better adapted to changing environmental conditions, including ocean warming and acidification. By selecting and propagating coral genotypes that exhibit higher thermal tolerance or resilience, nurseries can help create reef communities better equipped to withstand climate stressors (Van Oppen, 2015)
	Fish and Invertebrates	Construction activities can displace fish and invertebrates through habitat destruction.	See **Primary Mitigation Measures** previously listed. In addition: i. Coral nurseries should be established. These nurseries will support the cultivation and rehabilitation of various coral species, offering a scientifically grounded approach to preserving and restoring the impacted coral communities. ii. Coral nurseries are structures or areas specifically designed to cultivate and propagate corals for restoration purposes. They offer several benefits in the conservation and restoration of coral reef ecosystems.: iii. Coral Reef Restoration: Coral nurseries provide a means to propagate and grow coral fragments in controlled environments. This allows for the production of a large number of healthy coral colonies that can be used for reef restoration projects. By transplanting these nursery-grown corals onto degraded reefs, the nurseries contribute to the recovery and resilience of coral reef ecosystems. (Bayraktarov, n.d.).

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			iv. Genetic Diversity Preservation: Coral nurseries can enhance genetic diversity in restored reefs by cultivating and propagating multiple coral genotypes. By selecting diverse parent colonies and incorporating different genotypes, nurseries can contribute to the overall genetic health and resilience of coral populations. (Consortium, 2017) v. Climate Change Resilience: Coral nurseries can assist in developing coral populations that are better adapted to changing environmental conditions, including ocean warming and acidification. By selecting and propagating coral genotypes that exhibit higher thermal tolerance or resilience, nurseries can help create reef communities better equipped to withstand climate stressors (Van Oppen, 2015) i. Habitat Restoration, such as coral nurseries and artificial reefs, can enhance habitat availability.
	Intertidal Communities	Minimally impact the low-diversity, low-abundance rocky shore and intertidal communities, with species expected to recolonize post-construction and new structures potentially offering additional substrates for colonization.	See **Primary Mitigation Measures** previously listed.
	Sea Turtles	Site preparation and construction activities may temporarily displace sea turtles that use the area for foraging and nesting, with potential impacts including barriers like silt screens limiting access, increased noise from construction, and nighttime lighting.	i. All staff and workers should be sensitized to all sensitive ecosystems and species in the area, in particular turtles. The site should be inspected daily for any signs of turtle activity. If a nest is suspected or found, all activity nearby should stop until an expert can determine if there is a nest and how to relocate the eggs. ii. The stakeholders, proponents and the NEPA should develop clear lines of reporting and communication in the event that action needs to be taken. iii. Silt screens should be used to prevent sedimentation but should be removed promptly along with any other construction debris and material upon completion. iv. Night-time activities should be limited or avoided when possible. No lights should be pointed out to sea confusion and disorientation of turtles or any other species that maybe affected by lunar activity. v. Fixtures in direct line-of-sight from the beach should be shielded down-light only fixtures or recessed fixtures having low wattage "bug" type bulbs and non-reflective interior surfaces. vi. Fixtures mounted as low in elevation as possible through use of low-mounted wall fixtures, low bollards and ground level fixtures. vii. Floodlights, up-lights or spotlights for decorative and accent purposes that are directly visible from the beach, or which indirectly or cumulatively illuminate the beach shall not be used. viii. For high intensity lighting applications such as providing security and similar applications shielded low-pressure sodium vapour lamps and fixtures shall be used.
Socioeconomic / Cultural	***Employment***	The construction site will employ about 1,500 skilled labourers, fluctuating between 700 and 1,500 throughout the phase, potentially creating 2,660 to 5,700 indirect and induced jobs.	i. Prioritize sourcing potential workers from nearby communities to strengthen community relations and support local economies. Fiesta Jamaica aims to prioritize local talent and labour for both the construction and operation of the hotel whenever feasible. ii. Ensure that project-derived benefits are accessible to people of all genders, sexual orientations, and gender identities, fostering an inclusive environment where everyone can benefit equally from employment opportunities. iii. Implement robust measures to prevent incidents of sexual and gender-based violence, including sexual harassment, exploitation, and abuse. Establish clear protocols for prompt and effective responses to any incidents of SGBV. iv. Proactively identify and prevent risks and impacts related to gender, sexual orientation, and gender identity. When avoidance is not possible, mitigate and compensate for such impacts to ensure fairness and equality. By adopting these measures, the Developer can enhance community relations, promote inclusivity, and ensure that the benefits of the project are shared equitably among all community members.
	Wastewater	Improper disposal of wastewater at the construction campsite could harm water quality, potentially impacting aquatic ecosystems and human health.	i. Provision and maintenance of portable sanitary conveniences for the construction workers for control of sewage waste by a licenced contractor. A ratio of approximately 25 workers per chemical toilet should be used. ii. Portable toilets should be located approximately 25 metres from the high water mark, away from the shoreline to avoid discharge into the marine environment in the event of accidental spillage.
	Solid Waste	Increased generation of solid waste. Improper disposal of this waste poses risks such as environmental pollution, habitat degradation, and visual blight, while also attracting vermin and threatening the health of workers and nearby communities.	i. Waste Management Plan: a. Develop a comprehensive waste management plan outlining procedures for waste segregation, recycling, and disposal. This should be approved by the National Environment and Planning Agency (NEPA) and the National Solid Waste Management Authority (NSWMA). b. Assign responsibilities to personnel for waste management and designate waste collection points on-site. c. Employees should be educated on impacts of solid waste and best practises. d. Prioritize waste minimization by reducing packaging materials, reusing construction waste where feasible, and recycling materials such as metal, wood, and concrete. e. Encourage contractors and suppliers to use eco-friendly packaging and materials that are recyclable or biodegradable. f. Solid waste collection points and the number of staff assigned to collection and disposal should be increased with every stage of construction and changes to the number of workers present.

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			ii. Waste Segregation and Storage: a. Skips and bins should be strategically placed within the campsite and construction site. b. The skips and bins at the construction campsite should be adequately designed and covered to prevent access by vermin and minimise odour. c. The skips and bins at both the construction campsite and construction site should be emptied regularly to prevent overfilling. d. Disposal of the contents of the skips and bins should be done at an approved disposal site. e. Establish separate bins or containers for different types of waste, including recyclables, hazardous materials, and non-recyclable waste. f. Clearly label bins and provide training to workers on proper waste sorting and segregation practices. iii. Hazardous Waste Handling: a. Identify and properly handle hazardous materials such as paints, solvents, batteries, and chemicals according to regulatory requirements. b. Store hazardous waste in designated areas with appropriate containment measures to prevent spills and leaks. iv. Monitoring and Compliances: a. Monitor waste generation, segregation, and disposal activities regularly to assess compliance with waste management objectives. b. A ticketing system will be developed between both the Permittee and the Solid Waste Contractor to ensure effective management of waste and verification of disposal at the correct site.
	Health and Safety	Construction activities pose various risks, including potential accidental injuries and exposure to fugitive dust.	GENERAL i. Worker Protection: a. Provide comprehensive safety training and education programs for all construction workers, including hazard recognition, emergency response procedures, and proper use of personal protective equipment (PPE). b., If necessary, provision of lifelines, personal safety nets or safety belts and scaffolding. c. Ensure that workers wear PPE (hard hats, reflective vests, safety shoes, eye protection etc.) d. Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators. ii. Emergency Preparedness and Response Planning: a. Develop emergency response plans and procedures for handling accidents, injuries, fires, and other emergencies on-site. Designing and implementing an Emergency Response Plan (ERP) in the event of any emergency. This should include: Hurricane Earthquake Flooding Fire Civil Unrest and Riots Bomb Threats and Acts of Sabotage Acts of Terrorism and Armed Attacks Petroleum and Hazardous Material Stockpiling Security and Safety Information Medical Emergency Information Technological Emergencies a. Designate a qualified safety officer or supervisor responsible for emergencies and overseeing safety compliance and enforcement on-site. This person should be clearly identified to the construction workers. b. Conduct regular safety inspections, audits, and reviews to identify areas for improvement and implement corrective actions as needed. c. Site should be equipped with first aid kits and arrangement for a local nurse and/or doctor to be on call for the construction site. d. Ensure that there is an ambulance and requisite staff onsite for any eventualities. e. Make prior arrangements with staff at the Noel Holmes Hospital in Lucea and/or health centre to accommodate any eventualities. f. Make prior arrangements with the Lucea police and fire stations to accommodate any eventualities. iii. Hazardous Material Management: a. Properly store, handle, and dispose of hazardous materials and chemicals used during construction, following regulatory requirements and best practices. b. Material Safety Data Sheets (MSDS) should be stored onsite. iv. Communication and Reporting: a. Establish clear communication channels for reporting safety concerns, near misses, and incidents on-site. b. Encourage open dialogue between workers, supervisors, and management to address safety issues promptly and effectively. TRENCH EXCAVATION i. A trench 1.2m or more in depth must have a means of egress (ladders/ stairways/ramps) and should be located at 8m intervals.

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			ii. Excavated materials must be stored 0.6m or more from the open trench (not to be measured from the crown of the spoil). iii. Spoil should be placed so that the channels rainwater and other runoff water away from the excavation. iv. Take precautions regarding tension cracks - Tension cracks usually form at a horizontal distance of 0.5 to 0.75 times the depth of the trench. - Sliding or sloughing may occur as a result of tension cracks. VENDING AREAS i. Provision of adequate supply of potable water. ii. Monitoring of the various "cook shops" by public health authorities and the construction management team, to ensure proper hygiene is being followed. iii. The provision of areas to adequately wash hands and utensils. iv. Support the Hanover Municipal Corporation to ensure an orderly layout of vending areas. MARINE i. A safety officer, who is a competent swimmer and CPR trained, should be appointed. ii. Spotters in the water will assist the heavy equipment in accurate placement of the armour units. iii. The slopes and elevations of the armour layer will be demarcated with visual aids to guide the placement of boulders and to ensure they are properly interlocked.
	Vehicular Traffic	Proposed road design accommodates construction traffic without significantly affecting the overall level of service (LOS) on the main road, while the service entrance may experience occasional delays averaging LOS C.	To mitigate traffic impacts, it is recommended that the batching plant be placed within or close to the construction footprint. Vans and personnel vehicles are expected to follow normal 9 am and 5 pm peaks and should have minimal impact on traffic flow. To minimize the impact of increased traffic, it is highly recommended to discourage vehicles from crossing the main road from the service entrance to the proposed housing entrance. Alternatively, constructing an underpass to allow uninterrupted crossing between facilities should be prioritized. This issue is further complicated by the relatively short sight distance (~75 meters) to the adjoining corner. With vehicles traveling at the posted 50 km/h speed limit, the required stopping distance is 63 meters, which is acceptable. However, traffic camera analysis indicates that speeds often exceed 80 km/h, increasing the stopping distance to 129 meters, which far exceeds the available sight distance. This necessitates extensive traffic calming measures during the construction phase. To mitigate these, the following measures are recommended: i. Improved road lighting to enhance visibility in low-light conditions along the corner. ii. Appropriate traffic warning signs informing road users of the construction site entrance and instructing them to reduce speed. These signs should be placed at least 200 meters both westbound and eastbound from the site. iii. Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site, particularly for heavy vehicles. iv. Rumble strips to improve oncoming vehicle awareness. v. Schedule all major heavy vehicle traffic during off-peak hours to reduce the impact on the main road.
	Maritime Traffic	Construction activities for the project could disrupt fishing and maritime activities through increased vessel traffic, equipment deployment, and potential accidents, affecting local fishing operations, recreational boating, and other maritime activities.	i. Maritime Traffic Management: a. Clear Navigation Routes: Establish and clearly mark safe navigation routes for local fishers and recreational boaters to avoid construction areas. b. Exclusion/ Safety Zones: Establish safety exclusion zones around construction areas to prevent unauthorized access and reduce the risk of accidents. These zones should be clearly marked with buoys and warning signs to keep out other marine traffic and fishers from the work area and prevent potential accidents. c. Monitoring and Enforcement: Maritime patrols to monitor and enforce safety zones, ensuring compliance by all vessels operating in the area. ii. Coordination with Local Maritime Users: a. Stakeholder Engagement: Engage with local fishing communities and maritime users early in the planning process to understand their needs and concerns. Provide regular updates and opportunities for feedback throughout the construction phase. b. Communication Protocols: Implement communication protocols to inform maritime users of construction schedules, locations, and potential hazards through local notices to mariners and regular updates. c. Compensation and Support: Consider compensation or support measures for local fishers and maritime businesses adversely affected by the construction activities. iii. Environmental Protection: a. Minimize Turbidity and Pollution: Use turbidity curtains and other measures to minimize sediment disturbance and water pollution during construction. Ensure all vessels and machinery are well-maintained to prevent leaks and spills. b. Timing Restrictions: Schedule construction activities to avoid peak fishing seasons or sensitive periods for marine wildlife to reduce disruption to local ecosystems.
	Aesthetics	Construction activities may temporarily reduce the area's aesthetic appeal, primarily due to visual intrusion from machinery, equipment, and temporary structures, as well as dust and debris	i. Site Management: a. Erect temporary hoarding or fencing around the construction site to obscure unsightly machinery and activities. b. Maintain a clean construction site by regularly removing debris, waste materials, and dust. Implement dust control measures such as water spraying and covering stockpiles.

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
		accumulation, noise, light pollution, and alterations to natural features like vegetation and landform.	c. An area of gravel should be placed on site (just before exiting onto the main road) to help remove mud/marl from truck wheels. d. A wheel wash area on site (just before exiting onto the main road) should be implemented to rid wheels of as much mud/marl as possible. e. Use directional lighting to focus light only where it is needed and minimize spillover into surrounding areas. Employ low-intensity, warm-coloured lighting to reduce glare and light pollution. ii. Minimize Visual Intrusion: a. Compact Site Layout: Organize the construction site to minimize the footprint and reduce visual intrusion. Place equipment and materials in less visible areas whenever possible. b. Camouflage and Landscaping: Use temporary landscaping or plantings to soften the visual impact of the construction site. Employ natural colours and materials to blend temporary structures with the surrounding environment.
	Cultural and Heritage	No substantial evidence of Taino occupation was found; the JNHT determined that the site's cultural heritage does not warrant in situ preservation.	Given the findings of the by the JNHT, it is recommended to implement a protocol to halt construction immediately if significant archaeological finds are discovered, allowing for proper assessment and documentation by the JNHT.

Operational Phase

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
Physical	***Drainage***	Improved drainage systems, such as the proposal of swales, open channels, and a Retention Buried Pond system to effectively manage surface water while minimizing discharge impacts on the coastline.	Implementing the following mitigation measures will enhance the resilience of the drainage infrastructure, minimize environmental impacts, and ensure sustainable management of stormwater within and around the project area: i. Monitoring and Maintenance: Establish a comprehensive monitoring program to regularly assess the functionality and efficiency of the drainage system. This includes inspecting swales, open channels, and retention ponds to ensure they are free from obstructions and operating as designed. ii. Training and Awareness: Conduct training sessions for maintenance staff and relevant stakeholders on the proper upkeep of drainage infrastructure. This ensures that personnel are equipped to identify and address any potential issues promptly.
	Water Quality	Proposed drainage concept emphasizes the flushing capacity of the beach layout, maintaining/ improving water quality.	No mitigation required.
	Wave Climate	Localized wave energy reduction of approximately 40% around the proposed structures.	No mitigation required.
	Currents and Sediments	The influence of structures alters current directions, causing sediment accumulation on southern groynes and increased flow through gaps.	i. Perform periodic assessments of beach profiles to evaluate the stability and morphological changes of the constructed beach over time, including shoreline erosion, sediment movement, and alterations in physical characteristics. ii. Use the collected data to make informed decisions for adaptive management and potential enhancements based on observed performance.
Natural Hazards	***Swell Events***	Breakwaters effectively reduce wave heights by 50%, crucial for shoreline protection against erosion.	No mitigation required.
	Hurricane Waves	Reduction in wave heights in the sheltered area behind structures.	No mitigation required.
Biological	***Reef and Seagrass Communities***	Hard structures (pilings and boulders) provide ecological volume (FADs, additional habitat and colonization surfaces).	Regular monitoring, rehabilitation and restoration initiatives will be implemented within the Fish Sanctuary , including the proposed project area.
	Sea Turtles	Operational activities, obstructions and lighting may impact turtle nesting and foraging activity. Protection from poachers and predators.	I. All staff and workers should be sensitized to the sensitive ecosystems and species in the area, in particular turtles. The beaches should be inspected daily for any signs of turtle activity. If a nest is suspected or found; a. The nest should be cordoned off and remain undisturbed until it is hatched in approximately 60 days. b. All activity nearby should stop until an expert can determine if there is a nest and how to relocate the eggs if the nest is located in a highly vulnerable area. II. Turtle-friendly lighting and light positioning (if any) should also be placed on the overwater villas. Hotel operators should also educate their guests on sea turtle conservation and the correct actions to take if a sea turtle is observed nesting on the beach. III. The Hotel should also develop a Sea Turtle Monitoring programme which would include tagging and hatchling release. This could add to their attraction offerings (turtle watching).
Socioeconomic / Cultural	***Employment***	Significant opportunity for job creation in Lucea (approximately 3,500 direct jobs split between Phase I and Phase II, along with 5,800 indirect and 2,200 induced jobs).	i. Inclusive Hiring Practices: To ensure the maximum benefit to the community, it is crucial to prioritize inclusivity in hiring practices. Addressing barriers faced by individuals from diverse sexual orientations and gender identities is essential to ensuring equitable access to employment opportunities and fostering a more inclusive workforce environment. This approach will not only maximize the positive impact of job creation but also contribute to greater social equity and cohesion in Lucea. a. Anti-Discrimination Policies: Develop and enforce strict anti-discrimination policies that ensure fair hiring practices regardless of gender, sexual orientation, or gender identity. b. Diverse Recruitment Channels: Use diverse recruitment channels to reach a broad range of candidates, ensuring that job opportunities are accessible to all segments of the community. ii. Training and Development: a. Comprehensive Training Programs: Implement training programs that provide all employees with the necessary skills and knowledge, ensuring they can perform their roles effectively and progress in their careers. b. Diversity and Inclusion Training: Offer training on diversity and inclusion to all staff members to foster a supportive and respectful workplace culture.

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			iii. Community Engagement: a. Outreach Programs: Conduct outreach programs to engage with local communities, particularly marginalized groups, to inform them about job opportunities and the inclusive hiring process. b. Feedback Mechanism: Create a feedback mechanism for employees and community members to voice concerns and suggestions regarding employment practices and inclusivity. To ensure inclusive and equitable employment practices and to mitigate potential negative impacts, the above measures should be implemented. It should be noted that, despite the implementation of measures to prevent Sexual and Gender-Based Violence (SGBV), including sexual harassment, exploitation, and abuse, there remains a potential for such incidents to occur. Therefore, standard response procedures should be employed to address any incidents of SGBV swiftly and effectively.
	Water Supply	Phase 2 of the hotel complex will not directly affect the local water supply as it will source drinking water from a Reverse Osmosis seawater desalination plant located in the industrial area, separate from the community supply.	No mitigation required.
	Wastewater	The existing wastewater treatment plant, currently servicing Phase I, must double its capacity from 1,500 m^3/day to 3,000 m^3/day to accommodate the increased volume.	No mitigation required.
	Solid Waste	The hotel's operational activities are expected to increase solid waste generation significantly, potentially leading to environmental pollution, aesthetic degradation, and wildlife harm, particularly if waste enters marine environments near coastal areas.	i. Storage Bins and Skips: a. Strategic Placement: Place solid waste storage bins and skips at strategic locations throughout the hotel premises to ensure easy access for both guests and staff. b. Adequate Capacity: Ensure that the bins and skips have adequate capacity to handle the expected volume of waste without overflow. c. Secure Bins and Skips: Use bins and skips designed with secure lids to prevent access by vermin and other pests, minimizing health risks and maintaining hygiene standards. ii. Monitoring and Cleanup: a. Beach Garbage Monitoring: Regularly monitor and clean the beach area to prevent littering and maintain the aesthetic appeal of the coastal environment. b. Routine Inspections: Conduct routine inspections of the hotel grounds to promptly address any waste management issues. iii. Waste Collection and Disposal: a. Private Contractor Engagement: Contracting a private contractor to collect solid waste in a timely fashion to prevent a build-up. b. Scheduled Collections: Establish and adhere to a regular waste collection schedule to ensure consistent and efficient removal of waste. c. Proper Disposal: Ensure that all collected solid waste is disposed of at approved disposal sites, complying with local regulations and environmental standards. d. Verification System: Develop a ticketing system between the hotel (Permittee) and the solid waste contractor to ensure effective management and verification of waste disposal. e. Record Keeping: Maintain records of waste collection and disposal activities to monitor compliance and identify areas for improvement. iv. Waste Sorting and Recycling: a. Facilitate Sorting: Implement a waste sorting system to separate plastics, paper, glass, organic waste, and other recyclables. Provide clearly labelled bins to encourage proper waste segregation. b. Promote Recycling: Partner with local recycling programs to ensure that sorted materials are recycled and not sent to landfills. v. Employee and Guest Education: a. Training Programs: Provide training for staff on waste sorting, handling, and disposal procedures to ensure effective implementation of the waste management plan.
	Health and Safety	The operation of the proposed development will involve a substantial number of workers and guests, which increases the likelihood of illnesses, accidents, and emergencies occurring on-site.	i. First Aid Kits: a. Equip various sections of the development with well-stocked first aid kits, ensuring they are easily accessible in case of emergencies. b. Regularly check and restock first aid kits to ensure they are always ready for use.

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
		Additionally, the development is vulnerable to natural disasters such as earthquakes, floods, storm surges, and fires, all of which pose significant risks to health and safety.	ii. Emergency Response Plan: a. Comprehensive Planning: Design and implement a comprehensive emergency response plan that covers all potential scenarios, including medical emergencies, natural disasters, and fires. b. Staff Training: Conduct regular training sessions for staff to familiarize them with the emergency response procedures and ensure they can act swiftly and effectively during an emergency. c. Healthcare Facilities: Establish mutual assistance agreements with local healthcare facilities, such as Noel Holmes Hospital, to ensure quick and efficient medical care for any eventualities. Coordinate with associated doctors and nurses to facilitate prompt treatment. d. Fire and Emergency Services: Arrange prior agreements with the Lucea Fire Station to ensure rapid response in the event of a fire or other emergencies requiring firefighting services. e. Police Services: Coordinate with the Lucea Police Station to ensure prompt law enforcement support for any security or safety incidents that may arise. iii. Natural Disaster Preparedness: a. Risk Assessment: Conduct a risk assessment to identify potential vulnerabilities to natural disasters such as earthquakes, floods, and storm surges. b. Disaster Preparedness Plan: Develop and implement a disaster preparedness plan that includes evacuation routes, safe zones, and communication protocols for staff and guests. c. Regular Drills: Organize regular drills and simulations to practice emergency procedures and ensure all staff and guests are familiar with the actions to take during a natural disaster. iv. Safety Infrastructure: a. Emergency Exits and Signage: Ensure that all buildings are equipped with clearly marked emergency exits and safety signage to guide occupants during an emergency. b. Fire Safety Systems: Install and maintain fire safety systems, including smoke detectors, fire alarms, and sprinkler systems, to enhance fire prevention and response capabilities. v. Communication Systems: a. Emergency Communication: Establish robust communication systems to quickly disseminate information during an emergency, including loudspeakers, alarms, and mobile alerts. b. Coordination with Authorities: Maintain open lines of communication with local emergency services and authorities to ensure coordinated and efficient response efforts. vi. Health and Safety Training: a. Employee Training Programs: Implement ongoing health and safety training programs for employees to ensure they are knowledgeable about potential risks and the appropriate response measures. b. Guest Information: Provide guests with information on emergency procedures and safety protocols upon check-in to ensure they are prepared for any eventuality.
	Vehicular Traffic	Significant traffic increases during the hotel's operational phase, primarily due to expanded guest and staff requirements, affecting both the guest and staff entrances.	One solution to improve the hotel's main guest entrance is to implement an actuated stoplight with a 90-second cycle time. This stoplight would improve the LOS of the guest entrance from F in the AM and PM peak to B in both periods. This change would result in an LOS of B heading to Montego Bay and C heading to Negril in both the AM and PM scenarios for the main road. These levels of service remain within acceptable ranges based on NWA standards. For the operational scenario at the service entrance, the following recommendations are made: i. Improved road lighting to enhance low-light visibility along the corner. ii. Appropriate traffic warning signs informing road users of the site entrance ahead and instructing them to reduce speed, placed at least 200m both westbound and eastbound from the site. iii. Highly visible lane markings as recommended by NWA. iv. Rumble strips to improve vehicle awareness from the westbound traffic, increasing alertness and serving as traffic calming measures. v. All employee traffic should be routed through the tunnel and should not be permitted to travel from staff housing to the service gate via the main road. For the guest entrance, the following are recommended: i. Formalization of a turning lane with a minimum queue length of 35m.

CATEGORY	RECEPTOR	POTENTIAL IMPACT	RECOMMENDED MITIGATION
			ii. Implementation of high-visibility lane markings to guide commuters effectively on the proposed road.
	Maritime Traffic	The introduction of overwater rooms and coastal structures poses potential disruptions to maritime activities, including obstruction of navigational paths and increased risks of collisions, particularly in low visibility conditions like night or adverse weather.	i. Visible Marker Buoys: Installing permanent, highly visible marker buoys around overwater rooms to clearly indicate their presence and boundaries to maritime vessels. ii. Navigation Lights: Implementing turtle-friendly lighting and strategically positioning lights on overwater structures to ensure visibility for marine vessels during nighttime operations, reducing the risk of collisions. iii. Clearance and Safety Zones: Establishing and maintaining clearances and safety zones around overwater rooms in accordance with maritime regulations to facilitate safe navigation and prevent congestion. iv. Monitoring and Compliance: Regular monitoring of maritime traffic patterns and compliance with navigational safety standards to assess any potential impacts and adjust mitigation strategies as necessary. v. Public Awareness and Education: Conducting outreach and education campaigns to inform maritime stakeholders about the presence of overwater rooms, their potential impacts on navigation, and the importance of adhering to safety measures.
	Tourism	Poised to enhance the country's tourism offering by attracting more visitors and boosting local tourism revenue.	No mitigation required

ANALYSIS OF ALTERNATIVES

The following project alternatives have been identified and are discussed in further detail below:

- **Alternative 1 - The "No-Action" Alternative**
    - The "No Action" alternative represents the scenario where no changes are made to the current situation or existing conditions. It serves as a baseline against which other project alternatives are compared.
- **Alternative 2 - The Project as Proposed in the EIA**
    - Fiesta Jamaica Ltd. commenced the construction of The Grand Palladium Jamaica & Lady Hamilton Resort & Spa in 2007 (Phase 1) and now intends to undertake the Phase 2 expansion. This expansion project aims to add 948 rooms over approximately 83.78 acres of land. New rooms will be distributed across two hotels:
    - Grand Palladium: Comprising eight buildings with 475 rooms, standing at six storeys high. There will also be one-story two- and three-bedroom villas with swim-up pools.
    - TRS Hotel: Exclusively for adults, consisting of nine buildings with 473 rooms, also standing at six storeys high. It will also include two-bedroom single-storey villas and a swim-up pool.
    - Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:
        - Sixteen (16) overwater bungalows.
        - Creation of 2 beaches, one at the southern overwater bungalows area and the other in the TRS area, exclusively for guest enjoyment.
        - Three (3) revetments, 6 groynes, 2 submerged breakwaters.
- **Alternative 3 - The Project as Proposed in the EIA with Rearrangement of Overwater Rooms and Coastal Works**
    - New rooms will be distributed across two hotels. Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:
    - 16 overwater bungalows
    - Creation of 2 beaches
    - 1 revetment, 2 groynes, 2 submerged breakwaters

  Alternative 3 would have similar impacts compared to Alternative 2.
- **Alternative 4 - The Project as Proposed in the EIA with Reduced Overwater Rooms and Coastal Works**
    - New rooms will be distributed across two hotels. Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:
        - 14 overwater bungalows
        - 2 submerged breakwaters

Alternative 4 would have similar but reduced impacts compared to Alternative 2. For example, the benthic footprint is similar, while no new bathing beaches will be created. This reduces the tourism product, options and economic benefits.

- **Alternative 5 - The Project as Proposed in the EIA with Increased Overwater Rooms and Coastal Works**
    - New rooms will be distributed across two hotels. Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:
        - 20 overwater bungalows
        - 2 submerged breakwaters

  Alternative 5 is similar to Alternative 2, but with a greater benthic impact footprint. Additionally, no new bathing beaches will be created.

The Preferred Alternative is Alternative 2 – the Project Proposed in the EIA. This alternative aims to minimize ecological disruption while ensuring the project's feasibility and success.

ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

An Environmental Management System (EMS) is an important tool which can be used to assist operations managers in meeting current and future environmental requirements and challenges. It can be used to measure a company's operations against environmental performance indicators, thereby helping the company to reach its environmental targets. A good management system will integrate environmental management into a company's daily operations, long-term planning and other quality assurance systems.

It is therefore recommended that several parameters be monitored before, during and after the project implementation to record any negative construction impacts and to propose corrective or mitigation measures. The suggested parameters include but are not limited to the following:

1) Water Quality to include but not be limited to:
    a. Nitrates
    b. Phosphates
    c. BOD
    d. Fats, oil and grease
    e. pH
    f. TSS
    g. Turbidity
    h. TDS
    i. Faecal Coliform
2) Noise
3) Sediment loading
4) Coral and Seagrass

5) Traffic
6) Maritime Operations
7) Solid Waste Generation and Disposal
8) Sewage Generation, Treatment and Disposal
9) Equipment Maintenance
10) Health and Safety

Other specific Management/Monitoring Plans applicable to this project include:

- ***Coral Management Plan*** - will include a combination of coral monitoring exercises, water quality monitoring and sediment dispersal monitoring, before, during and after construction. The activities will be conducted by qualified and trained marine scientists and SCUBA divers.
- ***Seagrass Management Plan*** - will include a combination of seagrass survey/monitoring exercises and water quality monitoring before, during and after construction. The activities will be conducted by qualified and trained marine scientists and SCUBA divers.

CONCLUSIONS AND RECOMMENDATIONS

This proposed development is expected to increase the island's room offerings, thereby creating jobs and economic benefits, growing the tourist clientele, and enhancing and diversifying the Jamaican tourism product.

However, the project also poses potential negative impacts, including the degradation and loss of natural habitats, as well as adverse effects on noise levels, air quality, and solid waste facilities. These concerns have been highlighted through stakeholder involvement and public interviews conducted for this EIA.

The implementation of the recommended mitigation measures detailed in this EIA, along with the various environmental management and monitoring programs, will assist in reducing these negative impacts.

2.0 INTRODUCTION

2.1 PROJECT BACKGROUND AND CONTEXT

The objective of the project is to augment the Grand Palladium Jamaica Resort & Spa through the proposed Phase II development and enhancement of existing hotel facilities. This expansion initiative entails the establishment of a complex comprising two distinct hotels, namely the Grand Palladium (475 rooms) and TRS (473 rooms), resulting in a combined total of 948 rooms.

This project is consistent with the government's initiative to stimulate tourism arrivals by expanding tourism infrastructure beyond traditional areas like Negril, Ocho Rios, Montego Bay, Port Antonio, and Kingston, thereby broadening the scope of tourism offerings. As tourism arrivals surge, there is a corresponding demand to increase hotel room capacity to accommodate the expected influx of visitors. Moreover, the project aligns with Vision 2030, Jamaica's strategic blueprint for positioning itself as a premier destination for visitors and businesses. By expanding the island's accommodations through this development, the project aims to fuel the growth of clientele and enhance the overall quality of Jamaica's tourism offerings. With a diverse range of hotels, attractions, and activities available in Jamaica, the country is well-equipped to consistently meet and exceed visitor expectations, providing unmatched experiences and excellent value for money.

2.2 STUDY APPROACH

2.2.1 Scope of Work

The Natural Resources Conservation Authority Act (NRCA) of 1991 and subsequent legislation and regulations stipulate that individuals undertaking new developments falling within specific categories must obtain a permit. Additionally, the National Environment and Planning Agency (NEPA) deemed an Environmental Impact Assessment (EIA) necessary, with the approved Terms of Reference (TORs) for the EIA provided in Appendix 1.

The approach taken to conducting this EIA encompassed a systematic process for evaluating the potential environmental consequences of the proposed project, as guided by the approved TORs. It involved identifying, predicting, and assessing the potential impacts of the project on the environment, including natural resources, ecosystems, communities, and human health. The overarching goal of the EIA process is to ensure that development activities are carried out in a sustainable manner, minimizing adverse effects on the environment while maximizing social and economic benefits.

The EIA approach encompasses several key components, each essential for a comprehensive assessment of the proposed project's environmental impact. These components include scoping, baseline data collection, impact prediction and assessment, mitigation and management measures, public consultation and participation, and proposed monitoring plans. Within these major components, there are finer groupings that address various aspects of the environment, namely physical, biological, natural hazards, and socio-economic and cultural/heritage considerations. Methodologies employed for collecting baseline data and evaluating potential impacts are specific to each domain and are described in detail within the relevant sections of the report.

Geographic Information Systems (GIS) played a crucial role by providing spatial data management, analysis, and visualization capabilities. Existing geospatial data were acquired from multiple sources, including the Mona GeoInformatics Institute, Social Development Commission (SDC), Forestry Department, Planning Institute of Jamaica (PIOJ), Water Resources Authority (WRA), The Nature Conservancy (TNC), and the National Environmental Planning Agency (NEPA). When required, additional insights were obtained from the 1984 national topographic maps (metric series), as well as contemporary data from Google Maps and satellite imagery.

In fulfilment of the TORs, this EIA report has been compiled in strict accordance with the prescribed section headings and required information for inclusion.

2.2.2 Location and Study Area

The proposed Phase 2 development adjoins the existing Phase 1 hotel, Grand Palladium Jamaica Resort & Spa, to its south, along northern coastal highway (Figure 2-1). The site is located in the district of Point, approximately 3.8 km east of the capital of Hanover, Lucea. Additionally, it is approximately 1.4 km southwest of the Oceanpointe Housing development and approximately 34.8 km west of the Sangster International Airport, in Montego Bay (Figure 2-1).

As outlined in the TORs, the designated study area should extend at least 1 kilometre from the property's central point (Figure 2-2), ensuring the inclusion of all pertinent terrestrial and marine resources potentially impacted by the project. While this constitutes the minimum radius for evaluating the various physical, biological, and social environmental receptors, the study area expands for specific assessments, particularly in socio-economic descriptions, in which the area of study is a radius of 5 kilometres (section 5.4.1).

Figure 2-1 Proposed Phase 2 location in relation to the town of Lucea, city of Montego Bay and existing hotel (Phase 1)

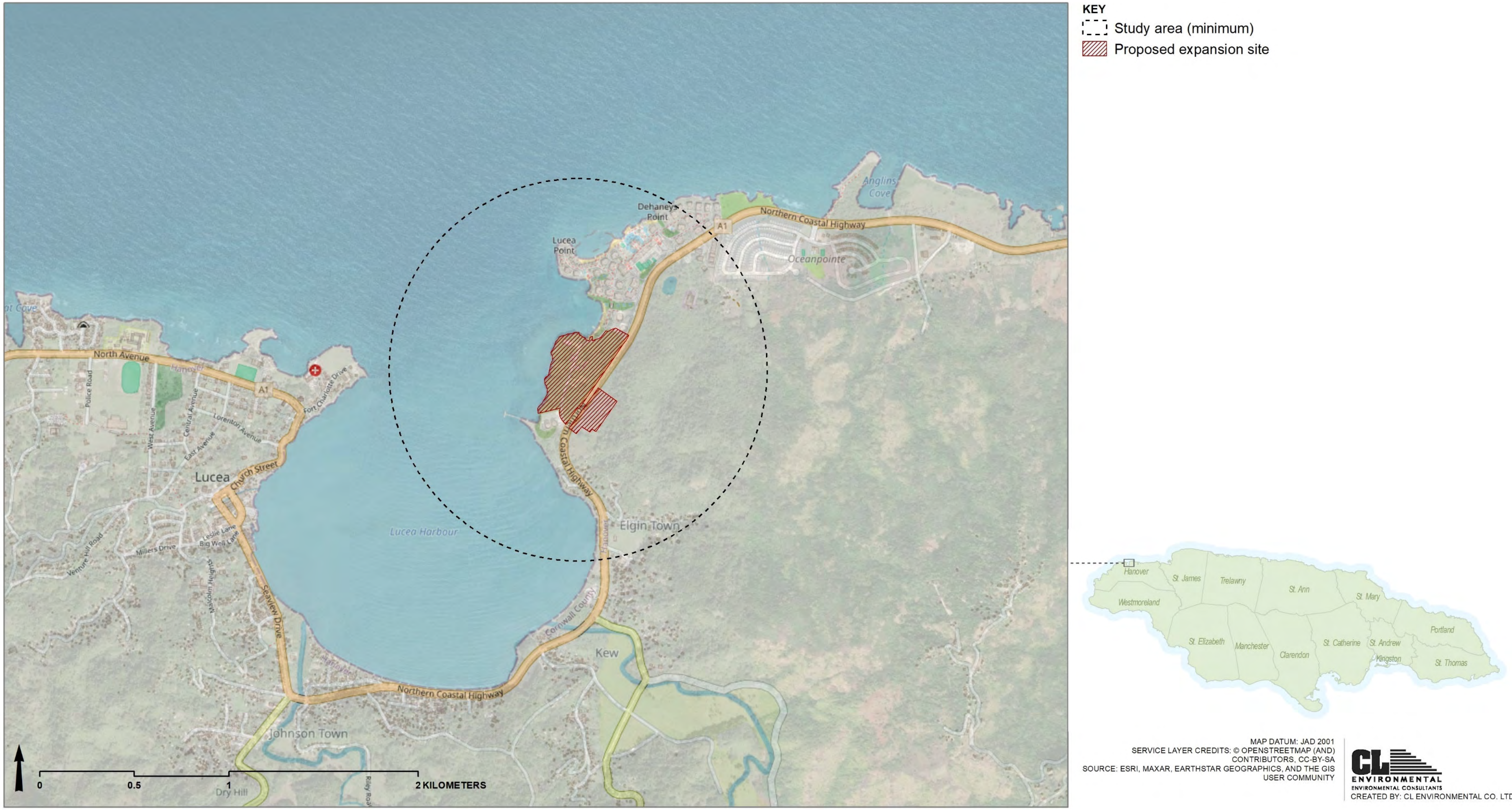


Figure 2-2 **Minimum study area and proposed Phase 2 location, in relation to the town of Lucea and the Oceanpointe housing development**

2.2.3 Assumptions and Limitations

The process of an environmental impact assessment (EIA) involves a systematic analysis to evaluate how proposed project activities may alter the existing environment. Its primary goals are to anticipate significant adverse impacts and propose measures to mitigate them. However, the effectiveness of an EIA is influenced by inherent assumptions and limitations.

Assumptions include the reliance on accurate baseline data and the predictability of environmental impacts using reliable models and methods. These assumptions are crucial for accurately assessing existing conditions such as water quality, air quality, soil conditions, and biodiversity, as described in Section 5.0 of the assessment. It must be noted that this section describes the conditions observed before the passage of Hurricane Beryl (July 3 and 4, 2024).

Data can vary spatially and temporally, prompting efforts within EIAs to gather comprehensive current and historical information that represents these variations. In cases where physical data collection is challenging, models are employed to predict conditions. It is also assumed that the methods and models used to predict the environmental impacts are reliable and accurately represent potential outcomes. The predictability of impacts is vital for developing effective mitigation strategies.

Stakeholder engagement plays a crucial role in ensuring that the EIA comprehensively addresses all potential concerns and integrates diverse perspectives. However, varying stakeholder views on what constitutes significant impacts can complicate this process. While it is assumed that stakeholders—including local communities, industry representatives, and regulatory bodies—provide comprehensive and representative input, it is important to recognize that some responses may be biased. The interpretation of data and the assessment of impact significance are inherently subjective, which can potentially lead to biased conclusions.

Understanding these assumptions and limitations is critical for interpreting EIA results accurately and making informed decisions regarding project development and environmental management. Continuous monitoring and adaptive management strategies are emphasized to address these challenges effectively.

2.3 ORGANIZATIONAL PROFILES

2.3.1 The Proponent

The Palladium Hotel Group hotel chain was founded in the late 1960s in Ibiza by businessman Abel Matutes Juan, who dreamed of bringing paradise within the reach of travellers and offering them amazing experiences. He set out to design the most exclusive accommodation, based on the fundamental concepts of luxury, quality and first-class service. He took his first steps in the Balearic Islands and the Canary Islands, and in the early 1990s he continued the adventure by opening several resorts in the Caribbean. He then built on his success by opening hotels in top world destinations: Spain, Italy, Dominican Republic, Mexico, Jamaica and Brazil. In 2000, these hotels were grouped together under the name of Fiesta Hotel Group. In 2012, the group opted to update its company image and became Palladium Hotel Group, taking its name from its five-star Caribbean resorts. The Palladium Hotel Group operates a total of over 50 hotels and resorts.

Table 2-1 Contact information for the project proponent and project consultants.

Company and Role	Address	Telephone	Website and Email
Fiesta Jamaica Limited *Project Proponent*	Shortridge Crescent P.O Box 704 Kingston 6	876. 619.0000	palladium.jamaica@palladiumhotelgroup.com https://www.palladiumhotelgroup.com/en/
C. L. Environmental Co. Ltd. *Project Environmental Consultant*	20 Windsor Avenue Kingston 5	876.648.7204	info@clenvironmental.com http://www.clenvironmental.com/

2.3.2 Project Consultant

C. L. Environmental Co. Ltd., established as a Limited Liability Company in Jamaica since August 2000, offers consultancy services to governmental and non-governmental agencies, both locally and internationally. Our area of expertise covers a comprehensive range of services centred on environmental management and impact assessment, spanning all project phases from pre-construction to operation. C.L. Environmental' s range of services include:

- Environmental Impact Assessments (EIAs)
- Environmental Monitoring
- Environmental Audits
- Seagrass and Coral Relocation/Replanting
- Mangrove Replanting
- Indoor Air Quality Assessments
- Noise Modelling, Measurements and Assessments
- Vibration Assessments
- Occupational Health and Safety Assessments
- Underwater Exploration (ROV)
- Unmanned Aerial Vehicle (UAV) Surveys and Remote Sensing
- Faunal and Floral Studies
- Socioeconomic Surveys, Social Impact Assessments and Stakeholder Consultations

Our multidisciplinary team comprises diverse professionals, including environmental scientists, marine ecologists, environmental engineers, waste management specialists, planners, industrial hygienists, environmental management systems specialists, environmental educators, and quality consultants.

Over the years, our team has successfully undertaken numerous environmental projects, many of which hold national significance. The range of environmental projects executed by CLE encompasses highways and road networks; hotels, residential areas, and commercial developments; power generation facilities; hospitals and health centres; and airports and port facilities. Some of our most recent and notable environmental assessments and monitoring projects include: the Hotel Development at Part of Richmond Estates, St. Ann; RIU Hotels (Aquarelle, Negril, Tropical Bay, Reggae, Mahoe Bay, Palace Montego Bay and Ocho Rios); Royalton (Negril, White Sands and Blue Waters); Excellence Oyster Bay, Trelawny; Karisma Hotels (Azul and Llandovery); Secrets Hotel (Wild Orchid, Breathless and St. James); Montego Bay Perimeter Road, Long Hill Bypass and West Green Avenue and Barnett Street Upgrades, St. James; Princess Hotels and Resorts, Cove, Hanover; Proposed Ian Fleming International Airport Runway Expansion, Boscobel, St. Mary; Southern Coastal Highway Improvement Project (SCHIP); Highway 2000 North South Link: Caymanas to Linstead and Moneague to Ocho Rios segments; Remediation of the American Airlines Flight 331 Accident Site at Norman Manley International Airport; and the Falmouth Cruise Pier Development in Falmouth, Trelawny, among others.

3.0 LEGISLATION AND REGULATORY CONSIDERATION

3.1 ENVIRONMENTAL IMPACT ASSESSMENT FRAMEWORK

3.1.1 Rationale and Basis

An Environmental Impact Assessment (EIA) is "a structured approach for obtaining and evaluating environmental information prior to its use in decision-making in the development process. This information consists, basically, of predictions of how the environment is expected to change if certain alternative actions are implemented and advice on how best to manage environmental changes if one alternative is selected and implemented" (Bisset, 1996).

The basis and rationale of an EIA has been summarised as follows (Wood, n.d.):

- EIA serves a broader goal beyond the mere preparation of technical reports; it aims at safeguarding and enhancing the quality of the environment.
- It involves a systematic procedure to identify and evaluate the impacts of activities on both natural and social environments. Rather than relying on a single analytical method, EIA integrates various approaches tailored to specific issues.
- While not a science in itself, EIA draws upon multiple scientific disciplines, evaluating relationships as they exist in real-world contexts.
- EIA should be considered an integral part of project planning, rather than an optional addition. Its costs should be factored into planning efforts rather than treated as an extra expense.
- Although EIA does not make decisions outright, its findings should inform policy and decision-making processes, influencing the ultimate choices made.
- EIA findings should focus on key or critical issues, elucidating their significance and estimating probabilities in a manner conducive to informing policy decisions.

3.1.2 Development Application and the EIA Process

The National Environment and Planning Agency (NEPA)[1] holds the responsibility for environmental management in Jamaica as stipulated by the Natural Resources Conservation Authority Act (NRCA) of 1991. Since the enactment of the NRCA Act, it has been reinforced by various supporting regulations that took effect in January 1997. The Environmental Permit and License System (P&L) is overseen by NEPA

[1] NEPA represents a merger of the Natural Resources Conservation Authority (NRCA), the Town Planning Department (TPD) and the Land Development and Utilization Commission (LDUC). Among the reasons for this merger was the streamlining of the planning application process in Jamaica.

through its Applications Section, introduced in 1997 to ensure adherence to required standards and minimize adverse environmental impacts of all developments. Under the NRCA Act of 1991, the NRCA possesses the authority to issue, suspend, and revoke environmental permits and licenses. Additionally, it has the power to request Environmental Impact Assessments (EIAs) for permits or activities within prescribed areas (the entire island of Jamaica) where potential adverse environmental effects are anticipated.

The NRCA permit process begins with the submission of an application to the Authority, which is reviewed to assess the need for an Environmental Impact Assessment (EIA) and to identify any environmental significance. If an EIA is required, the applicant is notified and provided with a generic Terms of Reference (TOR) (Figure 3-1). The applicant then drafts and submits the TOR to NEPA for approval. NEPA's EIA Sub-committee reviews the TOR and provides feedback until it is accepted. Once approved, the applicant completes the EIA and submits a draft report. NEPA, along with relevant stakeholders, reviews the report for compliance with the agreed TOR. If the report is accepted, NEPA requests hard copies and informs the applicant of the procedure for a public meeting. If the report is not accepted, the applicant is required to address the deficiencies. The EIA report is then published online and distributed to the appropriate agencies.

Public meetings are organized in accordance with the "Guidelines for Public Interface Relating to Development Applications". After the public meeting is held and the required timelines have passed, the technical review of the application proceeds according to the established procedures. The EIA is then submitted for final approval, and if it is not approved, proponents have the option to appeal the decision to the Office of the Prime Minister.

National Environment and Planning Agency

Environmental Impact Assessment Process

The following procedure applies where it has been determined that an environmental impact assessment (EIA) is required for an application.

1. Applicant is advised of the requirement for an EIA to be conducted and provided with a generic Terms of Reference (ToR)
2. The applicant prepares and submits draft ToR for acceptance by the NEPA
3. The NEPA (EIA Sub-committee) reviews draft ToR to determine if it is acceptable
    a. If the ToR is accepted, ToR is stamped by the NEPA as the agreed ToR and the applicant is advised to proceed with undertaking the EIA
    b. If the ToR is not accepted, the relevant comments are provided for the applicant to address (this process continues until the ToR is accepted)
4. Applicant submits draft EIA report based on the agreed ToR
5. The NEPA (EIA Sub-committee) and relevant stakeholders review the draft EIA against the agreed ToR to determine conformance
    a. If the EIA report complies with agreed ToR, NEPA accepts the EIA report, communicates same to applicant, request submission hard copies of the report and advises of the procedure for hosting of the public meeting
    b. If the draft EIA does not comply with the agreed ToR, NEPA advises the applicant of the shortcomings and requires that they be addressed (this process continues until the EIA report is accepted)
6. EIA report posted to NEPA website and hard copies placed at strategic locations to allow access and review by the public
7. EIA report circulation to relevant commenting agencies
8. The process for the public meeting commences as per the "Guidelines For Public Interface Relating To Development Applications"
9. Once public meeting is held and the required timelines have elapsed, the technical review of the application continues as per the established procedures

Source: National Environment and Planning Agency (NEPA)

Figure 3-1 Environmental Impact Assessment process

3.1.3 Project-Specific Requirements

Following an assessment of the proposed project, NEPA stated that the site is zoned for both resort and resort residential purposes (National Environment and Planning Agency, 2023). Subsequently, Fiesta Jamaica Limited was advised that they may proceed by submitting an overall Master Plan and updated Environmental Impact Assessment (EIA) for the development. Given the scale, scope, and magnitude of this proposed phase of development (Phase 2), which includes overwater suites, the EIA report must encompass terrestrial and marine components. It is also noted that a significant period has passed since the submission of the initial EIA for the earlier phases of the development. The Terms of Reference (TOR) tailored for the proposed project were approved by NEPA and utilized as a framework for conducting the EIA.

NEPA (2023) further outlined that planning permission is required pursuant to section 12 1 (A) of the Town and Country Planning Act, 1957. Therefore, a formal planning application must be submitted to the Town and Country Planning Authority (TCPA) through the Hanover Municipal Corporation (HMC) for determination.

Furthermore, the proposal will be subject to the requirements of the following legislations (refer to section 3.2.2.2 for further information):

- Natural Resources Conservation Authority Act (1991)
- Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013
- Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development (Amendment) Order, 2015
- Natural Resources Conservation (Permits and Licences) (Amendment) Regulations, 2015

Approval for environmental permits and licenses must be sought from the Natural Resources Conservation Authority through NEPA, under whose jurisdiction the Act currently falls.

3.2 NATIONAL LEGISLATION

3.2.1 Development Control and Planning

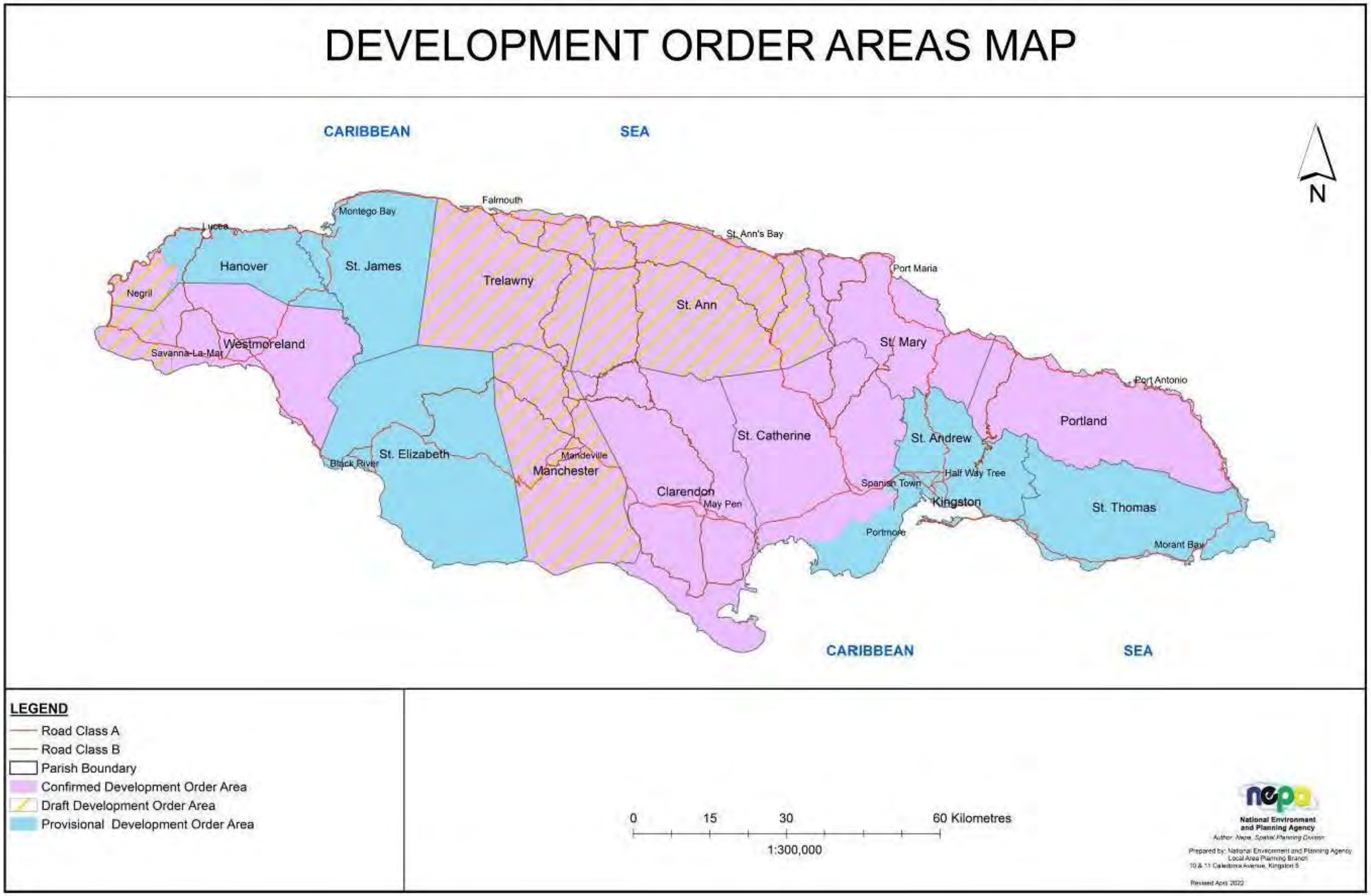
3.2.1.1 Town and Country Planning Act (TCP Act), 1957

The Town and Country Planning Act (TCP Act) of 1957 outlines the legal requirements for the organized development of land through planning and provides guidelines for the creation of Development Orders. A Development Order is a legal instrument used to direct development within its designated area, and the TCP Act applies only in regions where such orders are in place. These orders typically consist of land use zoning maps, policy statements, and standards governing land use activities. Within the framework of the TCP Act, protected areas such as Tree Preservation Areas and Conservation Areas are designated in gazetted Development Orders. Development Orders address various matters, including but not limited to: Roads, Buildings, Community Planning, Amenities, Public Services, Transportation and Communications, and Miscellaneous regulations.

The Town and Country Planning Act also institutes the Town and Country Planning Authority, which, in collaboration with the Local Planning Authorities (LPAs), also known as Municipal Corporations, oversees land use zoning and planning regulations outlined in their respective local Development Orders (Figure 3-2).

The **Hanover Municipal Corporation** serves as the local planning authority for this project, operating under **The Town and Country Planning (Hanover Area) Provisional Development Order, 2018** (Government of Jamaica, 2018). The project site is located within an area designated as Resort (Coastal, Lot 1) and Resort/Residential (Landward, Lot 2) (National Environment and Planning Agency, 2023), in the **Lucea Local Planning Area Land Use Proposal (Inset No. 1)**. The lot located south of the project site is zoned for seaport and seaport-related activities, designated for resort and residential purposes under the Town and Country Planning (Hanover Area) Provisional Development Order, 2018. The zoning designations are therefore in accordance with the proposed project's intended use.

Section 5.4.8.4 provides further details regarding zoning and policies outlined within the Town and Country Planning (Hanover Area) Provisional Development Order, 2018.



Source: NEPA

Figure 3-2 **Development Order Areas in Jamaica**

3.2.1.2 Building Act 2016

The Building Act 2016 repeals the Kingston and St. Andrew Building Act and the Parish Councils Building Act, introducing new regulations for the building industry. Its primary goal is to streamline the adoption and effective implementation of national building standards, as outlined in the National Building Code of Jamaica. These standards aim to ensure safety in the built environment, improve amenities, and foster sustainable development.

The Act defines a "building" broadly, encompassing various structures such as domestic buildings, public buildings, warehouse-class buildings, and other physical structures, including temporary ones. It also covers any architectural or engineering product or work erected or constructed on, over, or under land or bodies of water.

In accordance with the Act, the KSAC (for Kingston and St. Andrew), the Parish Council (for other parishes), and the Municipal Council (for municipalities) are designated as the Local Building Authorities for their respective areas. For this project, the Hanover Municipal Corporation serves as the local planning authority. Anyone intending to undertake building work must apply to the relevant Local Building Authority for the necessary building permit. It is prohibited to commence any building work without the issuance of the appropriate building permit, alongside any planning permit required under the Town and Country Planning Act, and ensuring compliance with the building permit, this Act, the National Building Code, and any other regulations established under this Act.

3.2.1.3 Local Governance Act 2016

This Act is a consolidation of the following existing Acts, which were repealed once the new legislation was enacted:

- The Parish Councils Act (1887)
- The Kingston and St. Andrew Corporation Act (1923)
- The Municipalities Act (2003)
- The Parochial Elections (Modifications) Act (1979)

This legislation introduces novel concepts and principles indicative of a modernized approach to local governance, aimed at fortifying local self-administration. Formerly referred to as Parish Councils, Local Authorities are now delineated as Municipal Corporations, City Municipalities, or Town Municipalities. Within the study area, the Hanover Municipal Corporation assumes the role of the Local Authority entrusted with the responsibility for development.

3.2.1.4 Beach Control Act 1956 and the Beach Control (Amendment) Act 2004

This legislation, enacted in 1956, was designed to ensure the effective management of Jamaica's coastal and marine resources through the implementation of a licensing framework. This system governs the utilization of both the foreshore and the seabed. Additionally, the Act addresses various issues such as shoreline access, fishing rights, public recreation, and the establishment of marine protected areas.

Under section 5 of this Act, it constitutes an offense to encroach upon the foreshore or seabed for public or commercial purposes without the appropriate license.

The Beach Control (Licensing) Regulations of 1956 mandate a permit for any activities conducted on beaches, coastlines, or foreshores. Applications for such permits must be submitted to NEPA. Permit requirements include posting a Notice of Application on both the landward and seaward sides of the property, with the notice also served on adjoining neighbours. Members of the Natural Resources Conservation Authority or authorized officers may conduct investigations to ensure compliance with the license and may request the submission of pertinent information.

Furthermore, NEPA must be approached for a BCA (Beach Control Authority) License for the commercial or recreational use of the foreshore and seabed.

3.2.1.5 Overwater Structure Planning Guidelines, 2016

The decision to formulate planning guidelines for overwater structures was prompted by the increasing interest in developing such accommodations within Jamaica's tourism sector. This document focuses on the establishment of overwater structures and also covers the construction of navigational facilities like docks, jetties, piers, and wharfs, as well as encroachments such as groynes, all of which must comply with regulations outlined in the Beach Control Act.

This draft document also includes general guidelines aimed at providing direction for the project proponent regarding the development of overwater structures. Furthermore, it specifies that detailed and specific conditions and guidelines will be furnished on an individual basis as part of the licensing or permit process. While designed to be adaptable, these guidelines are intended to safeguard natural ecological processes and protect marine resources from any adverse impacts resulting from construction-related activities.

3.2.1.6 NRCA Guidelines for the Planning, Construction and Maintenance of Facilities for Enhancement and Protection of Shorelines

This document provides guidance on the NRCA permitting process, environmental considerations, and coastal engineering planning and design for projects aimed at safeguarding and improving shorelines. Through such guidance, the aim is to eliminate or mitigate any undesirable environmental impacts associated with these types of projects.

In the Permitting Procedures section, it is emphasized that certain activities in the coastal zone may lead to specific effects. Therefore, it is crucial for all stakeholders to understand the potential negative effects that may arise from a particular project. Project Sponsors are encouraged to engage with NRCA (NEPA) at the earliest stages of project planning to ensure effective communication and collaboration.

3.2.1.7 Office of Disaster Preparedness and Emergency Management Act 1998

This legislation founded the Office of Disaster Preparedness and Emergency Management (ODPEM), tasked with the primary responsibility of formulating and executing policies and programs to attain and uphold a suitable level of national and sectoral readiness for managing emergency situations. It is imperative for the proposed project to establish collaboration with this agency to develop the requisite emergency response plans concerning natural hazard events, such as hurricanes.

3.2.1.8 Tourist Board (Water Sports) Regulations 1985

These regulations outline the operation and conduct standards for water sports activities, which will apply to the proposed hotel development upon commencement of operation. The regulations cover three categories of water sports: SCUBA diving; parasailing & water skiing, and jet-skiing; and sunfish sailing and board sailing. They include provisions for licensing water sports operations, conducting inspections, and other relevant rules and guidelines.

3.2.2 Environmental Conservation

3.2.2.1 Protected Areas System Master Plan: Jamaica 2013 – 2017

The Protected Areas System Master Plan (PASMP) sets out guidelines for establishing and managing a comprehensive system of protected areas that supports national development by contributing to long-term ecological viability; maintaining ecological processes and systems; and protecting the country's natural and cultural heritage (National Environment and Planning Agency, n.d.). The PASMP is consistent with several national policies and plans, including the Policy for Jamaica's System of Protected Areas 1997, the National Strategy and Action Plan on Biological Diversity in Jamaica (2003) and Vision 2030 Jamaica: National Development Plan (2009). It is also a requirement under the Convention for Biological Diversity's (CBD's) Programme of Work for Protected Areas (PoWPA).

Existing protected area categories in Jamaica are listed in Table 3-1, Table 3-2 and Table 3-3 and shown on Figure 3-3. The NRCA/NEPA is responsible for areas declared/designated under the acts it administers, including the Natural Resources Conservation Authority Act, Wild Life Protection Act and Beach Control Act. As of June 20204, there were 12 protected areas declared under the NRCA Act (Figure 3-3). In addition to NRCA/NEPA, a number of other government entities (such as the Forestry Department, Fisheries Division and Jamaica National Heritage Trust), local management entities, non-governmental entities, private sector and individuals are outlined as important role players. Responsibility for protected area management has been a shared endeavour and this collaborative approach to protected area management will continue under the PASMP (National Environment and Planning Agency, n.d.).

Proposed coastal project components are located within the Lucea fish sanctuary, which was recently gazetted on March 29, 2024 (please see section 5.4.8.3 for further detail). Additionally, Fort Charlotte, a significant protected asset in Lucea, has been designated as a site by the Jamaica National Heritage Trust.

Table 3-1 Existing categories of protected areas in Jamaica (January 2012) - protected area system categories

Source: (National Environment and Planning Agency, n.d.)

CATEGORY	RESPONSIBLE AGENCY	LAW
Protected Area	Forestry Department: Ministry of Economic Growth and Job Creation (MEGJC).	Forest Act, 1996 and Forest Regulations
	National Environment and Planning Agency (NEPA): MEGJC	NRCA Act, 1991
	NEPA: MEGJC	Beach Control Act, 1956
National Park	NEPA: MEGJC	NRCA Act, 1991
Marine Park	NEPA: MEGJC	NRCA Act, 1991
Environmental Protection Area	NEPA: MEGJC	NRCA Act, 1996
Forest Reserve	Forestry Department: MEGJC	Forest Act, 1996 and Forest Regulations
Fish Sanctuary (also previously referred to as Special Fishery Conservation Area)	Fisheries Division: Ministry of Industry, Commerce, Agriculture and Fisheries (MICAF)	Fisheries Act, 2018
National Monument	Jamaica National Heritage Trust (JNHT) Ministry of Youth and Culture (MYC)	JNHT Act, 1985
Protected National Heritage	JNHT: MYC	JNHT Act, 1985
Game Sanctuary	NEPA (NRCA): MEGJC	Wild Life Protection Act, 1945
Game Reserve	NEPA (NRCA): MEGJC	Wild Life Protection Act, 1945

Table 3-2 Existing categories of protected areas in Jamaica (as of 1 January 2012) - other designations not considered part of the system

Source: (National Environment and Planning Agency, n.d.)

CATEGORY	RESPONSIBLE AGENCY	LAW
Tree Order Preservation	Local Authority (Town and Country Planning Authority): MEGJC and Local Government Department, through Local Authorities	Town and Country Planning Act, 1958
Conservation Area	NEPA (Town and Country Planning Authority, Local Authorities): MEGJC	Town and Country Planning Act, 1958
Protected Watershed	NEPA (NRCA): MEGJC	Watershed Act, 1963 Protection

Table 3-3 Existing categories of protected areas in Jamaica (January 2012) - international designations

Source: (National Environment and Planning Agency, n.d.)

CATEGORY	RESPONSIBLE AGENCY	CONVENTION
Ramsar Site	NEPA (NRCA): MEGJC	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
World Heritage Site (no existing sites, however submissions have been made)	Jamaica National Heritage Trust: MYC	World Heritage Convention

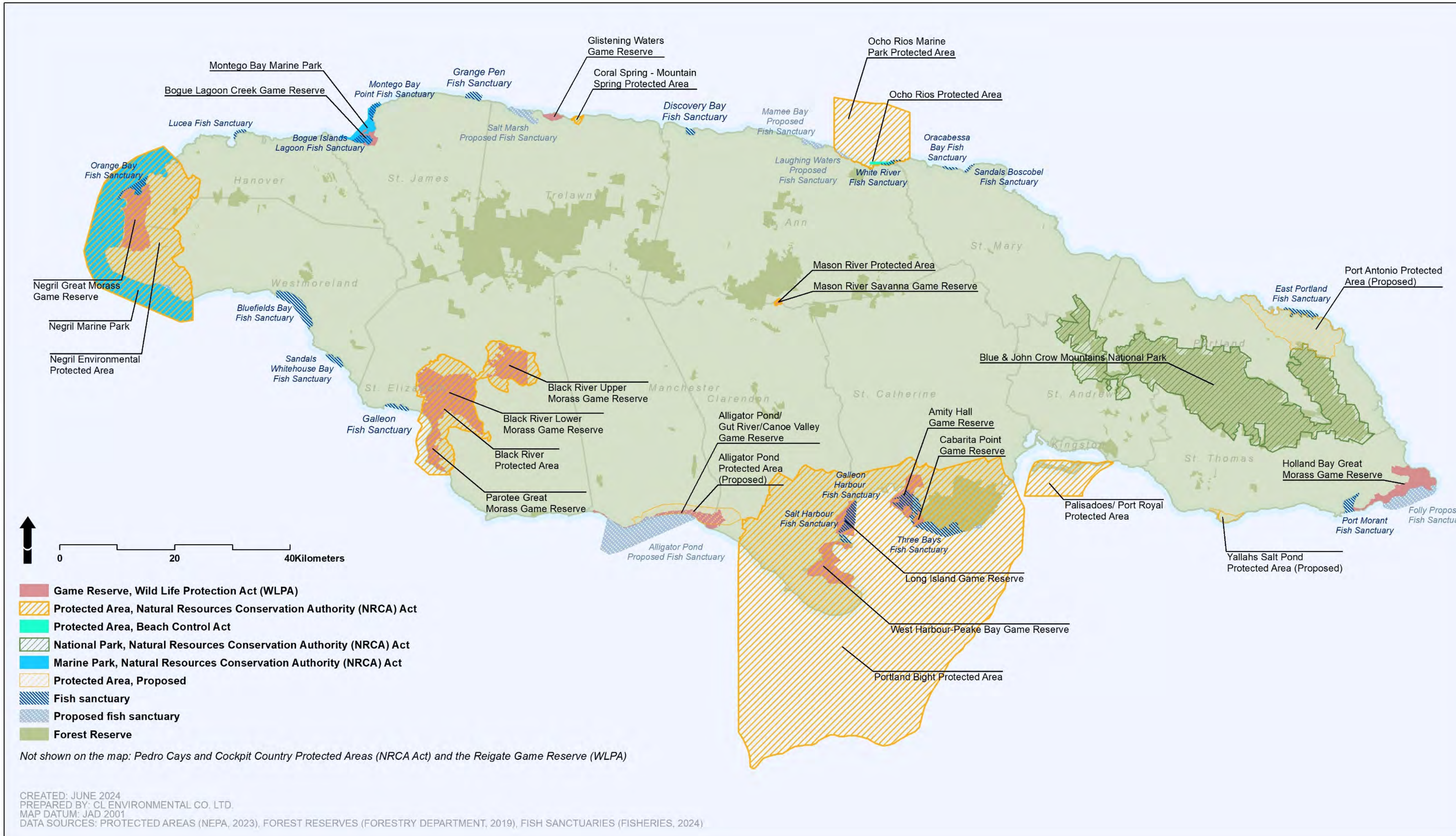


Figure 3-3 **Areas protected under various Jamaican legislation including existing and proposed protected areas, national parks, marine parks, game reserves, forest reserves and Special Fishery Conservation Areas**

3.2.2.2 Natural Resources Conservation Authority Act 1991

The Natural Resources Conservation Authority Act (NRCA) is regarded as Jamaica's overarching environmental legislation, governing the proposed project. It establishes the Natural Resources Conservation Authority (NRCA), which is primarily tasked with ensuring sustainable development by safeguarding and managing the nation's natural resources while regulating pollution. This is primarily achieved through an environmental permit and licensing framework. The Act confers authority upon the NRCA to:

- Issue permits to the person responsible for undertaking any enterprise, construction, or development of a prescribed category in a prescribed area [Section 9][2];
- Issue licences for discharge of trade or sewage effluent or for construction or modification of any works for such discharge [Section 12 (1) (a) and (b)];
- Request information or documents as the Authority thinks fit [Section 10 (1) (a)];
- Request an environmental impact assessment containing such information as may be prescribed [Section 10 (1) (b)];
- Request information on pollution control facilities [Section 17]; and
- Revoke or suspend permits.

The Act also gave power of enforcement of a number of environmental laws to the NRCA, namely the *Beach Control Act*, *Watershed Act* and the *Wild Life Protection Act*, as well as a number of regulations and orders including:

- *The Natural Resources and Conservation (Protected Areas) Regulations, 2023*
- *The Natural Resources (Permit and Licences) Regulations 1996 and* (Amendment) Regulations *2015;*
- *Natural Resources (National Parks) Regulations 1993 and (Amendment) Regulations 2003;*
- *The Natural Resources (Marine Parks) Regulations 1992, (Amendment) Regulations 2003,* and *(Amendment) Regulations, 2015;*
- *The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order 1996* and *(Amendment) Order 2015; and*
- *The Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013.*

[2] The Prescribed Area Order designates all of Jamaica as being within the prescribed area.

Natural Resources Conservation (Permit and Licences) Regulations 1996 and (Amendment) Regulations 2015

Under these regulations, a permit and licensing system was instituted to oversee the initiation of any new construction or development of a prescribed nature in Jamaica. Additionally, it manages the disposal of sewage, trade effluent, as well as poisonous or harmful substances discharged into the environment.

Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order 1996 and (Amendment) Order 2015

The Natural Resources (Prescribed Areas) (Prohibition of Categories of Enterprise, Construction and Development) Order (1996) and the Permits & Licensing Regulations were enacted in accordance with section 9 of the NRCA Act. Section 9 designates the entire island and territorial sea as a 'prescribed area', wherein certain activities necessitate a permit, and may also require an environmental impact assessment. The significant amendment made in 2015 involved the substitution of the Categories of Enterprises, Construction, and Development (Column A), which enumerates various activities by category, for which a permit is mandated.

Natural Resources Conservation (Wastewater and Sludge) Regulations 2013

These regulations pertain to the discharge of sewage effluent and trade effluent, and outline the operations, monitoring, and reporting procedures for sewage treatment facilities. The Natural Resources Conservation (Wastewater and Sludge) Regulations 2013 were promulgated and have been in effect since 2013. Section 3.2.3.1 outlines associated water quality standards.

3.2.2.3 Wild Life Protection Act 1945 and Wild Life Protection (Amendment of Second and Third Schedules) Regulations 2016

The Wild Life Protection Act of 1945 primarily focuses on safeguarding specified faunal species and stands as the sole statute in Jamaica specifically designated for this purpose. This legislation safeguards numerous rare and endangered faunal species, with the Wild Life Protection (Amendment of Second and Third Schedules) Regulations 2016 providing substitutions for the Second and Third Schedules of the principal Act, which enumerate these species.

Under this Act, the establishment of two types of protected areas, namely Game Sanctuaries and Game Reserves, is authorized. These sanctuaries/reserves encompass parcels of land, bodies of water, or areas comprising both land and water, wherein hunting of animals (including birds), removal of eggs or nests of any bird, and the use or possession of any hunting equipment are prohibited. Additionally, all Forest Reserves are designated as Game Reserves and constitute part of Jamaica's Protected Areas System.

This Act has undergone review, particularly concerning increased fines and the expansion of protected species. Further amendments are being pursued to address various issues related to the management and conservation of natural resources, including the inclusion of flora. Prohibited activities include the removal, sale, or possession of protected animals, the use of destructive materials to harm fish, and the discharge of trade effluent or industrial waste into harbours, lagoons, estuaries, and streams. Notably, six species of sea turtles are protected under the Wild Life Protection Act.

Section 5.2.1 provides a detailed account of the fauna found at the proposed site.

3.2.2.4 Endangered Species (Protection, Conservation and Regulation of Trade) Act 2000 and (Amendment of First, Second and Third Schedules) Order 2021

The Endangered Species (Protection, Conservation, and Regulation of Trade) Act was enacted in 2000 to formalize Jamaica's commitments under the Convention for the International Trade in Endangered Species of Wild Fauna and Flora (CITES). This legislation regulates both international and domestic trade in endangered species originating from Jamaica and encompasses provisions for the conservation and management of endangered fauna and flora.

The regulations associated with the Endangered Species (Protection, Conservation, and Regulation of Trade) Act were most recently revised in 2021. These amendments included updates to the listings of endangered species facing extinction, species at risk of extinction, or species requiring effective control. Additionally, it addresses species regulated by contracting Parties within their jurisdiction to prevent or restrict over-exploitation, necessitating cooperation among Parties to control trade in such species.

See section 5.2.1 for further detail of the flora and fauna found at the proposed site.

3.2.2.5 The Fisheries Act 2018

The Fisheries Act of 2018 serves as the principal legislation governing fishing activities in Jamaica, replacing the previous Fishing Industry Act of 1975. This Act is designed to ensure the efficient and sustainable management and development of fisheries, aquaculture, and related endeavours in alignment with internationally recognized norms, standards, and best practices.

Under the Fisheries Act of 2018, the National Fisheries Authority (NFA) is entrusted with various responsibilities. These include the licensing of fisherfolk and fishing vessels, whether for sport, recreational, or commercial purposes. Furthermore, the Act empowers the division to establish and demarcate fish sanctuaries (also referred to as Special Fishery Conservation Areas at certain points in time), for the protection of various fisheries resources. It also outlines measures such as the establishment of closed seasons and imposes fines and penalties for illegal fishing activities or the unauthorized sale of fish.

Proposed coastal project components are located within the Lucea fish sanctuary, which was recently gazetted on March 29, 2024.

3.2.2.6 National Policy for the Conservation of Seagrasses 1996

This policy provides guidance for the issuance of licenses or permits for various activities, including dredging, disposal of dredged material, beach development, and effluent disposal, all of which have direct or indirect impacts on seagrass communities.

Section 5.2.2.3 provides detail regarding the seagrass communities in the project area.

3.2.2.7 Mangrove and Coastal Wetlands Protection - Draft Policy and Regulations 1996

This policy provides a review of the issues affecting wetlands in Jamaica as well as the Government's role and responsibility. Five main goals are outlined which include guidelines for wetlands development, cessation of destructive activities, maintenance of natural diversity, maintenance of wetland function and values and integration of wetland functions in planning and development.

3.2.2.8 Coral Reef Protection and Preservation – Draft Policy and Regulations 1996

This document assesses the ecological and socio-economic significance of coral reefs, identifies the challenges they face, and delineates the Government's role and obligations in safeguarding them. It outlines five primary objectives, encompassing the mitigation of pollutants, curbing overharvesting of reef fish, minimizing physical damage caused by recreational activities, enhancing responsiveness to oil spills, and regulating coastal zone developments.

Section 5.2.2.4 provides greater detail regarding the occurrence of coral reef at the project site.

3.2.2.9 Coastal Management and Beach Restoration Guidelines: Jamaica

These guidelines complement Vision 2030 Jamaica and serve as a resource for coastal stakeholders, offering guidance at the community level to ensure sustainable coastal management while considering broader environmental impacts. Various management approaches are proposed for Jamaica's coastline, influencing the suitability of site-specific interventions. The document outlines progressive steps from project inception to design and the acquisition of planning permission for coastal zone projects. Multiple design outcomes must be evaluated to ensure environmental integrity, resilience, and prevent adverse impacts on neighbouring coastal sites.

The effectiveness of the governance structure and institutional framework is emphasized, highlighting the importance of national organizations with well-defined mandates, roles, responsibilities, and capacities for the successful management of Jamaica's coastal resources.

3.2.2.10 Water Resources Act 1995

The enactment of the Water Resources Act (1995) established the Water Resources Authority (WRA), entrusted with the regulation, allocation, conservation, and management of the island's water resources.

Additionally, the WRA is tasked with overseeing water quality control and providing technical support for projects, programs, or activities related to water resource development, conservation, and utilization.

According to Section 25 of the Act, prospective users must obtain planning permission, if required, under the Town and Country Planning Act. Moreover, Section 21 specifies that if the intended use of water entails effluent discharge, the applicant must apply for a license to discharge effluents from the Natural Resources Conservation Authority, or any other relevant body designated by the Minister.

3.2.2.11 The Jamaica National Heritage Trust Act 1985

The Jamaica National Heritage Trust Act established the Jamaica National Heritage Trust (JNHT) and has been in operation since 1985. The JNHT provides for protection of areas, structures, and objects of cultural significance to Jamaica by declaration of any structure as a national monument where preservation is of public interest due to historic, architectural, traditional, artistic, aesthetic, scientific or archaeological importance. This includes the floor of the sea within the territorial waters or the Exclusive Economic Zone.

Fort Charlotte stands as a significant protected asset within Lucea, recognized and designated as a site by the JNHT. Findings from an assessment of historical or archaeological sites undertaken by the JNHT for the purposes of this EIA is provided in section 5.4.9.2.

3.2.2.12 Towards an Ocean and Coastal Zone Management Policy in Jamaica 2000

Established in 1998, the Council on Ocean and Coastal Zone Management is tasked with delineating a national policy for Ocean and Coastal Zone Management. The objective of this policy document is to cultivate a framework that will "augment the role of economic sectors in the integrated management of coastal areas by fostering awareness among sectoral agencies and resource users." Acknowledging the substantial utilization and subsequent deterioration of coastal and oceanic resources in Jamaica, including coral reefs, mangroves, seagrass beds, and non-living resources such as sand, the document underscores the pressing need for concerted management efforts.

3.2.3 Public Health & Waste Management

3.2.3.1 Water Quality Standards

The NRCA has primary responsibility for control of water pollution in Jamaica. National standards for ambient marine water and freshwater are shown in Table 3-4 and Table 3-5 respectively. For drinking water, World Health Organisation (WHO) standards are utilized, and these are regulated by the National Water Commission (NWC).

Table 3-4 Draft national ambient marine water quality standards for Jamaica, 2009

Source: National Environment and Planning Agency (NEPA)

Parameter	Measured as	Standard Range	Unit
Phosphate,	P*	0.001-0.003	mg/L
Nitrate,	N**	0.007-0.014	mg/L
BOD_5	O	0.0-1.16	mg/L
pH		8.00-8.40	
Total Coliform		2-256	MPN/100mL
Faecal Coliform		<2-13	MPN/100mL

*Reactive phosphorus as P
**Nitrates as Nitrogen

Table 3-5 Draft national ambient freshwater water quality standards for Jamaica, 2009

Source: National Environment and Planning Agency (NEPA)

Parameter	Measured as	Standard Range	Unit
Calcium	(Ca)	40.0-101.0	mg/L
Chloride	(Cl^-)	5.0- 20.0	mg/L
Magnesium	(Mg^{2+})	3.6- 27.0	mg/L
Nitrate	(NO_3^-)	0.1- 7.5	mg/L
Phosphate	(PO_4^{3-})	0.01 - 0.8	mg/L
Potassium	(K^+)	0.74- 5.0	mg/L
Silica	(SiO_2)	5.0- 39.0	mg/L
Sodium	(Na^+)	4.5- 12.0	mg/L
Sulfate	(SO_4^{2-})	3.0- 10.0	mg/L
Hardness	($CaCO_3$)	127.0-381.0	mg/L (as $CaCO_3$
Biochemical Oxygen Demand	(O)	0.8- 1.7	mg/L
Total Dissolved Solids		120.0-300	mg/L
pH		7.00- 8.40	
Conductivity		150.0-600	µS/cm

Standards for industrial (trade effluent) and sewage discharge are stipulated within the Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013 (Table 3-6, Table 3-7 and Table 3-8).

Table 3-6 Industrial Trade Effluent Standards

Table 3—*Trade Effluent Standards*

PARAMETER	TRADE EFFLUENT LIMIT
Ammonia/ammonium measured as NH_4	1.0 mg/L
Barium	5.0 mg/L
Beryllium	0.5 mg/L
Biological oxygen demand (BOD)	<30 mg/L
Boron	5.0 mg/L
Calcium	No standard
Chemical Oxygen Demand (COD)	<100mg/L or <0.01 kg/1000 kg product
Chloride	300 mg/L
Colour	100 TCU
Cyanide (free)	0.1 mg/L
Cyanide (Total as CN)	0.2 mg/L
Detergent	15 mg/L
Dissolved oxygen (DO)	>4mg/L
Faecal Coliform	<100 MPN/100 ml
Fluoride	3.0 mg/L
Iron	3.0 mg/L
Magnesium	No standard
Manganese	1.0 mg/L
Nitrate as NO_3	10 mg/L
Oil and Grease	10 mg/L or < 0.01 kg/1000 kg product
PH	6.5 - 8.5
Phenols	0.1 mg/L
Phosphate as PO_4	5 mg/L
Sodium	100 mg/L
Sulphate	250 mg/L
Sulphide	0.2 mg/L
Temperature	±2° of ambient
Total Coliform	<500 MPN/100 ml
Total Dissolved Solids (TDS)	1000 mg/L
Total Organic Carbon (TOC)	100 mg/L
Total Suspended Solids (TSS) (maximum monthly average)	50 mg/L
Total Suspended Solids (TSS) maximum daily average	<150mg/L

PARAMETER	TRADE EFFLUENT LIMIT
Trace Metals:	
Zinc	1.5 mg/L
Lead	0.1 mg/L
Cadmium	0.1 mg/L
Arsenic	0.5 mg/L
Chromium	1.0 mg/L
Copper	0.1 mg/L
Mercury	0.02 mg/L
Nickel	1.0 mg/L
Selenium	0.5 mg/L
Silver	0.1 mg/L
Tin	No standard
Total Heavy Metals	2.0 mg/L

Table 3-7 Sewage Effluent Standards for plants other than existing plants

Parameter	Effluent Limit
BOD_5	20 mg/L
TSS	20 mg/L
Total Nitrogen	10 mg/L
Phosphates (PO4-P)	4 mg/L
COD	100 mg/L
pH	6-9 pH
Faecal Coliform	200 MPN/100mL
Residual Chlorine	1.5 mg/L
Floatables	not visible

Table 3-8 Sewage Effluent Standards for use in Irrigation

Parameter	Effluent Limit
Oil and Grease	10 mg/L
Total Suspended Solids (TSS)	15 mg/L
Residual Chlorine	0.5 mg/L
Biochemical Oxygen Demand (BOD_5)	15 mg/L
Chemical Oxygen Demand (COD)	<100 mg/L
Faecal Coliform	12 MPN/100mL

3.2.3.2 Noise Abatement Act 1997

The Noise Abatement Act of 1997 was created in order to regulate noise caused by amplified sound and other specified equipment. This act has been said to address "some concerns but is too narrow in scope and relies on a subjective criterion" (McTavish). Given this, McTavish conducted a study to recommend wider and more objective criteria in accordance with international trends and standards but tailored to Jamaica's conditions and culture.

National guidelines (NRCA) used for noise levels are an adaptation from the Jamaica's National Noise Standards, 1999 and are shown in Table 3-9; values for commercial, industrial and residential areas are specified.

Table 3-9 NRCA guidelines for daytime and night-time noise in various zones

ZONE	NRCA Daytime Guideline (dBA)	NRCA Night-time Guideline (dBA)
Commercial	65	60
Industrial	75	70
Residential	55	50

3.2.3.3 The Natural Resources Conservation Authority (Air Quality) Regulations 2006

Section 38 of the NRCA Act outlines regulations regarding air quality in Jamaica. These regulations establish the National Ambient Air Quality Standards (NAAQS), which are divided into two categories. Part I of the NRCA Air Quality Regulations (2006) outlines license requirements, mandating that owners of major or significant facilities must apply for an air pollutant discharge license. Part II addresses stack emission targets, standards, and guidelines.

According to the Natural Resources Conservation Authority (Air Quality) Regulations, 2006, a "significant air quality impact", means:

(a) the increment in the predicted average concentration of sulphur dioxide (SO_2), total suspended particulates (TSP), particulate matter less than ten microns (PM_{10}) or nitrogen dioxide (NO_2) is greater than an annual average of 20 μg/m^3 or a 24-hour average concentration of 80 μg/m^3; or
(b) the increment in the predicted average concentration of CO is greater than 500 μg/m^3 as an 8-hour average or 2000 μg/m^3 as a 1-hour average.

Table 3-10 summarizes the Significant Impact Concentrations and the Jamaican National Ambient Air Quality Standards (JNAAQS) and Guideline Concentrations (GC).

Table 3-10 Significant Impact Concentrations and the Jamaican National Ambient Air Quality Standards (JNAAQS) and Guideline Concentrations (GC) for air quality

Pollutant	Avg. Period	Significant Impact Concentration (μg/m^3)	Jamaican NAAQS or GC (μg/m^3)
PM_{10}	24-hr	80	150
	Annual	20	50
TSP	24-hr	80	150
	Annual	20	60
NO_2	1-hr	N/A	400
	24-hr	80	N/A
	Annual	20	100
SO_2	1-hr	N/A	700
	24-hr	80	280
	Annual	20	60
CO	1-hr	2000	40000
	8-hr	500	10000
1,3 Butadiene	1-hr	N/A	0.04
Acetaldehyde	1-hr	N/A	1250
	24-hr	N/A	500
Acrolein	1-hr	N/A	58.75
	24-hr	N/A	23.5
Benzene	Annual	N/A	1
Benzo (a) pyrene	1-hr	N/A	0.00275
	24-hr	N/A	0.0011
Carbon Tetrachloride	1-hr	N/A	6
	24-hr	N/A	2.4
Chloroform	1-hr	N/A	1250

Pollutant	Avg. Period	Significant Impact Concentration (µg/m³)	Jamaican NAAQS or GC (µg/m³)
	24-hr	N/A	500
Ethylene Dibromide	1-hr	N/A	7.5
	24-hr	N/A	3
Formaldehyde	1-hr	N/A	162.5
	24-hr	N/A	65
Methylene Chloride	1-hr	N/A	550
	24-hr	N/A	220
Styrene	1-hr	N/A	2500
	24-hr	N/A	1000
Xylenes	1-hr	N/A	5750
	24-hr	N/A	2300
Vinyl Chloride	24-hr	N/A	1
	Annual	N/A	0.2
Arsenic	1-hr	N/A	0.75
	24-hr	N/A	0.3
Beryllium	Annual	N/A	0.0013
Cadmium	1-hr	N/A	5
	24-hr	N/A	2
Chromium	1-hr	N/A	3.75
	24-hr	N/A	1.5
Cobalt	24-hr	N/A	0.12
Copper	1-hr	N/A	125
	24-hr	N/A	50
Lead	1-month	N/A	N/A
	3-month	N/A	2
Manganese	Annual	N/A	119
Mercury	1-hr	N/A	5
	24-hr	N/A	2
Nickel	1-hr	N/A	5
	24-hr	N/A	2
Selenium	24-hr	N/A	25
	Annual	N/A	10
Zinc	24-hr	N/A	12

In 1987, U.S. Environmental Protection Agency replaced TSP with PM_{10} as the indicator for both the annual and 24-hour health-related standards. The reason for this is because exposure to PM_{10} particles may cause serious health/respiratory related issues as these particles are retained deep in the lungs. The 24-hour NEPA standards for PM_{10} are shown in Table 1 4. However, the 24-hour US EPA standards are used for $PM_{2.5}$ and TSP:

- TSP = 150 µg/m³
- $PM_{2.5}$ = 35 µg/m³

3.2.3.4 The Clean Air Act 1964

The Clean Air Act (1964) pertains to premises housing industrial works, where the operation, as determined by an inspector, may lead to the emission of smoke, fumes, gases, or dust into the air. An inspector is authorized to access any such premises to inspect, conduct inquiries, perform tests, and collect samples of substances, smoke, fumes, gases, or dust deemed essential or appropriate for fulfilling their duties.

3.2.3.5 Public Health Act 1985

The Public Health Act is administered by the Ministry of Health through Local Boards, namely the Municipal Corporations. *The Public Health (Nuisance) Regulations 1995* aims to, control reduce or prevent air, soil, and water pollution in all forms. Under the regulations:

- No individual or organisation is allowed to emit, deposit, issue or discharge into the environment from any source;
- Whoever is responsible for the accidental presence in the environment of any contaminant must advise the Environmental Control Division of the Ministry of Health and Environmental Control, without delay;
- Any person or organisation that conducts activities which release air contaminants such as dust and other particulates is required to institute measures to reduce or eliminate the presence of such contaminants; and
- No industrial waste should be discharged into any water body, which will result in the deterioration of the quality of the water.

3.2.3.6 Public Health Act (Air, Soil and Water Pollution) Regulations 1976

Under the ambit of this act, the Environmental Health Unit, Ministry of Health, is required to review the design and plans for sewage treatment.

3.2.3.7 The National Solid Waste Management Authority Act 2001

The National Solid Waste Management Authority Act of 2001 was enacted to regulate and oversee solid waste management. It established the National Solid Waste Management Authority (NSWMA) in April 2002, tasked with efficiently managing and overseeing the collection and disposal of solid waste in Jamaica. The primary objectives are to safeguard public health, ensure environmentally responsible handling of waste through collection, sorting, transportation, recycling, reuse, or disposal, and to promote safety standards related to waste management. Additionally, the NSWMA is responsible for raising public awareness about the importance of effective solid waste management, advising the Minister on policy matters, and executing other functions related to solid waste management. The Act mandates that solid waste be deposited only at approved or designated sites. In Western Jamaica, the designated site is located in Retirement, St. James.

3.3 REGIONAL AND INTERNATIONAL LEGISLATIVE AND REGULATORY CONSIDERATIONS

3.3.1 United Nations Convention on Biological Diversity

Signed by 150 government leaders during the 1992 Rio Earth Summit, the Convention on Biological Diversity (CBD) is dedicated to advancing sustainable development. The CBD is considered instrumental in actualizing the principles outlined in Agenda 21, recognizing that biodiversity encompasses more than just flora, fauna, and microorganisms, but also addresses human necessities such as food security, medicines, clean air and water, housing, and a pristine environment. Jamaica acceded to the CBD on April 6, 1995. The country's Green Paper Number 3/01, titled 'Towards a National Strategy and Action Plan on Biological Diversity in Jamaica', underscores Jamaica's ongoing commitment to fulfilling its obligations as a signatory to the Convention.

3.3.2 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) primarily aims to safeguard endangered plants and animals, recognizing the transboundary nature of these species. This necessitates international collaboration to ensure that global trade in wild animal and plant species does not imperil their survival in the wild. CITES provides varying degrees of protection to over 35,000 species.

Originally drafted in 1963 during a meeting of members of the International Union for Conservation of Nature (IUCN), CITES was finalized in 1973. It was opened for signatures in 1973 and came into effect on July 1, 1975. Jamaica became a Party to CITES on June 22, 1997. In 2000, Jamaica enacted domestic legislation, the Endangered Species (Protection, Conservation and Regulation of Trade) Act, 2000, along with Regulations, to fulfil its obligations to CITES.

The Natural Resources Conservation Authority (NRCA) serves as the Management Authority for CITES in Jamaica. The Authority is responsible for processing applications for permits and certificates required for international trade in endangered species. Coordination with the local Scientific Authority is integral to the application processing procedure.

3.3.3 Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region), 1983

Adopted in March 1983 in Cartagena, Colombia, the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, more commonly referred to as the Cartagena Convention, is the sole legally binding environmental treaty for the Wider Caribbean. The Convention came into force in October 1996 as a legal instrument for the implementation of the Caribbean Action Plan and represents a commitment by the participating countries to protect, develop and manage their common waters individually and jointly. The Convention is currently supported by three Protocols as follows:

- *The Protocol Concerning Co-operation in Combating Oil Spills in the Wider Caribbean Region* (The Oil Spills Protocol), which was adopted and entered into force at the same time as the Cartagena Convention;
- *The Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region* (The SPAW Protocol), which was adopted in two stages, the text in January 1990 and its Annexes in June 1991. The Protocol entered into force in 2000;
- *The Protocol Concerning Pollution from Land-based Sources and Activities in the Wider Caribbean Region* (LBS Protocol), which was adopted in October 1999.

3.3.4 United Nations Convention on the Law of the Sea (UNCLOS III) 1982

The United Nations Convention on the Law of the Sea (UNCLOS), also referred to as the Law of the Sea Convention and the Law of the Sea treaty, defines the rights and responsibilities of nations in their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. UNCLOS III supersedes the Convention on the Territorial Sea and the Contiguous Zone (entered into force on 10 September 1964), as well as the Convention on the Continental Shelf (entered into force 10 June 1964), and both agreed upon at the first United Nations Convention on the Law of the Sea (UNCLOS I). Jamaica was the fourth country to ratify the UNCLOS III of 10 December 1982 on 21st March 1983. As of August 2013, 166 countries have joined in the Convention.

3.3.5 Convention on Fishing and Conservation of the Living Resources of the High Seas 1958

This convention considers that the development of modern techniques for the exploitation of the living resources of the sea has increased man's ability to meet the need of the world's expanding population for food and has exposed some of these resources to the danger of being over-exploited. It was done at Geneva on 29 April 1958.

3.3.6 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter

This international agreement, commonly known as the London Convention, was adopted at the Inter-Governmental Conference on the Convention on the Dumping of Wastes at Sea in London, United Kingdom, in November 1972. It became effective on August 30, 1975, and has been administered by the International Maritime Organization (IMO) since 1977.

The London Convention prohibits the dumping of certain hazardous materials and mandates a special permit for the dumping of specified materials, while other wastes or matter require a general permit. In 1996, Parties to the Convention adopted the London Protocol, a supplementary agreement aimed at preventing marine pollution by dumping wastes and other matter. The Protocol, which entered into force in 2006, emphasizes a precautionary approach and introduces new regulations governing the use of the sea as a waste repository.

Article 4 of the London Protocol outlines the prohibition of dumping wastes or other matter, with exceptions listed in Annex 1 of the document.

3.3.7 International Convention on Oil Pollution Preparedness, Response and Co-operation 1990

The International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC Convention) is an international maritime convention that sets measures for the preparation for and response to marine oil pollution incidents. The OPRC Convention was drafted within the framework of the International Maritime Organization (IMO) and entered into force in 1995. Jamaica is one of 107 parties to the convention (as of July 2013).

4.0 PROJECT DESCRIPTION

4.1 LOCATION AND BACKGROUND

4.1.1 Site Location and Characteristics

The planned Phase 2 expansion encompasses around 28 acres (113,310 m^2) and adjoins the existing Phase 1 hotel, Grand Palladium Jamaica Resort & Spa, on its southern boundary (Figure 4-3). Its eastern boundary runs parallel to the northern coastal highway, while the western boundary follows the shoreline.

The project site features urban tree cover, buildings, unpaved roadways, various infrastructure, and areas used for the temporary storage of furniture, construction materials, supplies, and solid waste. The current vegetation is primarily secondary growth and is characterized as degraded coastal forest. The shoreline is predominantly composed of cliffs, with occasional small sandy areas interspersed along its length. Seaward, a variety of benthic habitats exist, including seagrass beds, coral reef communities, pavement/hard bottom areas, and rocky shores/intertidal communities, which are protected within the bounds of the Lucea Fish Sanctuary.

4.1.2 Project Objectives and Overview

The project's objective is to enhance the Grand Palladium Jamaica Resort & Spa by undertaking Phase II development and upgrading the current hotel amenities. Originally planned for approximately 1000 rooms in 2007, the expansion was halted during the economic recession of 2009. This expansion includes the creation of a complex featuring two separate hotels, Grand Palladium (GP - 475 rooms) and TRS (473 rooms), totalling 948 rooms. While each hotel operates independently, they will share common services like restaurants, shops, a convention centre, and essential facilities to ensure efficient and seamless operations. Two beaches will be created within the premises, one situated at the southern overwater bungalows area and the other in the TRS area, exclusively for guest enjoyment.

The new TRS hotel, is a Palladium brand exclusively for adults (Figure 4-1 and Figure 4-2), with several already established in the Caribbean.

Figure 4-1 Render of Phase 2 expansion looking to the southwest (GP in the foreground)

Figure 4-2 Render of Phase 2 expansion looking to the southeast (TRS in the foreground and GP in the background)

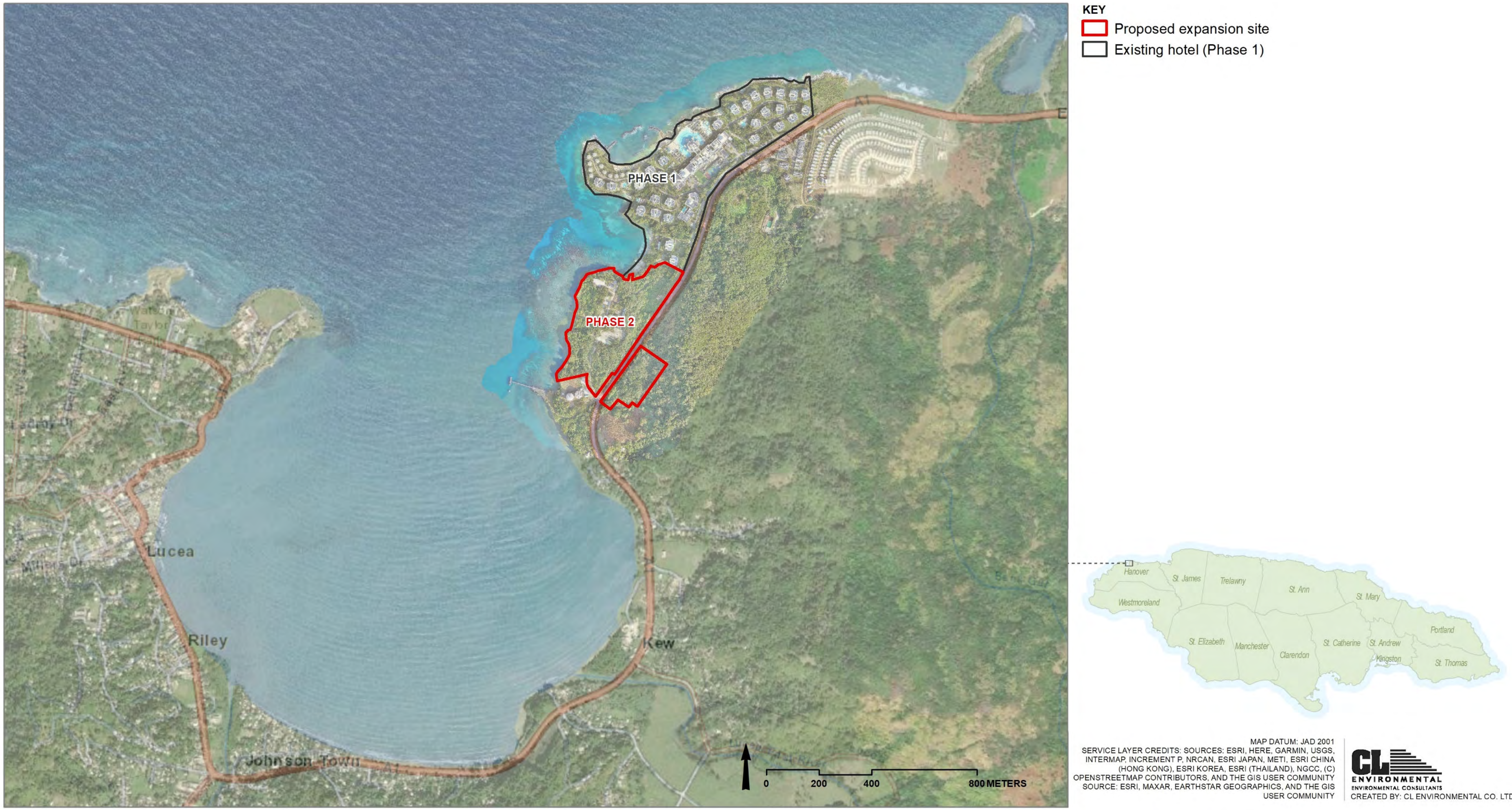


Figure 4-3 Location of proposed site for Phase 2 and existing Grand Palladium Jamaica Resort & Spa (Phase 1)

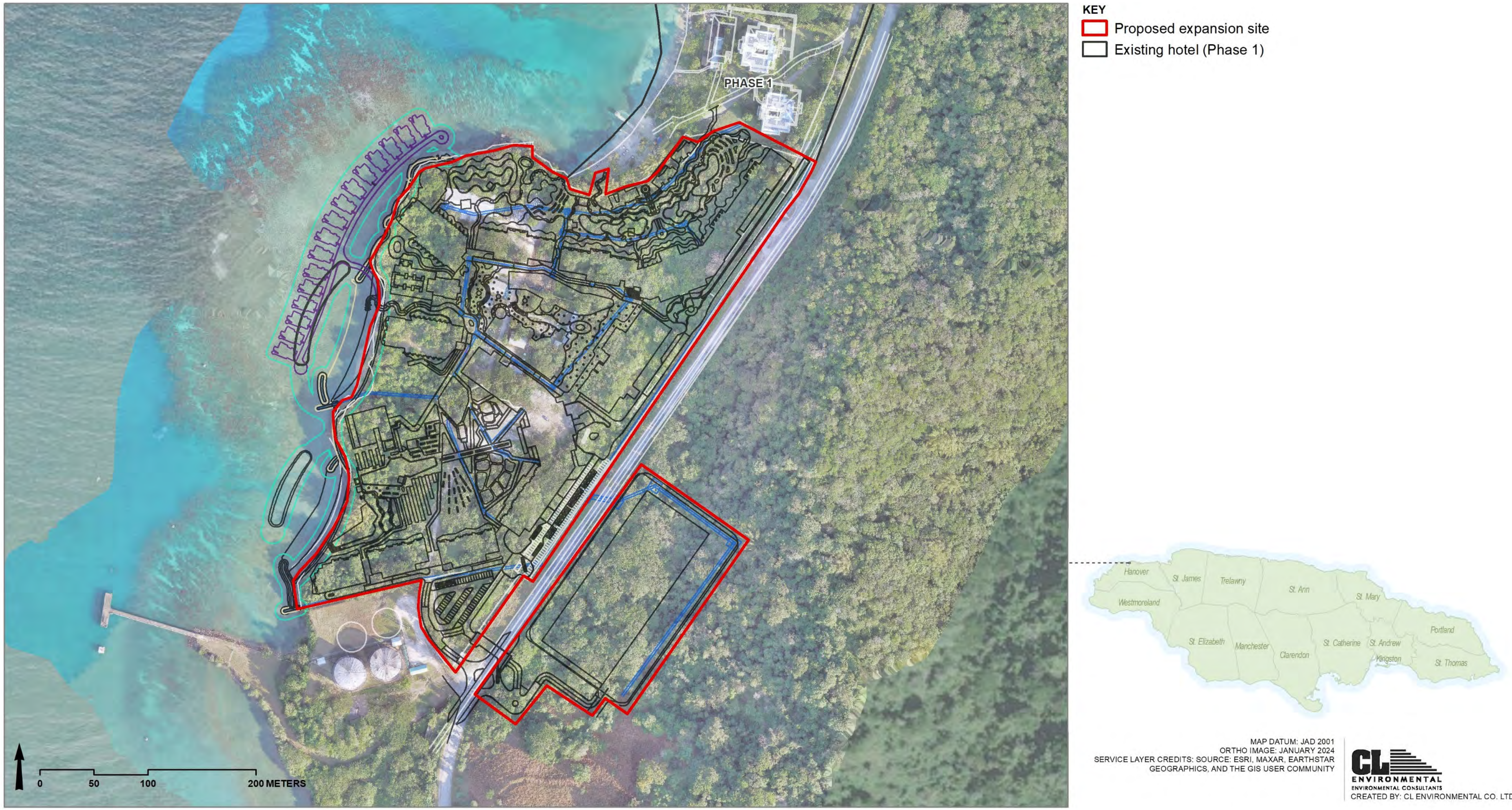


Figure 4-4 Proposed Phase 2 expansion site and layout

4.2 PROJECT FEATURES AND DESIGN

4.2.1 Hotel

4.2.1.1 Grand Palladium (GP)

GP01

This building stands at six stories tall and takes on a rectangular form. On each floor, hotel rooms are situated along the side facing the sea, while the back of the building accommodates access points, back-of-house spaces, stairs, and elevators. Each floor is equipped with two means of egress, and the ground level is set at an elevation of 23.00 FFL (Finished Floor Level (m)). Notably, the ground-level rooms feature swim-up pools. This building is linked with GP02 at the ground, 2nd, 3rd, 4th, and 5th floors (Figure 4-5).

GP02

This serves as the central edifice of the hotel, taking on a trapezoidal shape. Within its confines, you'll find key communal areas, such as the basement-floor buffet, and the ground-floor reception, lobby, lobby bar, shop, bathrooms, and courtesy rooms. The primary entrance to the building is centrally located on the main façade, accessible from the ground floor's motor lobby. Additionally, there's another entry on one side of the ground floor, establishing a direct connection to the gourmet square. To reach the buffet area, there are two more access points from the pools area on the basement floor. Noteworthy is that both the basement and ground floor boast double height. On the third through fifth floors, the rooms offer scenic views of the sea. Back-of-house spaces, stairs, and elevators are strategically positioned at opposite ends of the building. Each floor is equipped with two means of egress, and the ground level is established at an elevation of 23.00 FFL. The rooms on the third level are equipped with swim-up pools.

This building is interlinked with GP01 across the ground, 1st, 2nd, and 3rd floors. Furthermore, it is connected with GP03 on the basement, ground, 1st, and 2nd floors (Figure 4-5).

GP03

This six-story structure boasts a rectangular design, featuring hotel rooms on each floor overlooking the sea. At the rear, you'll find access points, back-of-house areas, stairs, and elevators. Each floor is equipped with two egress options, and the ground level is situated at an elevation of 16.00 FFL. Notably, the ground-level rooms come complete with swim-up pools. Additionally, the building is linked with GP02 on the ground, 2nd, 4th, and 5th floors (Figure 4-5).

GP04

Rising to six stories, this structure boasts a rectangular configuration. On the side facing the sea, hotel rooms adorn each floor, while the back of the building accommodates access points, back-of-house spaces, stairs, and elevators. With two means of egress on every floor, the ground level is situated at an elevation of 12.50 FFL. Notably, the ground-level rooms feature enticing swim-up pools (Figure 4-5).

GP05

Standing at six floors, this building accommodates hotel rooms across all levels. Positioned with a front and two sides, the family rooms offer captivating views of the sea. Towards the rear, just preceding the front rooms, you'll find access points, back-of-house spaces, stairs, and elevators. Each floor is equipped with two means of egress, and the ground level is set at an elevation of 9.00 FFL. Notably, the ground-level rooms come complete with enticing swim-up pools (Figure 4-5).

GP06 and GP07

These buildings are one-story villas, each featuring two bedrooms, a living room, a terrace, and a swim-up pool. The villas are constructed from multiple adjacent rectangular prisms, creating both the interior and exterior spaces (Figure 4-6).

GP08

This building is a single-story villa encompassing three bedrooms, a living room, terrace, and a swim-up pool. The villas are constructed by arranging multiple adjacent rectangular prisms, forming both the interior and exterior spaces (Figure 4-6).

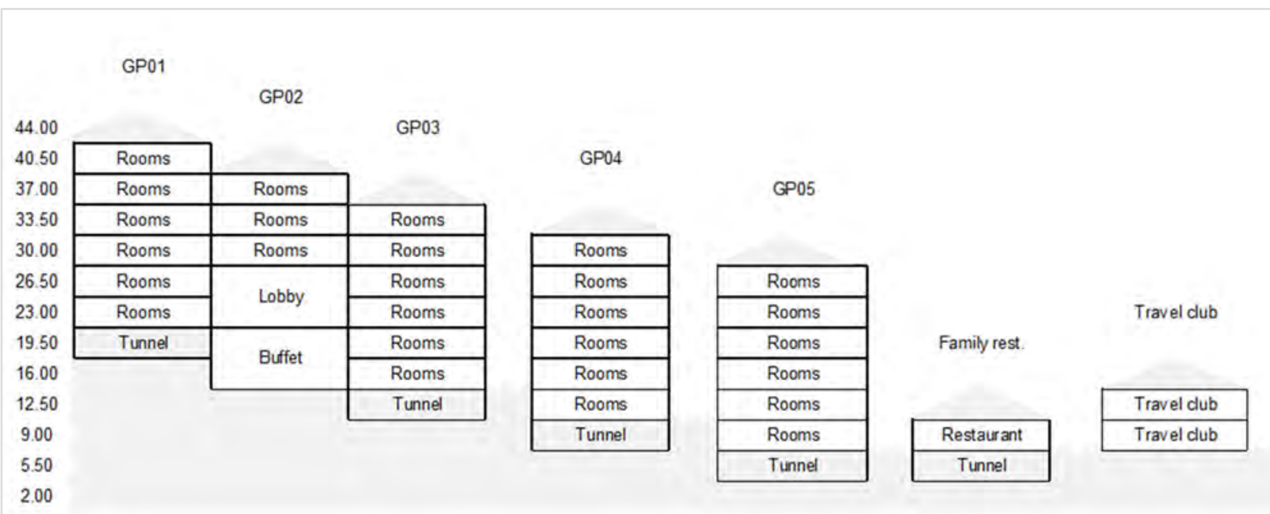


Figure 4-5 **Illustration of GP01 – GP05, family restaurant and travel club**

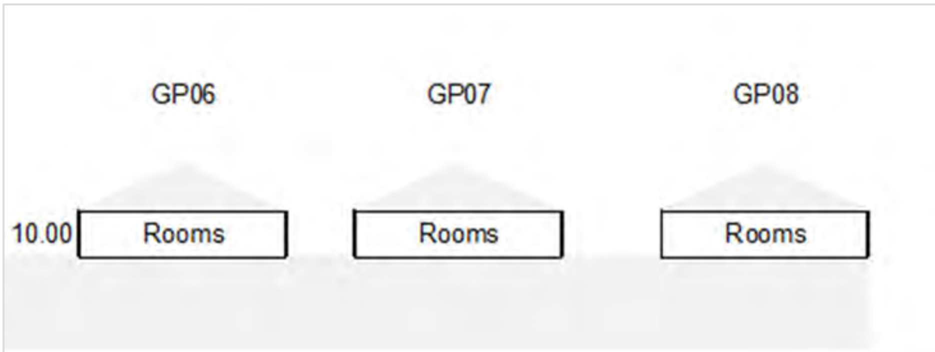


Figure 4-6 Illustration of GP06 – GP08

Renders of the typical GP buildings are depicted in Figure 4-7.

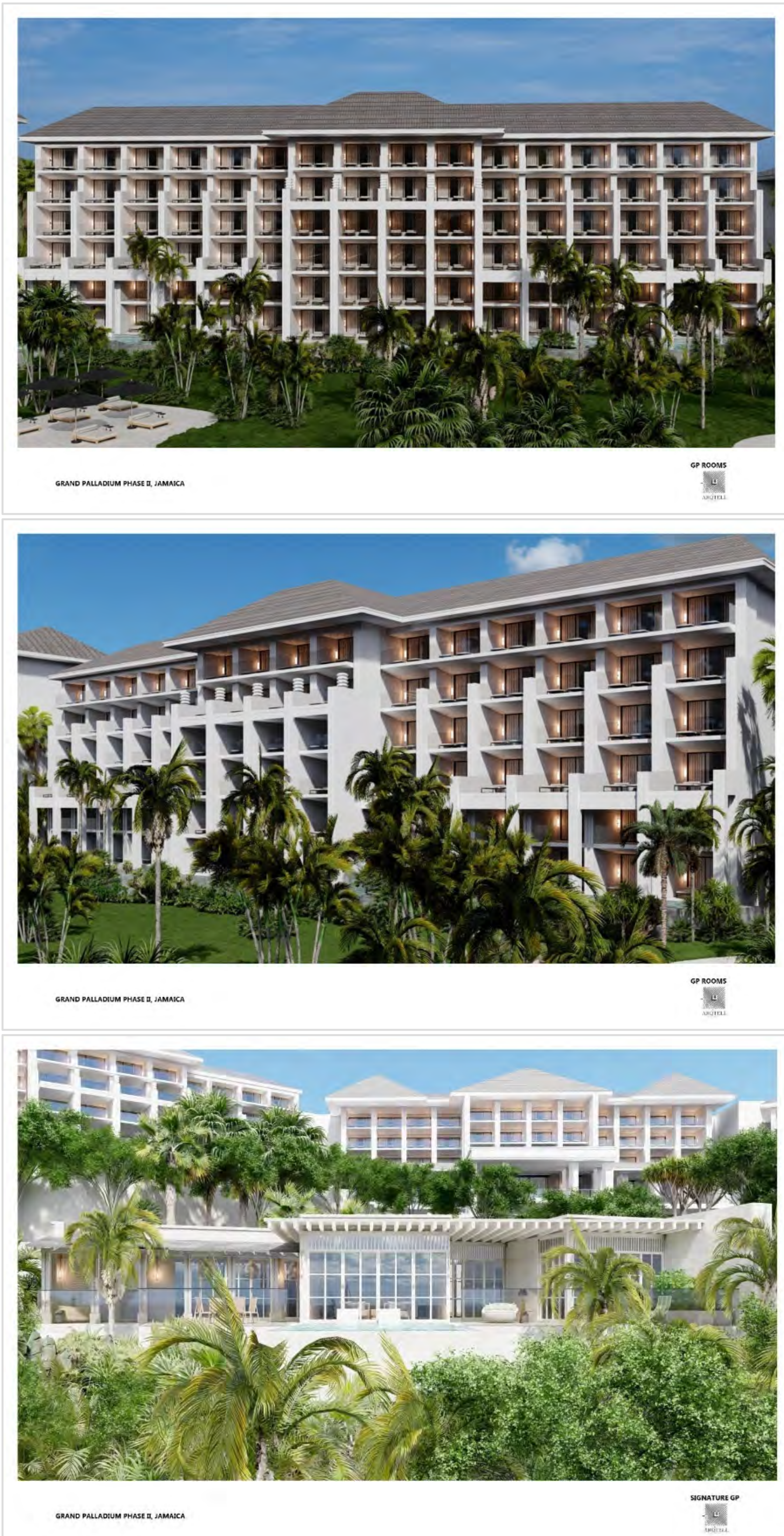


Figure 4-7 Renders depicting GP buildings

4.2.1.2 TRS Hotel

TRS01

This structure comprises six floors, each featuring hotel accommodations. The building has a front facade and two sides, with rooms offering scenic views of the sea. Towards the rear, just preceding the front rooms, you'll find entrances, back-of-house areas, stairs, and elevators. Each floor is equipped with two exit routes, and the ground level is situated at an elevation of 10.40 FFL (Figure 4-8). Notably, the ground-level rooms boast swim-up pools.

TRS02

This six-story building features a rectangular design and hosts hotel rooms spanning from the ground to the fifth floor, all oriented towards the sea. Positioned at the rear of the building are access points, back-of-house spaces, stairs, and elevators. The basement floor is home to a thematic restaurant with a double-height level. With two means of egress per floor, the ground level is situated at 16.00 FFL. Notably, the third-level rooms come equipped with swim-up pools. Additionally, the building is interconnected with GP02 on the ground, second, third, fourth, and fifth floors (Figure 4-8).

TRS03

This serves as the central structure within the hotel, showcasing a trapezoidal design. Among its features are the primary common areas, including a basement-floor buffet, and a ground-floor reception, lobby, lobby bar, shop, bathrooms, and courtesy rooms. The main entrance to the building is centrally positioned on the main facade, accessible from the motor lobby on the ground floor. Another access point on one side of the ground floor directly links the building to the gourmet square. For entry into the buffet area, there are two additional access points from the pools area on the basement floor. Both the basement and ground floor exhibit double height. The three upper floors house rooms with sea-facing views. Back-of-house spaces, stairs, and elevators are strategically placed at opposite ends of the building. Each floor boasts two means of egress, and the ground level is situated at 19.50 FFL. Notably, the first-level rooms feature swim-up pools.

This building is interconnected with TRS02 on the basement, first, second, and third floors, and it is also connected with GP03 on the basement, ground, first, second, and third floors (Figure 4-8).

TRS04

This six-story structure adopts a rectangular configuration. Featuring hotel rooms from the ground to the fifth floor that offer scenic views of the sea, the building's rear section houses access points, back-of-house spaces, stairs, and elevators. The basement floor accommodates two thematic restaurants with a double-height level. Each floor is equipped with two means of egress, and the ground level is situated at an elevation of 19.50 FFL. Noteworthy is the presence of swim-up pools in the rooms on the second level.

Additionally, the building is interconnected with GP02 on the basement, ground, second, third, fourth, and fifth floors (Figure 4-8).

TRS05

Standing at six floors, this rectangular building features hotel rooms on each floor along the side that overlooks the sea. The rear portion of the building is dedicated to access points, back-of-house spaces, stairs, and elevators. With two means of egress per floor, the ground level is situated at an elevation of 12.50 FFL. Notably, the ground-level rooms are equipped with swim-up pools.

TRS06

Ascending six stories, this rectangular building is adorned with hotel rooms on every floor along the side that opens up to the sea. Positioned at the rear of the structure are the access points, back-of-house spaces, stairs, and elevators. Each floor is equipped with two means of egress, and the ground level is situated at an elevation of 12.50 FFL. Noteworthy are the ground-level rooms featuring swim-up pools.

TRS07

At six stories, this rectangular building boasts hotel rooms on every floor along both the long and short facades that offer captivating views of the sea. At the rear of the structure, you'll find access points, back-of-house spaces, stairs, and elevators. With two means of egress on each floor, the ground level is positioned at an elevation of 9.00 FFL. Additionally, the ground-level rooms come equipped with enticing swim-up pools.

TRS08 and 09

Consisting of two buildings, each villa is a single-story residence featuring two bedrooms, a living room, terrace, and a swim-up pool. The villas are crafted from multiple parallel rectangular prisms, creating both the interior and exterior spaces.

Beach Club

This single-story building adopts a square shape, encompassing a buffet area, a sea-view restaurant with a terrace, restrooms, and a kitchen. A bar on one side caters to the pool area. There are separate access points for customers and employees, with one leading directly through the kitchen.

Additional Structures

Additional small structures, including pool bars, towel huts, restrooms, and a food corner, are present to enhance the support for the pool area. All of these structures are single-story and primarily open in design.

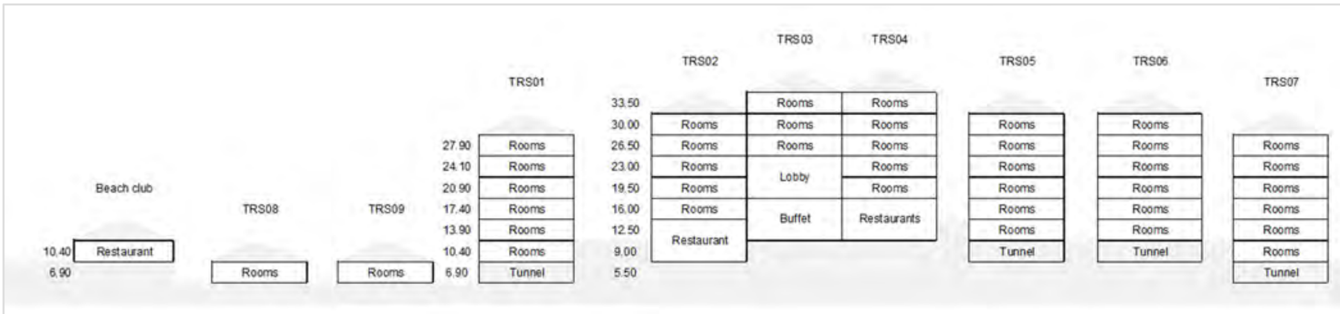


Figure 4-8 TRS schematic levels

The typical TRS buildings are depicted in Figure 4-9.

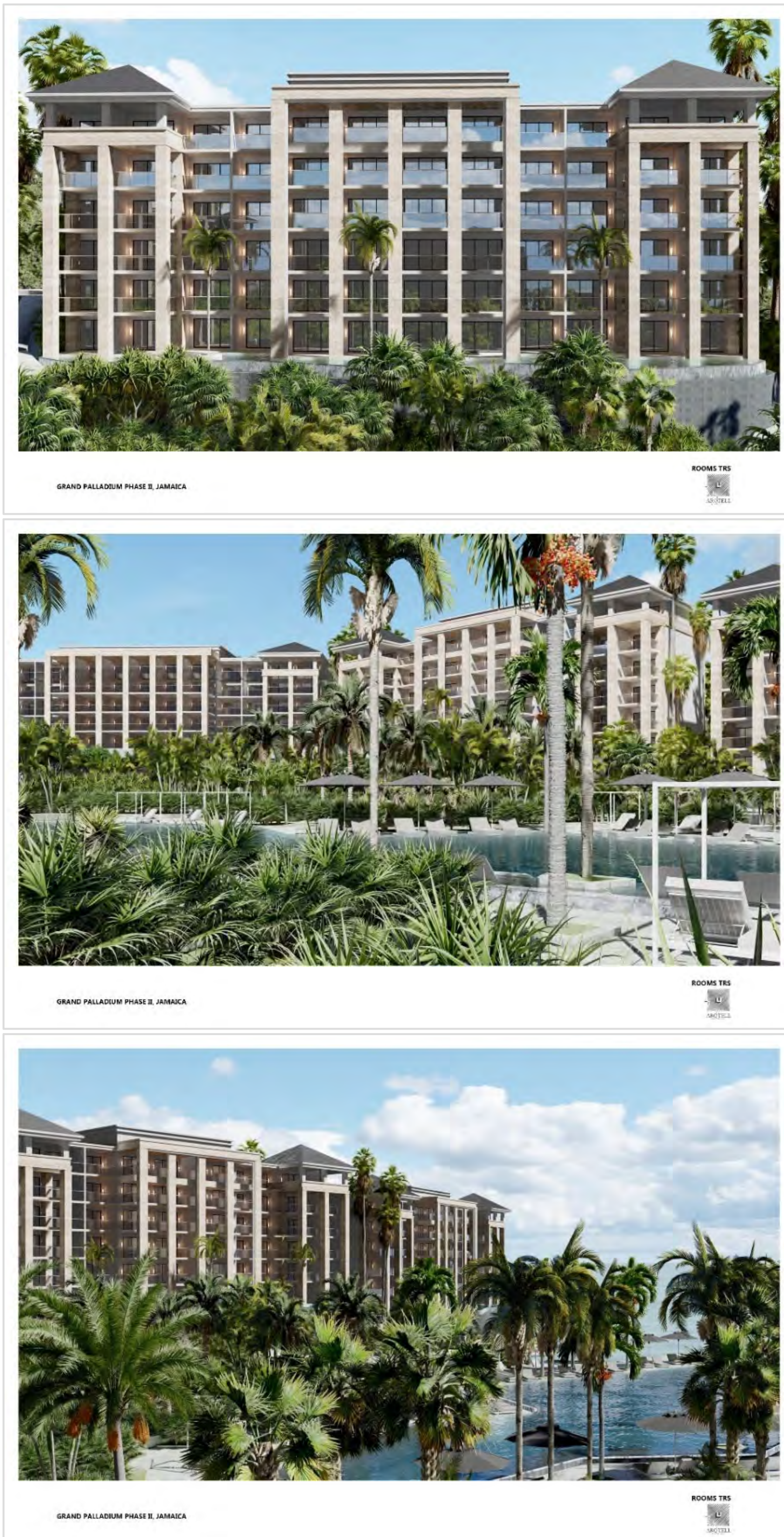


Figure 4-9 Renders depicting the typical TRS building

4.2.2 Gourmet Square

The gourmet square serves as a recreational space offering cafes, shops, bars, and restaurant services. It is structured across two distinct levels: 19.50 m and 12.50 m. The upper level provides a connection to the convention centre access and the two restaurant buildings. Meanwhile, the lower-level grants access to the ground floor of the restaurant buildings and the space beneath the square, which encompasses back-of-house areas. A render of the gourmet square is depicted in Figure 4-10.

Figure 4-10 Render of the Gourmet Square

4.2.2.1 Building 1

To the left side of the square stands Building 1, characterized by a rectangular shape with a rounded tip and two double-height floors. Within, there are three restaurants, a shop, and a sports bar. Access to the building is available on both levels, with one entry point on the higher level and another on the lower one (Figure 4-11).

4.2.2.2 Building 2

On the right side of the square, you'll find Building 2. This structure takes on a rectangular shape, featuring rounded facades in varying scales. It encompasses two double-height floors and hosts two restaurants along with a coffee shop. Access to the building is available with two entry points on the upper level and one on the lower level (Figure 4-11).

4.2.2.3 Convention Centre

This rectangular building features two entrances: the primary one through the gourmet square and another on the road connecting the TRS hotel to the GP hotel. Positioned at the 19.50 level, aligned with the square, the entire interior space of the building is double height. Designed for events, it houses both spacious and more intimate rooms (Figure 4-11).

4.2.2.4 Basement

The basement, is situated at 12.50 level, encompasses a double-height area that links to the tunnels. This basement space serves various purposes, including public restrooms, stores, a staff canteen, workshops, a wardrobe, and a kitchen dedicated to room service (Figure 4-11).

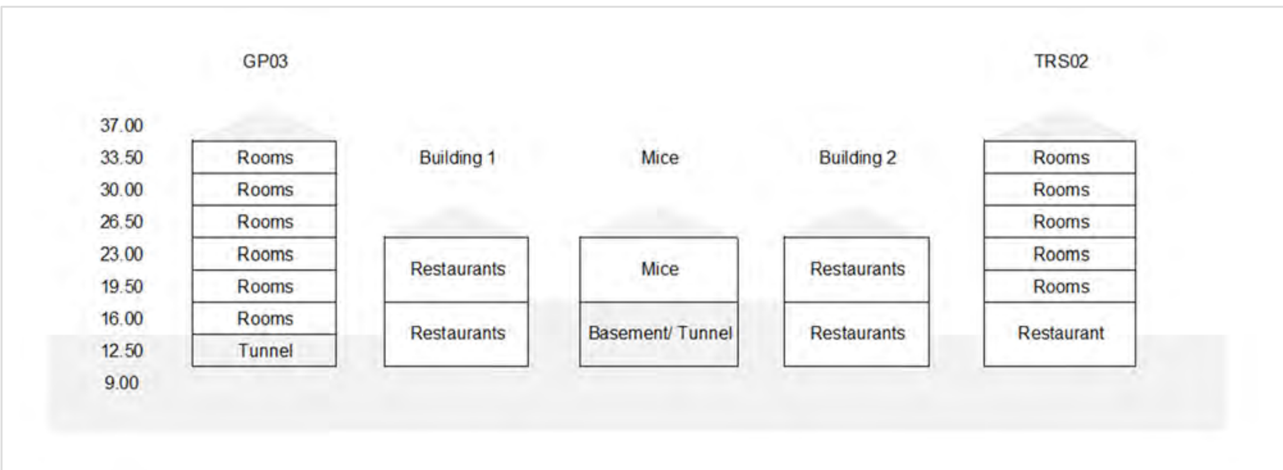


Figure 4-11 Illustration of GP03, Building 1, Conference Room, Building 2 and TRS02

4.2.3 Overwater Rooms

The design of the overwater bungalows prioritizes sustainability and harmony, ensuring the protection of marine resources from construction and operational activities. These structures seamlessly integrate with the natural environment, exuding a tropical aesthetic (Figure 4-12).

Comprising 16 small, single-story, rectangular bungalows, each approximately 228.95 m^2. Each unit includes a living room, bedroom, bathroom, and a terrace area featuring a swim-up pool. Access to each bungalow is provided via a path at the rear.

The property's total sea frontage measures 2,607.46 meters, with the overwater bungalows accounting for a length of 252.41 meters. This represents 9.68% of the overall sea frontage of the property.

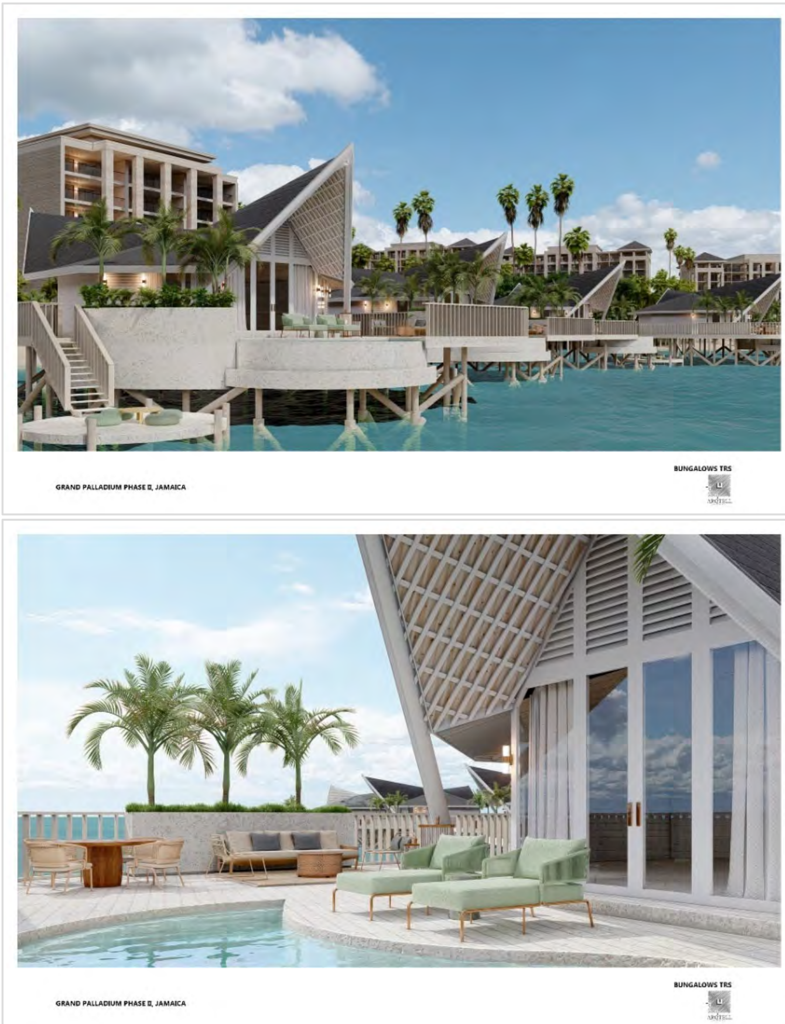


Figure 4-12 Renders depicting the overwater bungalows

4.2.4 Beach Works

The following points outline the rationale for beach creation at the Phase 2 development:

- Shoreline Composition: Phase 2 features a narrow sandy beach resulting from sediment deposition from the reef and a vegetated coastal cliff requiring stability measures. Interventions are necessary to expand the beach and address cliff stability.
- Site Elevations: Data collected indicates the shoreline cliff has elevations ranging from 8-10m, necessitating consideration for beach access that meets both aesthetic and functional requirements.
- Reef Platform: The reef platform allows for approximately 140m of walking before encountering a depth of 0.9m, presenting an opportunity for overwater suites.

- Beach Expansion: With 948 rooms planned for Phase 2, along with desired recreational activities, expanding the narrow beach presents a challenge. Recommendations suggest dry beach space per room ranging from $5m^2$ to $25m^2$, but due to size limitations, up to $2500m^2$ of expanded beach can be created between the existing beaches.
- Drainage Paths: Natural drainage routes must be considered to ensure effective flushing of stormwater and prevent the formation of new drainage pathways across constructed beaches.
- Coastal Cliff Stability: Measures are required to maintain the stability of the vegetated coastal cliff, preventing erosion and preserving natural features, while considering existing drainage paths.
- Beach Access: Providing access for guests from the 10-meter cliff down to the shoreline poses a significant challenge.
- Overwater Suites Location: Placement of overwater suites is critical, requiring shallow areas less environmentally sensitive.

Creating a North Beach and South Beach involves the implementation of curved breakwaters meticulously designed to counteract the prevailing wave and current conditions in the area. Furthermore, beach nourishment is integrated to extend the shoreline by approximately 15 meters, while strategically positioned groynes ensure the stability of the widened beach area. Sixteen overwater suites are strategically located in the sheltered area behind the reef, following the curvature of the north breakwater to minimize seabed coverage, and then aligning with the shoreline beneath the cliff as one progresses northward. Shoreline stabilization measures, such as revetments and constructed headlands, are also incorporated, along with two strategically placed drainage outfalls designed to channel significant flows into the predominant southerly currents, with seamless integration into structures like spur groyne.

The following summarises the proposed costal components, with detailed design specifications for these elements in s Table 4-1 :

- Three (3) revetments
- Six (6) groynes
- Two (2) submerged breakwaters
- $4700m^3$ of sand nourishment
- Two (2) temporary access roads
- Piles (to be determined for the construction of overwater suites)

Table 4-1 Design Specifications for North Beach, South Beach and Overwater Suites

Source: (Smith Warner International Limited, 2023)

Elements	*Key Features*		*Volume (m^3)*	*Area of Seabed (m^2)*
1. North Revetment	140m elevated to +2.0m MSL rock armour structure	M_{50} = 0.4T to 0.8T D_{50} = 0.4m to 0.8m		
North Beach Elements				
a. North Beach – North Groyne	40m elevated armour structure	M_{50} = 0.4T to 0.8T D_{50} = 0.4m to 0.8m	95 m^3	120 m^2
b. North Breakwater	120m Submerged armour structure	M_{50} = 0.7T to 1.5T D_{50} = 0.6m to 1.0m	950 m^3	1470 m^2
c. Beach Nourishment	1(V):14(H) sloped beach area with +1.5m beach crest	Nourished with marine grade sand with D50 between 0.25mm to 0.5mm	3600 m^3	3670 m^2
d. North Beach – South Groyne	30m elevated armour structure		270 m^3	230 m^2
2. North Beach Drainage Outfall	10m elevated armour structure with drainage channel.	M_{50} = 0.4T to 0.8T D_{50} = 0.4m to 0.8m	190 m^3	170 m^2
3. Central Revetment	55m elevated armour structure		350 m^3	460 m^2
4. South Beach Elements				
a. South Beach – North Groyne	20m elevated armour structure	M_{50} = 0.4T to 0.8T D_{50} = 0.4m to 0.8m	110 m^3	100 m^2
b. South Breakwater	100m submerged armour structure	M_{50} = 0.7T to 1.5T D_{50} = 0.6m to 1.0m	1200 m^3	1050 m^2
c. Beach Nourishment	1(V):14(H) sloped beach area with +1.5m beach crest	Nourished with marine grade sand with D50 between 0.25mm to 0.5mm	2100 m^3	2700 m^2
d. South Beach – South Groyne	30 elevated armour structure		400 m^3	350 m^2
5. South Revetment	20m elevated armour structure	M_{50} = 0.4T to 0.8T D_{50} = 0.4m to 0.8m	465 m^3	380 m^2
6. South Beach Drainage Outfall	20m elevated armour structure with drainage channel.		80 m^3	100 m^2
7. Overwater Suites Rooms and Access Road	16 overwater rooms and broads on piles.	To be elevated at +3.2m MSL		

4.2.5 Parking

The development provides a total of 325 parking spaces, with specific allocations: 96 spaces designated for hotel employees, 16 spaces for individuals with disabilities, and the remaining 213 spaces reserved for guests (Figure 4-13). Additionally, there is a designated area for a temporary bus stop. Employee parking spaces are situated in the staff quarters area. Some handicapped and bus spaces are conveniently located in front of the TRS hotel, while the remainder is situated in the industrial area.

Figure 4-13 Illustration depicting the parking areas

4.3 AUXILIARY PROJECT ACTIVITIES

4.3.1 Access to Hotels and Connections

The existing primary entrance to Phase 1 of the complex remains operational and is accessible to guests from both Phase I and Phase II. This entrance is secured by a 24/7 private security gate with a control point. Adjacent to the entrance is a welcoming motor lobby area for the Phase I hotel, featuring a traditional Colonial architectural style with an open-air design.

The driveway within the property runs parallel to the main road boundary lines in the Phase 1 hotel and will be extended to the end of the Phase 2 property. This extension will connect the two new hotels of the complex with the existing main entrance for guest use. Along the driveway, well-maintained gardens will showcase a variety of tropical plants and flowers, creating a vibrant and aromatic environment that immediately induces a sense of relaxation and escape.

Furthermore, a new service access point from the main road to the new industrial area will be established (Figure 4-14). This access point is also secured by a 24/7 private security gate with a control point. The connection from the industrial area to the complex will be facilitated through a new tunnel under the main road in the Phase II area.

The purpose of this new access arrangement is to segregate guest access and service access, offering several benefits for both guests and resort management, such as:

- Guest Comfort: Providing guests with a more peaceful and serene environment, minimizing noise and disruption from resort staff and service activities in their immediate vicinity.
- Staff Efficiency: Enhancing the mobility of resort staff within the industrial area, leading to improved coordination and service. Staff can access service areas without navigating through crowded guest areas.
- Better Maintenance and Cleaning: Ensuring that service areas can be well-maintained without affecting the aesthetics and tranquillity of guest areas, contributing to the overall appeal of the resort.
- Compliance and Safety: Facilitating effective compliance with safety and health regulations and enabling emergency evacuations and first responder access when necessary.

The Phase II new roads proposal includes connecting all the room buildings at the back, allowing motorized access for guests similar to Phase I hotels. These roads will be designed to accommodate emergency services such as firefighters or ambulances, with a minimum width of 4 meters and load-bearing capacity for these vehicles.

Pedestrian paths are also planned to provide access to swimming pools and other outdoor services from every building. These paths are designed with wheelchair accessibility in mind, ensuring slopes are limited to a maximum gradient of 12% in all sections, and shade and rest areas are incorporated for pedestrians.

Finally, underground service tunnels will be designed to connect all room buildings with service areas such as laundry or room service kitchens. All necessary installations for the proper functioning of the buildings will run through galleries in the ceiling, remaining visible for potential repair and maintenance work.

Figure 4-14 Location of service entrance, industrial area and under the road tunnel

4.3.2 Services and Energy

The hotel expansion's electricity, heat, and cooling requirements in Phase II are based on consumption patterns from Phase I and comparable resorts. The project adheres to the existing trigeneration plant's design, operating off-grid and utilizing engine heat sources for efficient electricity and thermal energy generation. Conventional equipment supplements the trigeneration system for continuous energy production. The plant uses stationary reciprocating internal combustion engines powered by natural gas, with an absorption chiller using exhaust gases for chilled water and heat plate exchangers for sanitary hot water. These diverse energy sources will be applied throughout various areas within the hotel.

The locations of the service areas are illustrated in Figure 4-15.

Figure 4-15 Layout of the service areas

4.3.3 Electricity

The hotel expansion's power generation relies on natural gas gensets, each with a nominal power output of 1,500 kWe, in conjunction with a solar plant. In the event of emergencies, failures, or maintenance requirements for these systems, backup diesel generators will ensure a dependable and uninterrupted power supply under any circumstances.

To facilitate effective management of the hybrid power system involving photovoltaic and gas engines, a Battery Energy Storage System (BESS) will be implemented.

Main equipment that will be installed for the expansion of the hotel is as follows:

- 500 kWp rooftop photovoltaic plant
- 3x 1,500 kWe natural gas gensets
- 4x 2,000 kWe backup diesel generators for phase I and phase II (existing diesel generators are at the end of their lifespan generators and will be removed and replace by these ones).
- 1x 1000kW/1000kWh Battery Energy Storage System (BESS).

4.3.4 Chilled Water Production

The primary unit for chilled water production in the HVAC system of the hotel expansion will be an absorption chiller. This technology is highly efficient and utilizes the thermal energy found in the exhaust gases of the natural gas engines (Figure 4-16). To complement chilled water production, water-cooled centrifugal chillers will also be employed.

The exhaust gas from each engine undergoes a three-way valve, diverting it in two ways: either directly to the atmosphere during engine start-up or when the absorption chiller is at 100% load and no further exhaust gas is required, or to the absorption chiller to produce chilled water at 7 ºC for the cooling system and then released into the atmosphere. In both scenarios, exhaust gases exit through a silencer to minimize noise in the vicinity.

In the event of peak demand exceeding the capacity of the absorption chiller or if one of the natural gas engines is undergoing maintenance, a chiller plant utilizing water-cooled centrifugal chillers will ensure continuous chilled water supply to the hotel.

The control system orchestrates chilled water production, prioritizing the absorption chiller as the most efficient machine and supplementing it with electric chillers to achieve optimal system efficiency.

The thermal cooling capacities of the installed equipment are as follows:

- 1x 1,585 kWc exhaust gas absorption chiller
- 5x 1,550 kWc centrifugal chillers

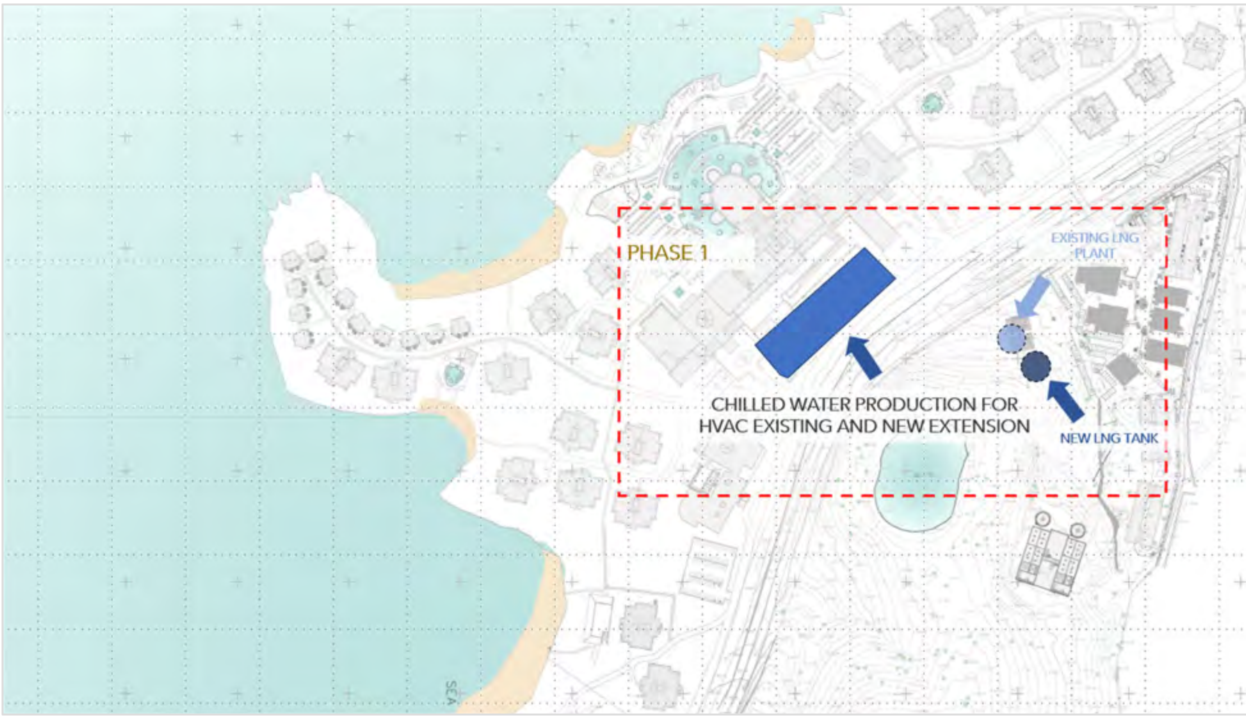


Figure 4-16 Location of the chilled water production

4.3.5 Sanitary Hot Water Production

The provision of sanitary hot water for the hotel expansion will be generated through the recoverable heat from the cooling circuits of the engines, supplemented by gas boilers as a backup system (Figure 4-17).

Each engine features two distinct cooling circuits: high temperature (HT) and low temperature (LT). The primary objective of the engine's cooling system is to cool the HT circuit (engine jackets, lube oil, and the first stage of the intercooler) and the LT circuit (second stage of the intercooler).

These engine components will be water-cooled through plate heat exchangers, facilitating heat transfer in two ways: raising the temperature of the water destined for the hotel as domestic hot water, or direct dissipation into the air coolers. A motorized three-way valve will be incorporated to redirect the flow to the radiators in case hot water is no longer required.

To generate domestic hot water for hotel consumption, two plate heat exchangers will be installed to transfer the heat to the secondary water circuit. During regular operation, one heat exchanger will be operational while the other remains on standby, ready for use during maintenance tasks on the main unit. The hot water will be stored in four insulated tanks, each with a capacity of 10 m^3, ensuring a consistent supply to the hotel.

In the event that the engines are temporarily out of service due to maintenance, a conventional system utilizing natural gas boilers has been designed to supply sanitary hot water to the complex.

The heat capacities of the equipment to be installed are as follows:

- Plate heat exchangers: 2x 1,800 kWt
- Natural Gas Boilers: 2x 900 kWt

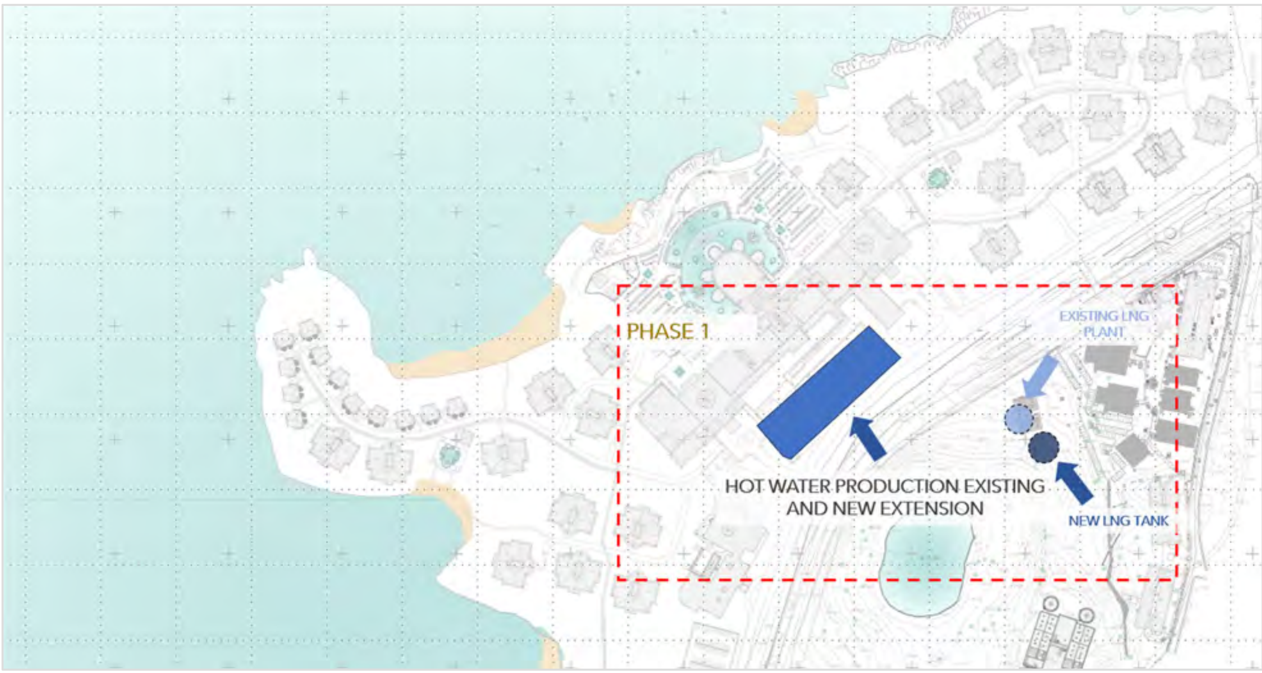


Figure 4-17 Location of the hot water production

4.3.6 Potable Water

The hotel complex will obtain its drinking water from a Reverse Osmosis (RO) seawater desalination plant situated in the industrial area. The potable water system originates from the trigeneration plant situated in the industrial area in Phase I. From the desalination plant, the drinking water is conveyed to tanks in Phase II, situated near the Phase II parking area on the opposite side of the road.

Seawater will be collected through abstraction wells and conveyed to raw water tanks within the RO facility. The entire RO system comprises three units, each boasting a nominal capacity of 900 m^3/day. The design and execution of abstraction and rejection wells will adhere to Jamaican standards and regulations.

These newly installed water storage tanks are designed to cater to the water needs of both Phase I and Phase II. Adjacent to the tanks, a machine room has been incorporated to house the water booster pump system for both hotel phases, ensuring a continuous water supply to the entire complex.

Potable cold water will be distributed to the buildings through a main ring within a facilities service tunnel. It will then be branched to each building through standpipes servicing each level. Sectioning valves have been incorporated for future maintenance, and air elimination valves are positioned at the top of each standpipe.

The estimated daily water consumption rates are as follows:

- Total complex (including all services): 1400 l/room/day (maximum daily rate based on experience from other resort hotels)
- Only hotel rooms without services: 1000 l/room/day
- Staff (restaurants, theatre, rooms, offices and stores, shopping centre, buffet, laundry): 60l/pers./day
- Restaurant customers: 100 l/client/day
- Employees of offices, shopping centre, restaurants, and meals (grease): 25 l/day meal
- Laundry: 1600 l/day

4.3.7 Brine Discharge

The brine produced by the water treatment system will be released through PVC pipes into rejection wells. A manifold, equipped with a set of valves, will distribute the reject to each well.

The anticipated quality of the brine will adhere to the Trade effluent standards.

4.3.8 Water Tank

The storage water tank capacity for Phase 2 has been planned to meet the overall water needs of the hotel premises, ensuring that the cisterns can consistently meet the maximum demands throughout the project's lifespan. These tanks are designed not only to accommodate regular water usage but also to handle potential interruptions in the water supply from the desalination plant and any damages to the cistern filling lines.

In light of the above considerations, the minimum requirement is set to provide one day of service at the daily consumption rate plus an additional three days of backup storage. Therefore, the total tank volume is calculated as four times the daily consumption rate. This works out to be (1,327 m^3/day) x (4 days) = 5,309 m^3.

4.3.9 Sewage System

The wastewater treatment facility currently situated in Phase I Hotel will extend its service to the new Phase II hotel, necessitating an augmentation in line with the updated requirements (Figure 4-18). Presently, the hotel complex features a wastewater treatment plant with a capacity of 1,500 m^3/day. The treated water is utilized for irrigation purposes and the maintenance of the irrigation ponds. Details of the existing system are provided under section 5.4.3.3, Hotel Wastewater Treatment Plant.

Figure 4-18 Illustration depicting the location of wastewater plant expansion

In response to the expansion of the hotel complex, the existing treatment plant is mandated to increase its capacity, doubling it from the current 1,500 m^3/day to accommodate a daily volume of 3,000 m^3.

The sewage network of the resort comprises pipes that receive water from chambers positioned at the base of each building, connecting to vertical sewers. These vertical sewers gather all the sanitary water from bathrooms, kitchens, and laundries within the buildings, as well as water from the backwash of swimming pool filters or cleaning processes, transporting the collected wastewater to the wastewater treatment plant (WWTP).

The network is comprised of three main collectors:

1. Main Sewer Grand Palladium Hotel: This gravity sewer collects wastewater from the Grand Palladium Buildings via the service tunnel located in the basement of those buildings.

2. Main Sewer TRS Hotel: Another gravity sewer, it gathers wastewater from the TRS Buildings through the service tunnel located in the basement.
3. Main Sewer Gourmet Square: This gravity sewer collects wastewater from the common areas of the resort through the basement of the common areas.

As illustrated in Figure 4-19, the main sewers discharge wastewater into the respective Sewage Pump Stations situated at the end of the service tunnels or in basement areas. A primary Sewage Pump Station, positioned on the high side of the resort, will collect wastewater from all Sewage Pump Stations and pump it to the wastewater treatment plant. For overwater bungalows, each unit is equipped with a dedicated home sewage pumping station, facilitating the drainage of used water into the nearest sewage pump station.

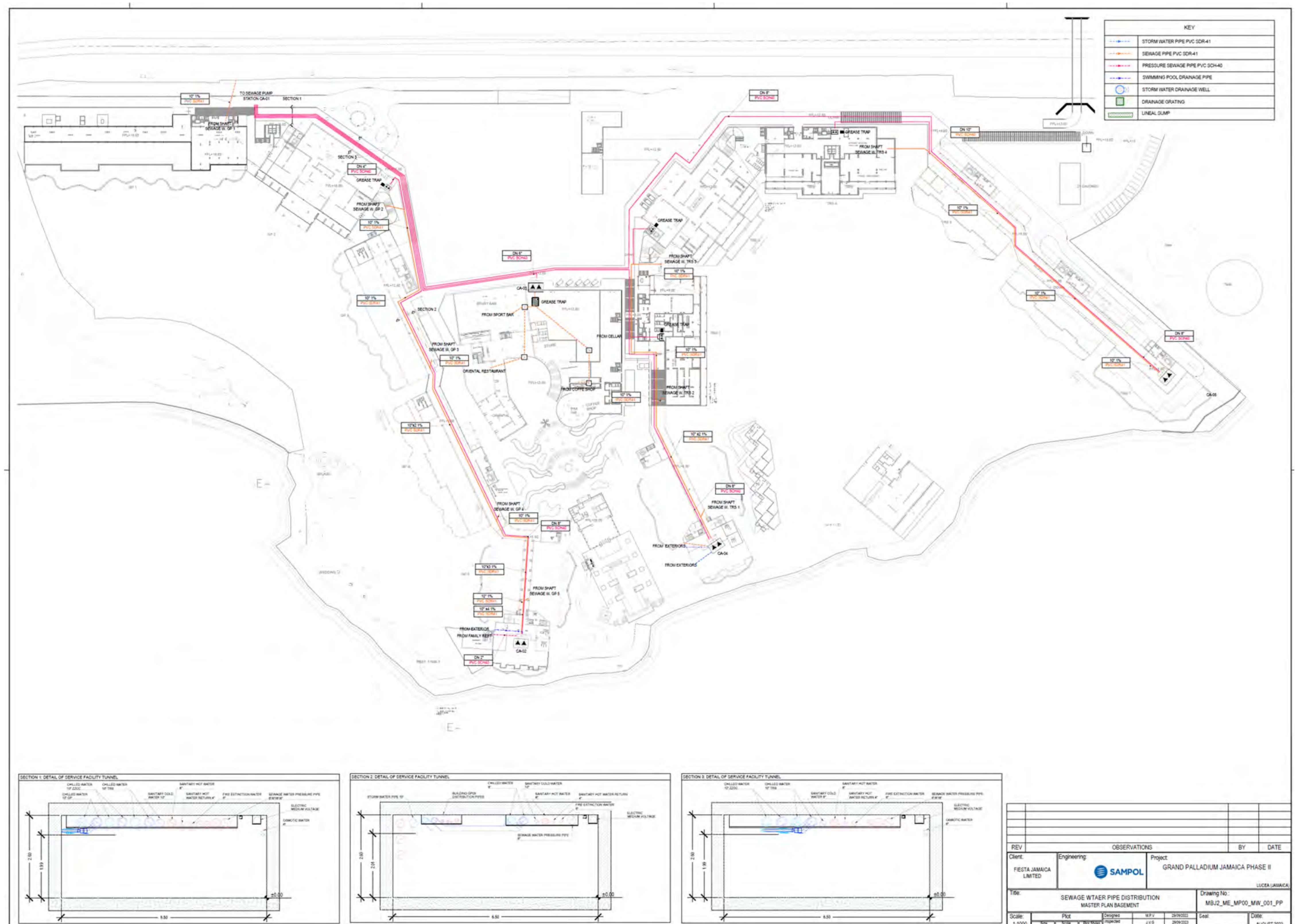


Figure 4-19 Sewage pipeline layout masterplan

4.3.10 Drainage System

4.3.10.1 Overview

The existence of paved and covered areas of buildings, (roofs), as well as the proximity to the ocean coastline, requires specific treatment of storm water, so that the discharge of solids and debris is minimized, and the natural purification effect is optimized. The drainage system must align with the characteristics of a luxury hotel project, taking into consideration the need for shallow drainage elements due to high-water tables to minimize visual impact. Additionally, the number of discharge points into the ocean should be minimized to reduce the impact on the coastline. Two designated points are specified, each equipped with a flow lamination braking system in accordance with sustainable construction standards.

The natural slopes of the land are utilized to establish a water collection area, known as a Retention Buried Pond, featuring landscaping that facilitates water filtration into the subsoil. In the event of saturation and sedimentation of suspended solids, the water is then discharged into the sea. Close ducting pipes are employed to channel rainwater into this retention pond.

For areas where the natural soil slope does not permit water to reach the retention point, stormwater drainage wells are essential.

The collection of stormwater is broken down into four categories:

1. Collection of rainwater from roofs
2. Collection of rainwater from common areas
3. Collection of rainwater from parking and access roads
4. Collection of rainwater from the mountains and reception of runoff from road drainage and parking

The stormwater drainage layout is depicted in Figure 4-20.

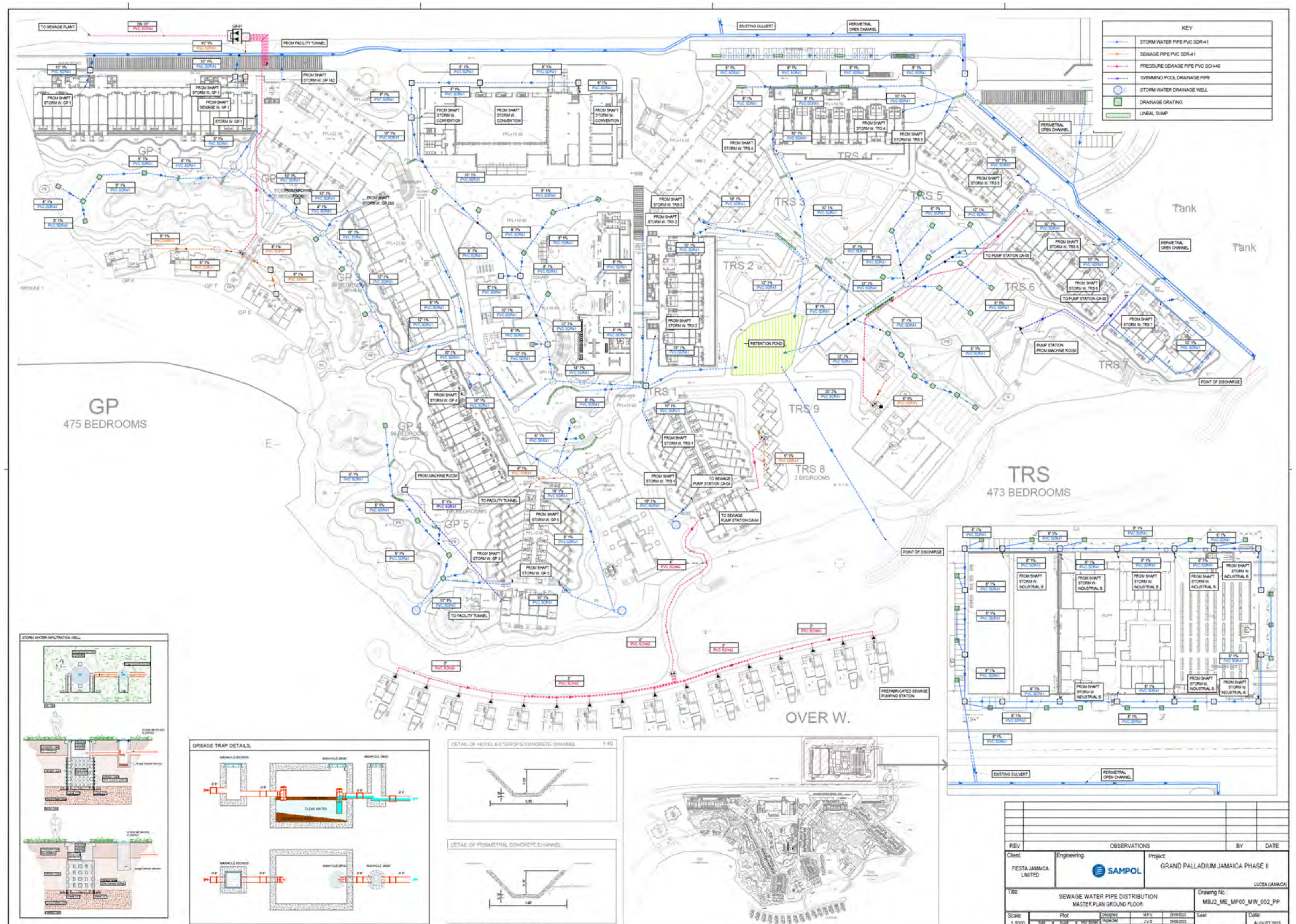


Figure 4-20 **Drainage layout masterplan with sewage pipe layout for overwater rooms**

4.3.10.2 Drainage Strategy

The drainage strategy is divided into two main segments: the upper catchment and on-site drainage.

Upper Catchment/Roadway Basin

The expansive upper catchment area, covering approximately 1400 acres, currently relies on two drainage culverts beneath the road. The existing water flow naturally converges towards a central drainage path within the property. The proposal involves optimizing this flow by introducing an open channel drain and a grass swale, starting from the northeastern property boundary and extending to the southeastern edge along the road. This channel will capture all the water from the culverts, directing it southwest based on the design slope. The flow will then be channelled through a U-channel drain, ultimately discharging onto the proposed rocky revetment structure along the southwestern shoreline.

On-Site Drainage (Major Drains) - Hotel Property

The master drainage plan focuses on a singular outflow point, using the natural path for water discharge to avoid impacting the north side of the property. Starting from the northeastern edge, the drainage system manages runoff from various sources, including buildings, roofs, pools, and gardens. The runoff converges at a central catchment or detention area strategically positioned in the property's centre. This area, designed to resemble a garden in the master plan, will function as a wetland during significant storm events. The stormwater will follow the natural path, ensuring efficient and aesthetically pleasing water management.

For the proposed drainage systems, high-density polyethylene (HDPE) closed pipes will be employed. Stormwater will be directed to strategically positioned manholes and catch pits within the drainage networks. Additionally, an open channel originating from the detention area will complement the natural surroundings. To enhance the visual appeal and maintain a natural aesthetic, techniques such as gabion baskets and landscaping methods will reinforce the sides of the drainage paths. The final discharge point will be adjacent to the expanded spur groyne structure in the beach design, preventing sediment flow into the beach areas.

4.3.11 Firefighting and Compartmentalization

In accordance with the International Fire Code (IFC) and International Building Code (IBC), the design of fire protection systems is contingent upon the occupancies and characteristics of the building. Considering these regulations, the following fire protection facilities are proposed for each building:

1. Portable extinguishers will be installed in all hotel buildings.
2. Automatic Sprinkler Systems will be installed in every building, except GP6, GP7, GP8, TRS8, TRS9, Overwater Bungalows, Travel Club, and Beach Club. These exclusions are based on the following criteria:

- Buildings do not exceed the square feet area limit for those classified in groups A1, A2, A3, A4.
- Buildings do not exceed the occupant load limit for those classified in groups A1, A2, A3, A4.
- Buildings do not have three or more stories above grade in group R1 building classification. The system will be supplied by the cistern and fire pressure group located in the industrial building.

3. Standpipe systems will be installed in all buildings, except GP6, GP7, GP8, TRS8, TRS9, Overwater Bungalows, Travel Club, and Beach Club. These exclusions are due to the absence of:
    - More than three stories above grade where the building is protected by an approved automatic sprinkler system.
    - An automatic sprinkler system.
    - More than 15 m above grade and containing intermediate stories or balconies.
    - More than one story below grade.
    - More than 6.1 m below grade.
4. Fire alarm and detection systems will be installed in all buildings, except GP6, GP7, GP8, TRS8, TRS9, Overwater Bungalows, and Travel Club. These exclusions are justified by the absence of:
    - An occupant load of 300 or more or is more than 100 persons above or below the lowest level of exit discharge.
    - More than two stories in height where all individual sleeping units are separated from each other or common areas by not less than 1-hour fire partitions, and each individual sleeping unit has an exit directly to a public way.
    - Interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.
5. Every commercial cooking equipment used in processes producing smoke or grease-laden vapours will be protected by an automatic fire-extinguishing system.

The firefighting layout is depicted in Figure 4-21 and Figure 4-22.

4.3.12 Telecommunication

Telecommunication services will be provided by either Columbus Communications Jamaica Limited (Flow Jamaica Ltd) or Digicel Jamaica.

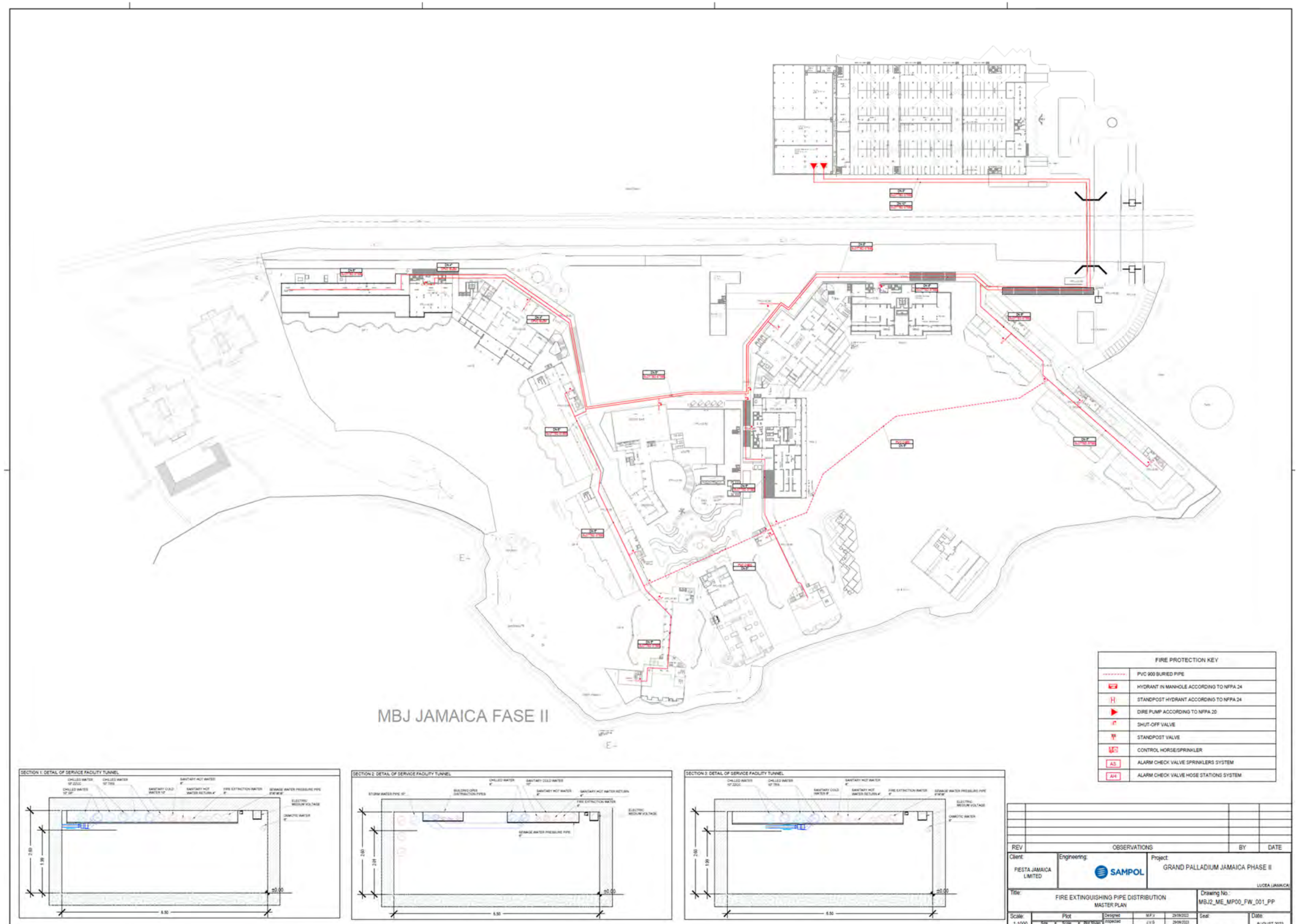


Figure 4-21 Fire water pipeline layout

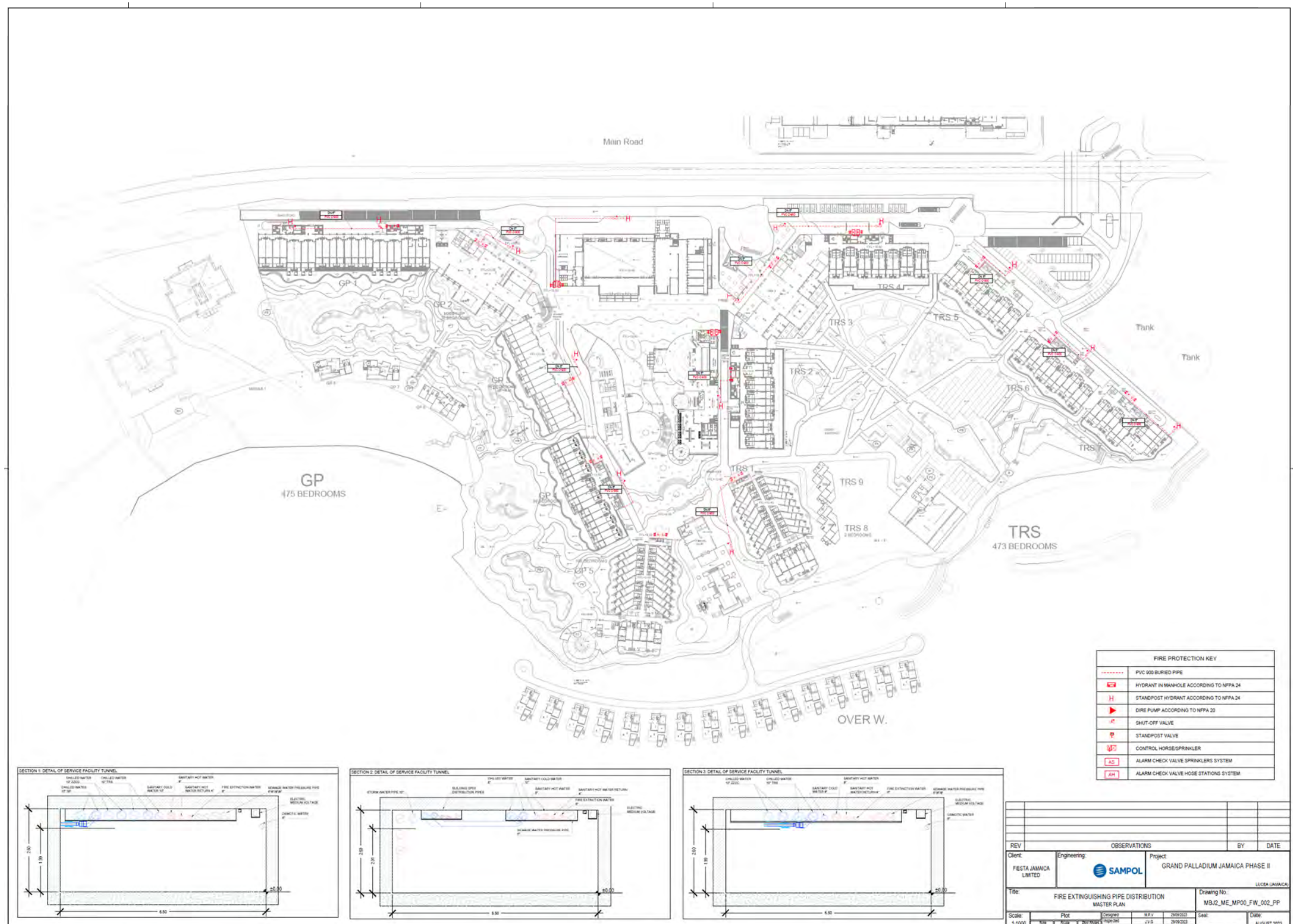


Figure 4-22 Hydrant distribution masterplan

4.3.13 Landscaping and Topography

The gardens and access roads are slated for reforestation using indigenous plant species, which will significantly enhance the existing vegetation on the property (Figure 4-23 and Figure 4-24). Any trees that must be removed during construction will be replaced through a comprehensive replanting effort.

The proposed design has been carefully developed to minimize changes to the existing land levels, with the aim of preserving the natural topography as much as possible and reducing the need for filling or excavation (Figure 4-25). To accomplish this, the buildings have been positioned at the intermediate levels within their footprints, and the landscaping has been adapted accordingly, ensuring that the original landscape is largely maintained.

A detailed landscaping plan will be presented to the NEPA for review and approval.

Figure 4-23 Illustration of the landscape concept

Figure 4-24 Landscape master plan

Figure 4-25 Grading plan

4.3.14 Solid Waste

Solid waste from the rooms and blocks, will be separated by the housekeeping into food waste and recyclables using different bags. These bags are then transported from the villas to the Waste Management Area located in Phase 1, where further separation takes place (Figure 4-26).

Food waste is packaged for the animal farmer program, and the remaining waste is placed in a compactor. Recyclables are sorted and compressed into bales for pick-up by the recycling company.

Waste from the kitchen and other areas is handled similarly, except for metals, chemicals, waste oils, and electronics, which are stored and removed by an approved contractor. Garbage collection and disposal will also be done by an approved solid waste company will have regularly schedule pickups. Disposal will be at the Retirement Disposal Site.

Garbage disposal areas will be clearly identified to adequately contain the daily solid waste from the building areas including the Hotels buildings, restaurants etc. Appropriate recycling methods will also be explored the minimize the overall waste for disposal and appropriate storage and systems for wet and dry garbage. Excavated material will be stored on-site, covered with tarpaulin to minimize dust pollution, and bermed to prevent runoff. The maximum amount of soil will be used for landscape purposes.

Figure 4-26 **Waste Management Area**

4.4 CONSTRUCTION METHODOLOGY

4.4.1 Concrete Batching Plant

A concrete batching plant will be established southeast of the North Coast Highway (Lucea to Montego Bay) on lands earmarked for Phase 2 development taking up an area of 5,871 m^2 (Figure 4-27). The layout is depicted in Figure 4-28 and the plan and elevation views of the Frumecar Batching Plant are depicted in Figure 4-29.

Figure 4-27 Map showing the location of the batching plant and surroundings

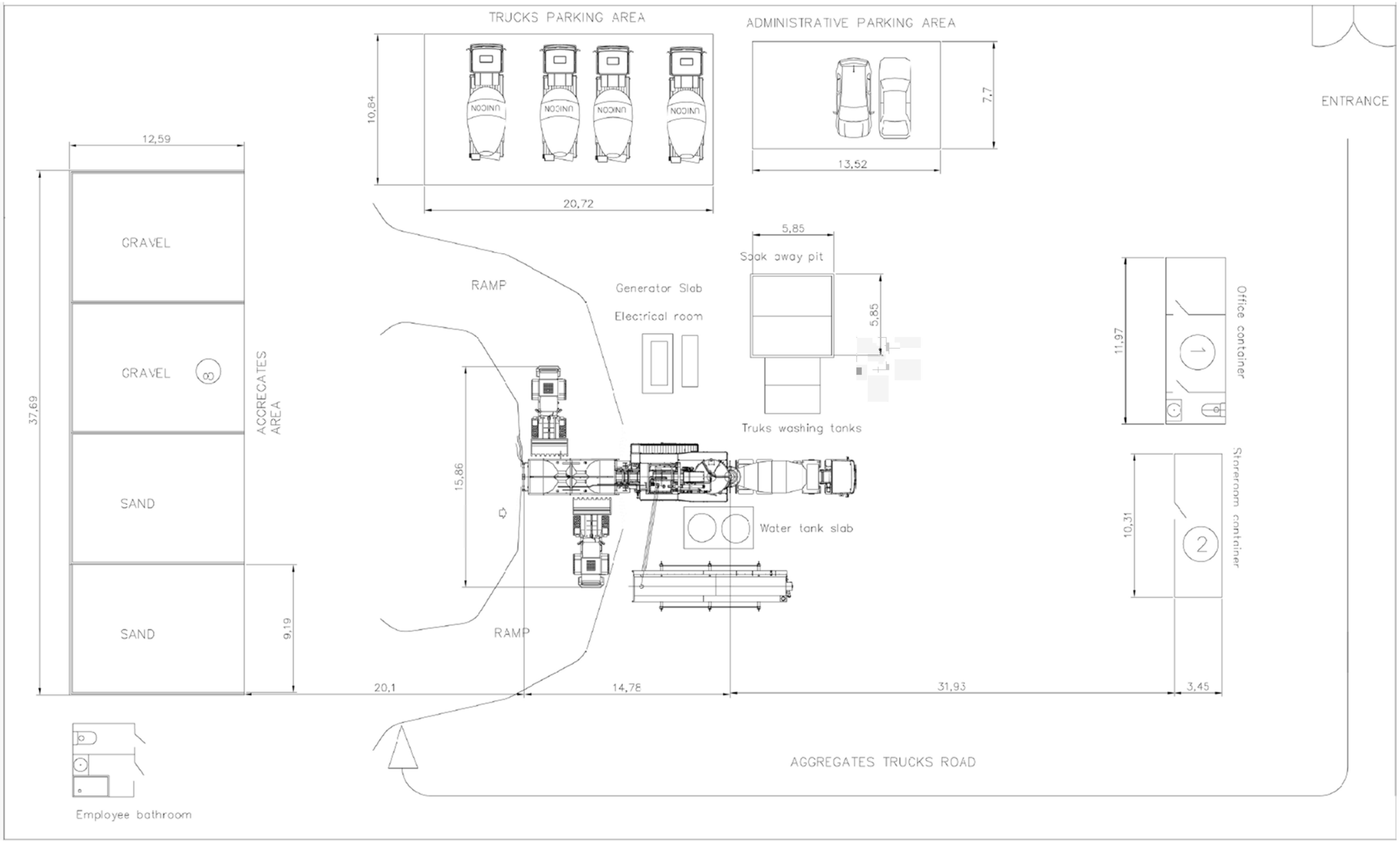


Figure 4-28 **Drawing showing batching plant**

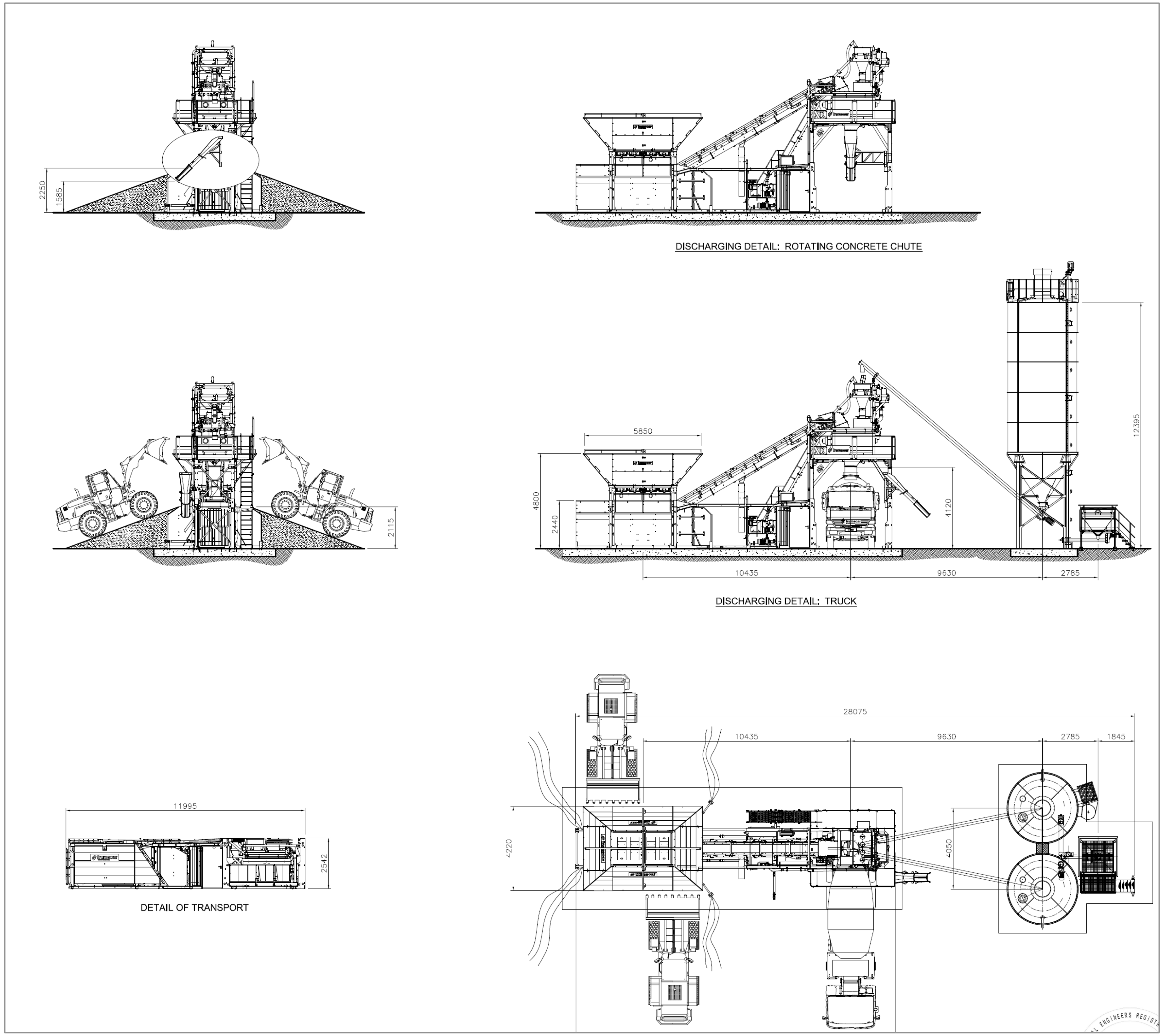


Figure 4-29 Temporary Frumecar Batching Plant

4.4.1.1 Specifications

The batching plant to be used will be the Frumecar model, double silo system. The process entails the combination of water, aggregates and cement. The temporary batching plant facility will generate a total of approximately 75,000 cubic metres of concrete during the construction phase of the project. Table 4-2 details the breakdown of raw materials and quantities to be used in the process.

Table 4-2 Raw materials and quantities to be used in the process

Description	Units	Quantity (m^3)	Total Quantity
Cement	Ton	0.400	30,000
Additive	Gallon	0.800	60,000
Sand	M^3	0.720	54,000
Gravel	M^3	0.580	43,500

The batching plant will operate for approximately 20 months (or until project completion). The facility will be constructed and operated within curtilage of the property. The raw materials consist of the following:

- Bulk cement – to be purchased from Caribbean Cement Company Ltd. and stored in silos.
- Aggregate – To be purchased from the Lydford Mines in St. Ann and stored in well-defined
- containment areas, separated via walls and covered with tarpaulin.
- Water – To be supplied by the National Water Commission (NWC). Estimated total volume of water to be used in the process throughout the entire construction phase of the project is 4,000 m^3.

Concrete wastewater, originating from washing out trucks and pumps, as well as rinsing off chutes, equipment, and truck exteriors, will be generated. To prevent this wastewater from entering waterways, storm drains, and groundwater, a designated concrete washout area will be constructed. This area will consist of a hole where the concrete wash water will be discharged and left to dry for a period of 1 to 2 weeks. Once dried, the concrete will be broken up and removed using excavators. It will then be loaded into dump trucks and transported to an authorized disposal facilities.

The technical specification of the batching plant is outlined in Table 4-3.

Table 4-3 Technical specifications for the batching plant

Technical Specifications	Units	Quantity/Particulars
Production	m^3/h	50
Cycle	m^3/h	1
Dry Numbers	u	4
Hopper Layout		Square
Dry Storage Capacity	m^3/h	25
Cement Silos	u	2
Cement Storage Capacity of each silo	Tn	112
Water Meter		Yes
Screw Conveyor Diameter	mm	219

Technical Specifications	Units	Quantity/Particulars
No. Charge Ways	u	1
Mixer		Verticale Axle FTR-1500
Dy Storage		Optional
Control Cab		Provided
Pneumatic Installation		Provided
Electrical Panel		Provided
Computer Equipment		Provided
Total Power	Kw	84
Power Input	Kw	72

4.4.1.2 Dust Control

The following mechanisms are integral to the batching plant process and help minimize dust emissions during operations:

Cement Handling and Storage Process

Cement is delivered in sealed trucks and transferred into two silos using high-performance pressurized pipes specifically designed for this procedure. The system features an electronic valve that monitors and controls the flow, automatically stopping it in case of an emergency. Cement is stored in an independent double silo system, each equipped with four fluidizer filters that allow one-way movement of cement dust, preventing any leaks to the exterior. These filters are maintained weekly.

For concrete production, cement is transported from the silos via sealed spin pipes directly to the wet mixer. This sealed and protected system ensures no loss of product or quality during the process.

Vehicular Activities and Speed Limit

All trucks delivering aggregate to the site must be securely covered with tarpaulins. To minimize dust emissions from access roads, a speed limit of 25 km/h (15 mph) must be observed on site. When needed, flag personnel will be positioned at the main entrance to manage and control vehicle movement and speed. Additionally, speed limit signs will be posted throughout the site.

Management of Aggregate Stockpiles

Aggregate material is delivered in trucks covered with tarpaulins and stored in designated areas specifically prepared for its management. These areas are isolated with concrete slabs and walls to prevent contamination from mud, water, or soil. The material, consisting mainly of stone or sand, is untreated and free from chemical additives, as found in natural mines.

The material is transferred to the aggregate hopper using a backhoe. Although some dust may be present, it is typically minimal due to the material's wet state. Any dust generated is simply the natural dust from moving sand. Once in the hopper, an electronic system continuously feeds the raw material into the wet mixer, where it is combined with other components for processing.

Wetting Activities

Consistent wetting of site grounds, aggregate stockpiles, and access roads will be conducted to minimize dust levels. The frequency of wetting will depend on weather conditions (temperature, rainfall, wind speed, etc.). Re-wetting will occur immediately when previously wetted areas have dried out. This frequency will increase on hotter and windier days.

Dust/Particulate Monitoring

Air quality monitoring will be conducted on-site to measure coarse particles, which are airborne pollutants ranging from 2.5 to 10 micrometres in diameter. These particulates, known as PM10, can originate from crushing or grinding operations and dust stirred up by vehicles. Monitoring will take place at various locations along property boundaries and in neighbouring residential communities. At least one monitoring station will be established upwind of the proposed site. The collected data will be compared with National Environment and Planning Agency standards.

4.4.1.3 Emergency Response

Risk Assessment and Emergency

Potential emergency situations and accidents will be identified through the Risk Assessment process for all new contracts and the introduction of new working methods. This process includes documenting methods, risks, hazards, and controls based on site- or job-specific risk assessments, as requested by the Company/Owner. The documentation will include method statements, relevant legislation, and required personal protective equipment (PPE). Proposal documents will also address environmental issues such as potential noise, land, water, and air pollution.

The purpose of risk assessment is to identify significant workplace risks and control them to acceptable levels, ensuring compliance with the Environmental, Health, Safety, and Security (EHSS) Plan and Manual. All aspects of work activities are reviewed for Risk Assessment. For hazardous chemical risks, the Control of Substances Hazardous to Health (COSHH) Assessment Procedures are followed. For other risks, the policies in the EHSS Plan and Manual are implemented, covering key aspects such as working at heights, confined spaces, manual handling, waste contact, equipment use, and environmental risks. Health and Safety requirements may also be supported by an external consultancy.

Detailed method statements are produced for specific contracts and site operations. These statements include the scope of work, job-specific instructions, risk assessment, accident and near-miss reporting, toolbox talks, PPE and equipment information, and sign-off/acknowledgment sheets.

Emergency response activities include measures for spillage and contamination control. In the event of an emergency or accident related to the collection, processing, and shipment of waste or recycling, contractor emergency response activities will be implemented accordingly.

Response to Emergency Situation

Activities with higher risk may include:

- Fires and explosions
- Storms, hurricanes, or other unexpected weather conditions
- Major chemical spills or leaks
- Accidents resulting from equipment failure
- Issues related to admixtures and cement

In the unlikely event of an emergency situation with an adverse environmental impact, emergency response actions (as documented in site folders, risk assessments, and material safety data sheets) will be implemented.

Upon satisfactory completion of the emergency response, the necessary paperwork and documentation required by NEPA will be prepared and submitted. Concurrently, a post-accident evaluation will be conducted, and appropriate corrective and preventive actions will be implemented. These actions must be documented on an Accident Report Form, detailing the emergency situation or accident, root cause, environmental impact, corrective and preventive actions, responsibilities, and timelines. A review of the effectiveness of these actions should also be included.

Test and Review of Emergency Preparedness and Response Procedures

Testing and reviewing the Emergency Preparedness and Response process is conducted in accordance with the batching plant contractor's Emergency Response procedures. This may include testing and reviewing disaster recovery elements, training and performance of emergency response personnel, building evacuation procedures, internal and external communication, availability of risk and hazard information, and the effectiveness of planned mitigation and response actions. These processes are tested and verified each time an emergency arises.

4.4.1.4 Maintenance and Operations

The following maintenance tasks will be carried out to ensure the proper functioning of the plant.

Engines and Mechanisms

1. Check the oil levels (by portholes and stopper reducer).
2. Check if there is an oil leak.
3. Change reducers oil maximum every 2 years.
4. Grease the bearings of plant mechanisms before first plant set up and 40 h of operation (weekly).
5. Lubricate grease points on electric motors (if any) every 40 h or once a week.
6. Exhaust internal cleaning. At least twice a day and if there is more than 30 min of stop of machine.
7. Checking of oil levels:
    - Reduction gears oil: type ISO-150.

- Oil pressure system oil: type ISO-HP46 (yellow colour).
- Bearings grease grade UNI XM 2.
- Seals lubrication:
- Type NGL2 (filling up or topping up must be done by the appropriate connection (see instructions manual table 10 A. It's absolutely forbidden to fill the grease tank by disassembling its cover).
- Type 00 in case of zones with very low temperatures. Same recommendations for filling.

8. Change oils every 4000 working hours or at least every 2 years.
9. Before to the first put in function, keep the reduction gears caps open in order to free inside air until oil reach its working level.
10. Checking of transmission belts regarding wear and tension.

Pneumatic Installation and Compressors

1. Check the oil level of compressor head weekly.
    - If it's necessary, fill up with oil type 15W-50.
    - Change oil each 3 months.
2. Check the compressor filter.
    - Fill up with the same oil than we used for the compressor head. SAE 80-90.
    - According to the environment dust, change the oil every 3 months.
    - Clean the filter each week. Drain the decantation glass of the pneumatic panel and compressor every 2 days (every day if the temperature or humidity conditions require it).
3. Check the work pressures of the pneumatic lines:
    - Regularly pneumatic drives – 6 bar.
    - Regularly cement filter – 5-6 bar (max)
    - Regularly fluidization pads from silos –. 4 bar.

1. Review weekly fluidization pads piping and if they have cemented the solution is in the maintenance book.

Electric Installation

1. Check tension of emergency stop system cables.
2. Check the running of emergency buttons.

Scales

1. Check the hoses.
    - See that there are no cracks or fractures.
    - Check they are not tightened or hardened to not distort the measures.
    - Check that the scales are free from obstacles, fixed or rested elements.
2. Review vent pipes are cleaned (once per week).

Conveyor Belts

1. Tighten the belts and centre them periodically, especially first working months. Later monthly checking.
2. Check that the rollers turn free and without dirt weekly.
3. Check the adjustment and wearing of scrapers.
4. Cleaning collection hoppers, trays under the tape and covered rollers, avoiding the accumulation of aggregate material.

4.4.2 Hotel Construction

4.4.2.1 Geotechnical Study

A Geotechnical Study of the proposed project site was conducted during May-June 2012 using a Rolatec and RL 48 crawler rotation probe, and consisted of:

- 28 Rotating mechanical soundings with continuous core recovery
- Unaltered sampling (IM) and standard penetration testing
- 20 Superheavy continuous dynamic penetration tests (P), until the rejection condition is achieved.
- 16 well/trench excavations by mixed backhoe
- 2 Geomechanical stations on rock outcrops
- 3461 linear meters of Electrical Tomography

Plate 4-1 Rolatec and RL 48 crawler rotation probe

4.4.2.2 Earth Moving

This is a very important issue on the project because the plot has a significant slope. Therefore, preliminary excavation, stabilization, and soil retention works are necessary to construct buildings on it. Additionally, drainage strategies will be considered to channel water towards the sea without affecting the buildings.

One of the primary reasons for earth movement is to level the ground and create a flat surface for construction. This ensures that the buildings and infrastructure are stable and safe. Earth movement will also be used to create proper drainage systems on sloped terrain. By reshaping the land, engineers will direct water away from buildings and prevent issues such as flooding or erosion. Grading the land will improve the overall stability of the site by redistributing the soil and minimizing the risk of landslides or soil erosion. This earth movement will also be used for aesthetic purposes for landscapers, such as creating terraced landscapes or scenic viewpoints.

4.4.2.3 Foundation

After reviewing the geotechnical study, the most suitable foundation for each building will be proposed by the structural engineer, based on the type of soil and building characteristics, with two main types of foundation being identified: Deep foundation and shallow foundation.

Buildings

For the execution of deep foundation piles, specific machines will be used to drill the ground to the required depth. Then, reinforcement bars will be installed in the hole, and concrete will be poured slowly to prevent air bubbles. The characteristics of the concrete will be defined by a structural engineer according to the substrate found. Once this process is completed, the concrete will be allowed to cure for the appropriate time to acquire the necessary strength.

After being cast in-situ, the piles are cut at the top to integrate them into the Shallow Foundation. The Shallow Foundation can consist of strip footings and/or isolated footings and pedestals.

For shallow foundation formwork will be constructed around the perimeter of the excavated area to contain the concrete during pouring. Once the formwork is in place, reinforcement bars (rebar) will be positioned within it according to the structural design specifications. The concrete mixture will then be poured into the formwork, ensuring that it fills the entire area evenly. Vibrators may be used to eliminate air pockets and ensure proper compaction of the concrete. After pouring, the concrete will be allowed to cure for a specified period to achieve its full strength and durability.

To connect the foundation with the structure (which will be precast reinforced concrete in most buildings), a precast footing will be used. This footing will receive the heads of the piles and will have a socket for the column achieving the integration of both systems.

Pools, Water Features, and Other Exterior Areas

Most of these elements will have a foundation made of reinforced concrete slab on site. The area designated for the foundation will be excavated to the necessary depth, which will be determined by the specific requirements of this elements design and the characteristics of the local soil. Following excavation, formwork will be erected around the perimeter of the excavated area to contain the concrete during pouring. Once the formwork is in place, reinforcement bars (rebar) will be installed within it according to the structural design specifications. Subsequently, the concrete mixture will be poured into the formwork, ensuring that it fills the entire area uniformly. Finally, the concrete will be allowed to cure for a specified period, typically several days, to achieve its full strength and durability.

Structure

The structure will be design using The Jamaica National Building Code which is based on the International Building Code (IBC2018). As such concrete design is based on ACI (318) codes. Building Loading Codes are based on ASCE 7-10.

During the design of the structure, the load patterns were considered as following:

- Permanent Actions (Gravity and dead loads): Corresponds to the structure's own weight and additional weights considered as dead load (columns, main beams, floor beams, and floor system, cladding and superimposed dead load. The determination of the superimposed dead loads will be undertaken during the design development phase of the project after receiving proposed floor build-ups from the architect.
- Variable Actions: Corresponds to the loads generated according to the usage of the building (live load with the corresponding intensity). For maximum intensity combination, live load is considered. For accidental combination instantaneous live load is considered. Live loads will be determined by ASCE-7-10.
- Accidental actions: Corresponds to the loads resulting by an action generated by a catastrophic event (earthquake, wind and natural disasters). Because Jamaica lies within an area of high seismic risk, the design of the lateral system is expected to be controlled by seismic loading. Nonetheless, the proper wind and seismic loads were calculated according to ASCE-7-10 and included in the building model.

Rooms, Conference Room, Restaurants, and Industrial Buildings

The rooms buildings have very similar plan rectangular dimensions, and they are 6 stories buildings with typical story heights of 3.50m, except for the first/basement with a variable dimension. The building's plan dimensions vary, but they have a typical column spacing of 4.50 m along the long dimension, and 7.80 m along the short dimension.

The structure of these buildings is being studied in two options: precast wherever possible, or in situ, depending on the geometry and shape of the building. Tentative, precast is the most suitable option for typical buildings, and in situ structure, for isolated villas and small buildings.

The first phase consists of designing and planning. This is a very important step to achieve a faster, cost-effective, high-quality, and environmentally friendly construction solution.

4.4.2.4 Prefabrication

The prefabricated concrete elements, such as panels, beams, columns, and slabs, will be manufactured on site, with the concrete being supplied by the batching plant. This process involves pouring concrete into moulds, reinforcing with steel bars, and allowing the elements to cure properly.

The superstructure consists of precast concrete slab of 10 cm thickness supported by load bearing girders and stiffening beams. These in turn are supported by precast rectangular concrete columns (Figure 4-30).

The central buildings for receptions and restaurants, have a somewhat more irregular geometry, but they all share the same floor system that consists of precast concrete "double-tee" slab perimeter supported by load bearing girders and stiffening beams (Figure 4-31). These in turn are supported by precast concrete columns.

Once the prefabricated elements are ready, they will be transported to the construction site using trucks and specialized equipment. The prefabricated concrete elements will be lifted and positioned into place using cranes or other lifting equipment. Labourers will connect safely the elements to each other and to the foundation using bolts, welding, or other fastening methods. At the end they will employ a compression layer made of reinforced concrete with electro-welded mesh.

The lateral force-resisting system is comprised of ordinary moment frames along the short and long dimensions. Throughout the construction process, quality control measures will be implemented to ensure that the prefabricated elements meet industry standards and regulatory requirements in Jamaica. Inspections will be conducted by third-party inspectors to verify compliance.

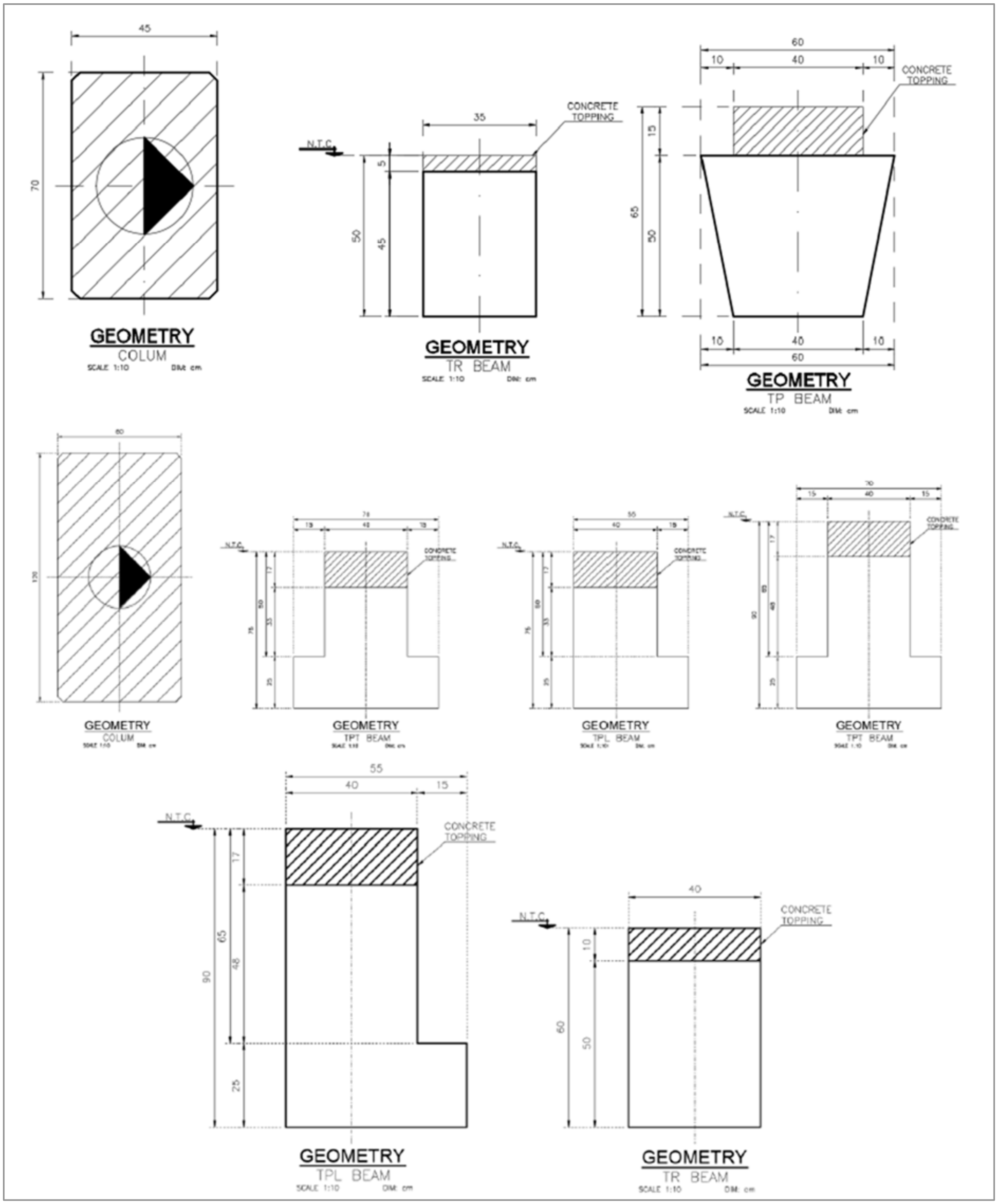


Figure 4-30 **Beams and columns geometry**

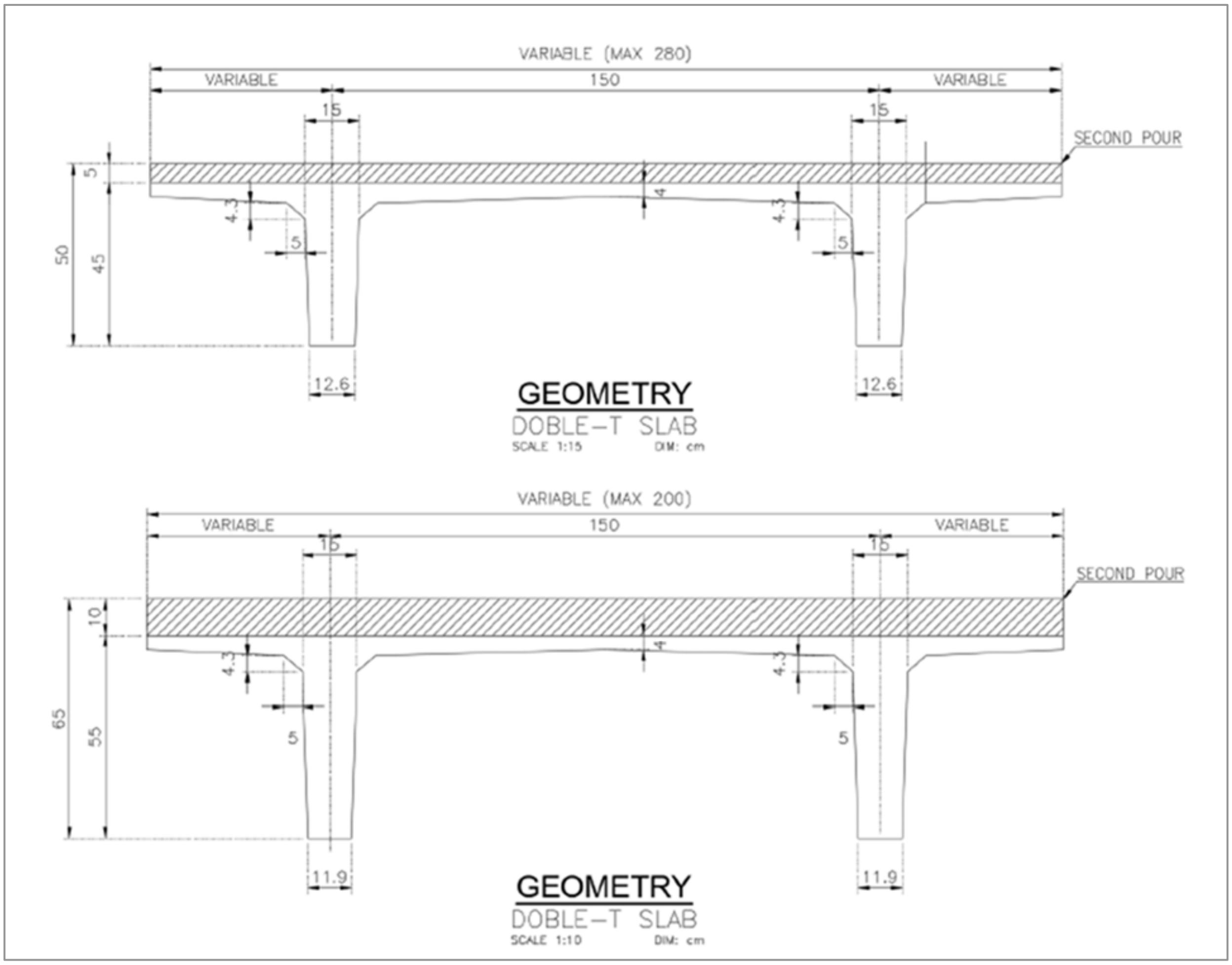


Figure 4-31 Double tee system

Other Buildings

Other buildings such as villas, beach club and pool services buildings in which precast is not possible, will be constructed with load-bearing walls using hollow blocks measuring 15x20x40 cm, reinforced with ladder reinforcements every third row. Additionally, reinforced concrete offset chains and columns of varying dimensions will be incorporated, with columns "tied" to the block wall every 3 m. Concrete enclosures and drag beams will reinforce the structure. Slabs for the mezzanine and roof will consist of reinforced concrete and beams, with light concrete added as an extra layer for the roof slab to achieve the necessary slopes.

4.4.2.5 Masonry

Walls will be constructed using concrete blocks. Precast concrete blocks are set in place using mortar or a specialized adhesive. These blocks are designed with interlocking features or grooves to ensure stability and alignment. Reinforcement elements such as steel rods or rebar may be inserted into the hollow cores of the blocks and secured with concrete.

Every wall and ceiling will be rough casted and rendered then masked with shifted cement-sand to level them with a cement- sand mortar mixture with 15 mm average thickness. In walls where marble or other natural stones will be placed only rough casting and rendering will be done and after a base coating will be applied to install the final stone. The floor will be levelled using cement and sand mortars where necessary.

4.4.2.6 Covering and Finishes

Flooring

In indoor areas, the floors will be natural stones like marble, combined with carpet in hallways to prevent noise from disturbing people resting in the rooms. Marble will also be used for the terraces of the rooms. In outdoor areas, the floors will also be made of stone, such as limestone, granite, or sandstone, with a non-slip finish for exteriors. Some sunbathing areas will be treated with coextruded deck.

Wall finishes

The walls will be covered with different materials such as paint and vinyl wallpaper in bedrooms and natural stones like marble in bathrooms. In common areas, some pillars and walls will be decorated with wood panelling. Ceramic materials will be used for service areas.

4.4.2.7 Carpentry

The entrance doors to the rooms, bathrooms, and closets will be constructed from wood. Doors will be sturdy and well-designed to provide security and privacy to the guests. Wooden cabinets and furniture will be designed to offer storage and comfort.

Given the region's typical conditions, it's crucial to carefully choose the appropriate wood types for the climate and apply suitable treatments to avoid moisture and pests.

4.4.2.8 Windows and Glass

All windows will be crafted from aluminium hurricane-resistant profiles. The glass used will undergo tempering, lamination, annealing, and screen printing for decorative purposes. The glass will have a minimum thickness of 5mm, although the final thickness will vary depending on its intended function or the exposure to heavy winds.

4.4.2.9 Drywall and Paint

In indoor areas, all false ceilings in both guest rooms and customer areas will be made of drywall and subsequently painted. The drywall will be caulked with joint reinforcement tape and joint compound and then sanded and primed before being painted.

Drywall will also be used on the walls of the guest rooms to avoid making channels in the block walls for the passage of installations. Moisture-resistant drywall and/or Durock will be used in outdoor and moisture-prone areas. In kitchens and other back of house areas needed, a fire-resistant, moisture-resistant, and removable false ceiling will be installed.

4.4.2.10 Exterior Works

Pedestrian and vehicular pathways will be constructed using reinforced and/or stamped concrete, supported by a double-layer base measuring 30 cm in thickness, compacted at 90% PROCTOR.

Small buildings, such as towel hubs, bars or restrooms in pools, will feature load-bearing walls made of 15-cm blocks, situated on concrete strip footings and reinforced concrete slabs (unless specified otherwise).

4.4.2.11 Equipment

The following equipment will be used during hotel construction:

- CME 55 drilling rigs
- Platforms for transporting prefabricated elements
- Hydraulic cranes
- Four (4) 110-tonne tucks
- Four (4) 60-tonne trucks
- Pile driver
- Benders
- Rod cutters
- Welding Plants

4.4.2.12 Raw Material and Solid Waste

The plan is to acquire the aggregate and concrete blocks for the project from sourced suppliers.

Excavated material will be stored on-site, covered with tarpaulin to minimize dust pollution, and bermed to prevent runoff. The maximum amount of soil will be used for landscape purposes.

Construction waste will be managed by an on-site waste disposal company, which will transport it to the authorized Retirement Disposal Site.

4.4.3 Beach Works and Overwater Rooms

The construction methodology has been developed to minimize and mitigate the environmental impact on the natural habitat, businesses, residences, and recreational areas in around the project sites.

4.4.3.1 Beach Works

Revetment and Groyne

Land-based equipment, including excavators and front-end loaders, will be employed to construct both the groyne and revetment. These structures will utilize the footprint as access for the equipment during construction. The groyne construction will commence at the landward end, progressing towards the seaward most point, with the foundation being established first. Subsequently, the placement and shaping of the groyne will proceed from the seaward end to the landward end. A similar methodology will be applied to the revetment, where land-based equipment will travel along the shoreline to position the foundation and shape it to the specified elevations.

Breakwaters

The breakwaters will be constructed from temporary access roads. This will require an excavator and front-end loader to construct the road to the breakwater footprint and remove it afterwards. Access roads will facilitate the delivery of resources and serve as a work platform for mechanical placement of the armour stones.

Spotters in the water will assist the heavy equipment in accurate placement of the armour units. The slopes and elevations of the armour layer will be demarcated with visual aids to guide the placement of boulders and to ensure they are properly interlocked.

Equipment and Materials

To complete the proposed beach and shoreline works, the following equipment and materials will be needed:

- Medium-sized excavators – For removing, loading, placing and handling boulders, fill, sand and other materials
- Front end loaders – For loading, removing, placing and transporting material onsite
- Hydraulic Suction Dredge Pump Assembles - for clearing of silty areas and hydraulic removal and transport of sandy/silty material
- Cement Mixer – to mix concrete
- Small Boat – turbidity barrier management
- Trucks – for material transport
- Boulders
- Sand sourced from either manufactured, dredged or imported sand source.
- Fill material
- Filter fabric/Geotextile

4.4.3.2 Overwater Rooms

Overwater Suites

Selecting an appropriate location for overwater suites requires meticulous consideration of several essential factors to ensure optimal functionality and environmental compatibility. Primarily, the bathymetry and water depth of the site are crucial, as overwater structures must be positioned in areas where the depth supports their design and construction.

At Phase 2 Grand Palladium, the water depth remains less than 1.5 meters, even at a considerable distance from the shoreline. The reef platform permits an individual of average height to walk approximately 140 meters from the shoreline before reaching a depth of 0.9 meters.

Evaluating shoreline orientation and prevailing wave patterns is essential to enhance the guest experience by providing serene and sheltered conditions. The reef platform offers protection for the suites, with a wave transmission of less than 40%. Furthermore, alignment with coastal engineering objectives, such as sediment transport dynamics and overall coastal stability, contributes to the long-term sustainability of the overwater suites.

The construction of the 16 overwater suites requires the installation of offshore drilling piles. These piles will be positioned near the area where a breakwater must be installed for the north beach, allowing the project to overlap the piles within the same area of the groyne to minimize the impact on the marine environment. The piles will be installed by drilling with an auger.

Temporary access roads will be necessary for this operation (Figure 4-32). These access roads will follow the same route as the boardwalk and will be constructed using granular material below sea level to minimize sediment introduction into the area. This access pad is expected to remain in place for approximately six months and will then be removed, starting from the seaward-most end.

The construction of the superstructure for the overwater suites will primarily involve masonry and carpentry work above sea level. Platforms and scaffolding will be installed to facilitate this construction.

Boardwalk

The boardwalk will be built using heartwood timber supported as the overwater bungalows. Construction will rely only on manual labour, without the use of heavy machinery. Only solid hardwood piles, devoid of decay and insect damage, will be used. Additionally, lumber will undergo dressing on all sides, ensuring it's free from splits, cracks, and defects. Decking planks and rail posts will be meticulously dressed and finished on all sides and edges.

Equipment and Materials

To construct overwater suites, the following equipment and materials will be required:

- Hammer attached to a crane/excavator or one Auger cast pile rig – for piling installation.
- Medium-sized excavators – for removing, loading, placing, and handling boulders.
- Front-end loaders – for loading, removing, placing, and transporting material onsite.
- Small boat – for turbidity barrier management.
- Boulders.
- Auger cast piles.
- Timber pilings and structures

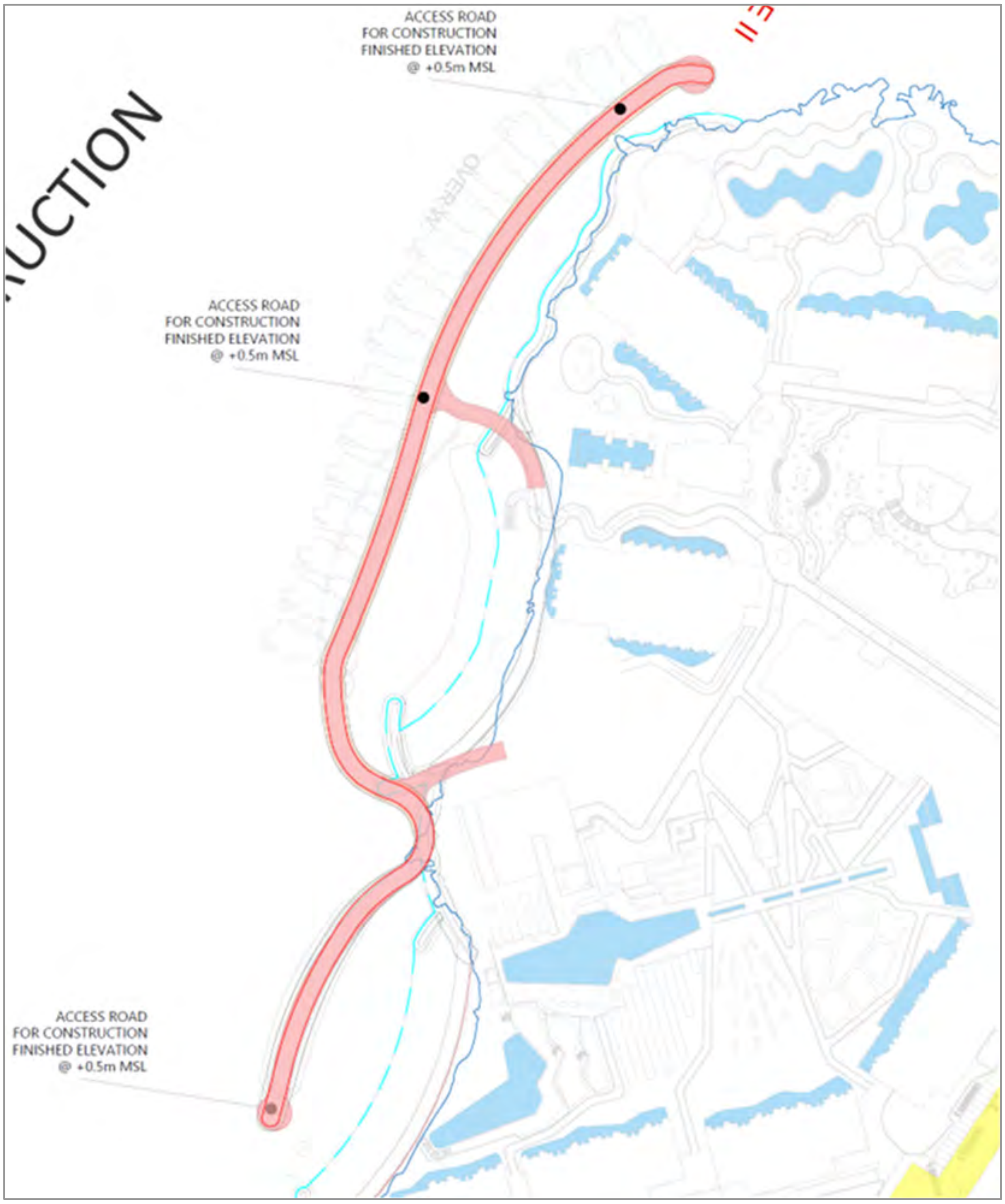


Figure 4-32 Temporary access road

4.4.4 Employment

At its peak, the workforce at the site is expected to reach around 1,500 skilled labourers, with numbers fluctuating between 700 and 1,500 throughout the construction phase. This is anticipated to generate approximately 2,660 to 5,700 indirect and induced job opportunities. Fiesta Jamaica's aim is to prioritize the utilization of local talents and labour for both the construction and operation of the hotel, wherever feasible.

4.5 OPERATIONS

4.5.1 Energy Conservation Strategies

The hotel will be focused on energy conservation and for this purpose, it will rely on the following strategies and technologies:

- Thermal energy demand reduction
  - Architectural design avoiding direct sunlight and heat exposure.
  - Thermal isolation and moisture condensation control.
  - Shading strategies.
  - Cross ventilation.
- Control systems BMS
  - Hour schedule for lighting, according to sun light and night periods.
  - Presence detection to deactivate air conditioning and no essential electrical circuits when no needed.
  - Temperature range limited.
  - Presence and light detection to activate lighting.
- High efficiency equipment
  - Light Emitting Diodes (LED) use for lighting appliances and bulbs.
  - Heat pumps and combined heat and electricity generation.
- Renewable energy
  - Roof will provide free photovoltaic (PV) electricity.
  - Combined Heat and Cold Power plant (CHCP). The solution consists in a Hybrid Trigeneration Plant and Desalination Plant. Trigeneration plant has been designed to generate electricity in island mode (off grid), taking advantage of all heat sources of the engines to produce useful thermal energy and achieving a highly efficient solution.
  - Chilled water production for HVAC systems by an absorption chiller, with the actual highest efficient technology for cold production
  - Hot water demand covered by the recoverable heat from the cooling circuits of the engines, and therefore using free energy.

4.5.2 Water Conservation Strategies

The project has integrated water conservation measures due to the water shortages Jamaica suffers lately. These measures include:

- Reduction on demand
  - Low flow faucets and aerators, which reduce water flow.
  - Toilets with 2 ways discharge systems.
  - Pressure control in pipe distribution system to avoid pressure leaks at joints.
- BMS. Scan and control

- Intelligent meters to scan water consumption and automatic leakage detection.
- Water production. Water to be consumed in the hotel complex will be produced by a Reverse Osmosis (RO) seawater desalination plant. Seawater will be obtained through abstraction wells and pumped to raw water tanks in the RO plant.
- Valve and sector control.

- Irrigation strategy
    - Use of local plants in landscaping to reduce the need for irrigation, as local plants are climate adapted.
    - Waste water treatment to be used for irrigations purposes, means expansion of the actual Wastewater Treatment Plant (WWTP).

4.5.3 Employment

Once the hotel is fully operational, it anticipates employing around 3,500 individuals (1,600 personnel in Phase I and 1,900 personnel in Phase II). The projected workforce of approximately 3,500 individuals during the operational phase is expected to generate approximately 5,800 indirect and 2,200 induced jobs.

4.5.4 Decommissioning

Decommissioning of the construction site involves a series of steps to ensure the site is safely and effectively cleared and the area is restored to a suitable condition. This process includes addressing all aspects of the construction site, such as the batching plant, prefab areas, and any other temporary structures or facilities. The decommissioning steps include:

- Site Assessment and Planning
    - Conduct a thorough site assessment to identify all areas and structures to be decommissioned.
    - Develop a detailed decommissioning plan, including timelines, resource allocation, and safety protocols.
- Dismantling of Structures
    - Safely dismantle the batching plant, ensuring all equipment is properly decommissioned and removed.
    - Remove prefab areas and any temporary structures, including offices, storage units, and worker accommodations.
- Waste Management
    - Segregate and manage waste materials, ensuring proper disposal or recycling of construction debris.
    - Handle hazardous materials, such as chemicals from the batching plant, according to environmental regulations.
- Site Clean-Up
    - Remove any remaining construction materials, tools, and equipment from the site.

    - Clean up spillages, particularly in the batching plant area, to prevent soil and water contamination.
- Stakeholder Communication and Notifications
    - Inform relevant stakeholders, including local communities and regulatory bodies, about the decommissioning process and progress.
    - Address any concerns or feedback from stakeholders regarding the decommissioning activities.
    - Advanced notification (2 weeks) to relevant local authorities (NEPA, Hanover Municipal Corporation) of near completion of construction and potential change in status of the site.
    - Final notification to relevant local authorities (NEPA, Hanover Municipal Corporation) of completion of construction and change in status of the site to that of an operational hotel resort.

4.6 PROJECT PHASING AND SCHEDULING

Grand Palladium comprises two phases, Phase 1 of the hotel is already constructed and operating:

- Phase 1 (already constructed)
    - Hotel GP (family resort) – 1,054 rooms
    - **Total Rooms - 1,054 rooms**
- Phase 2
    - Hotel GP (family resort) – 475 rooms
    - Hotel TRS (adults only) – 474 rooms
    - **Total Rooms – 949 rooms**

The construction of the Phase 2 hotel is expected to last 18 to 24 months.

5.0 DESCRIPTION OF ENVIRONMENT

This section, which describes the existing environment, details the conditions observed before the passage of Hurricane Beryl (July 3 and 4, 2024).

5.1 PHYSICAL

5.1.1 Topography and Bathymetry

Elevations peak at 47 m on the eastern side of the highway within the site, where heights typically surpass those on the western expansion site (Figure 5-1). Elevations on the western side of the main site generally remain below 33 meters. The highest elevations are found in the northeastern corner of the site, sloping with an average gradient of 50% towards the coastline along the western property boundary, where steep cliffs define the coastal terrain (Figure 5-2). On the northwestern section of the site, the existing Phase 1 beach exists, with the terrain gradually sloping towards the coastline. The predominant aspect of the land exhibits a west to northwest orientation (Figure 5-3).

Along the site's western boundary, the foreshore area exhibits shallow depths, typically measuring less than 1 meter and extending approximately 150 meters from the coastline (Figure 5-1, Figure 5-4). Beyond this zone, the seabed gradually descends as the morphology transitions into spur and groove reef formations. Past the spur and groove formation, the underwater slopes become steeper, signifying notable alterations in the underwater topography (Figure 5-4).

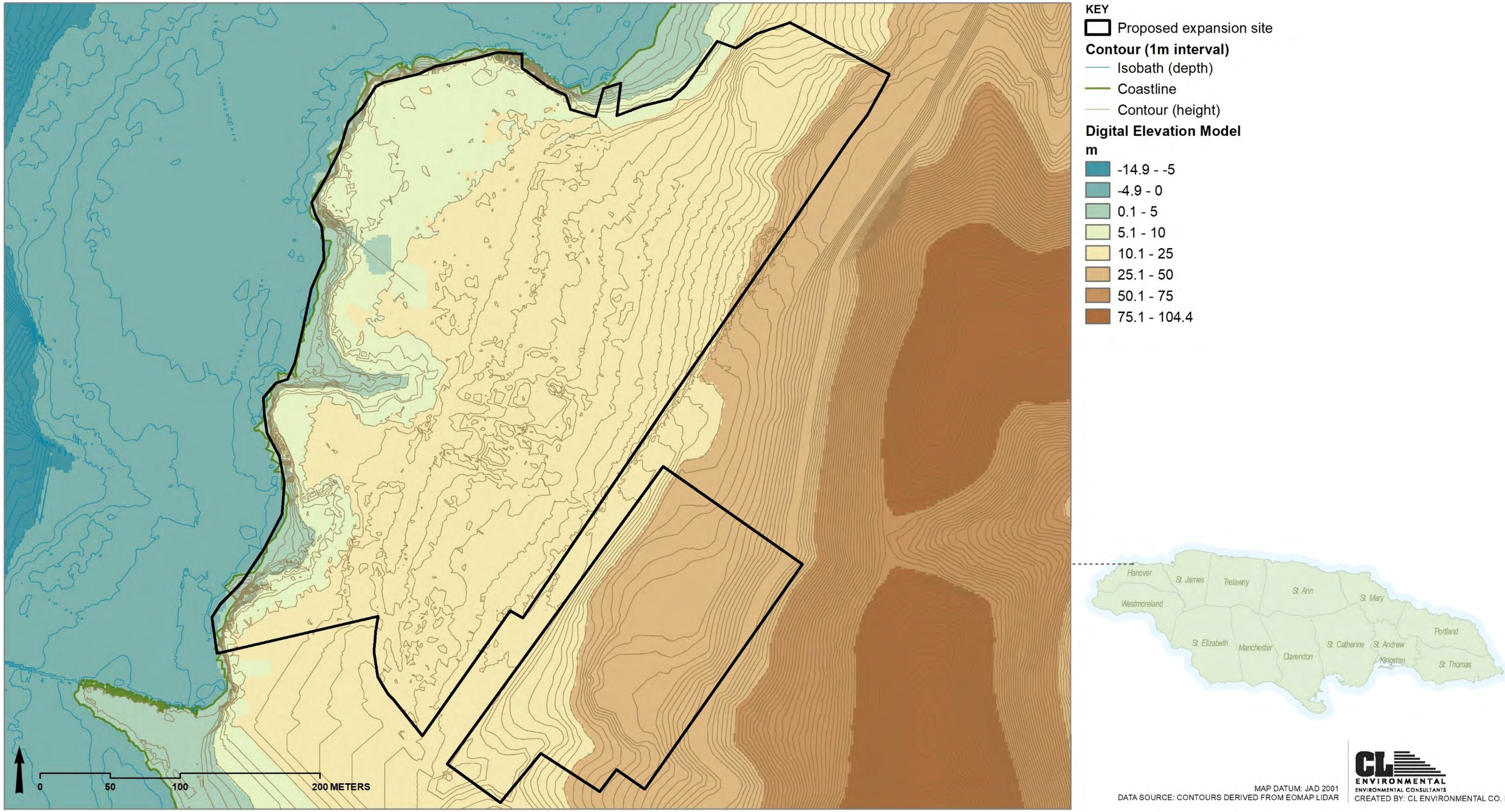


Figure 5-1 Digital elevation model at the proposed Phase 2 expansion site

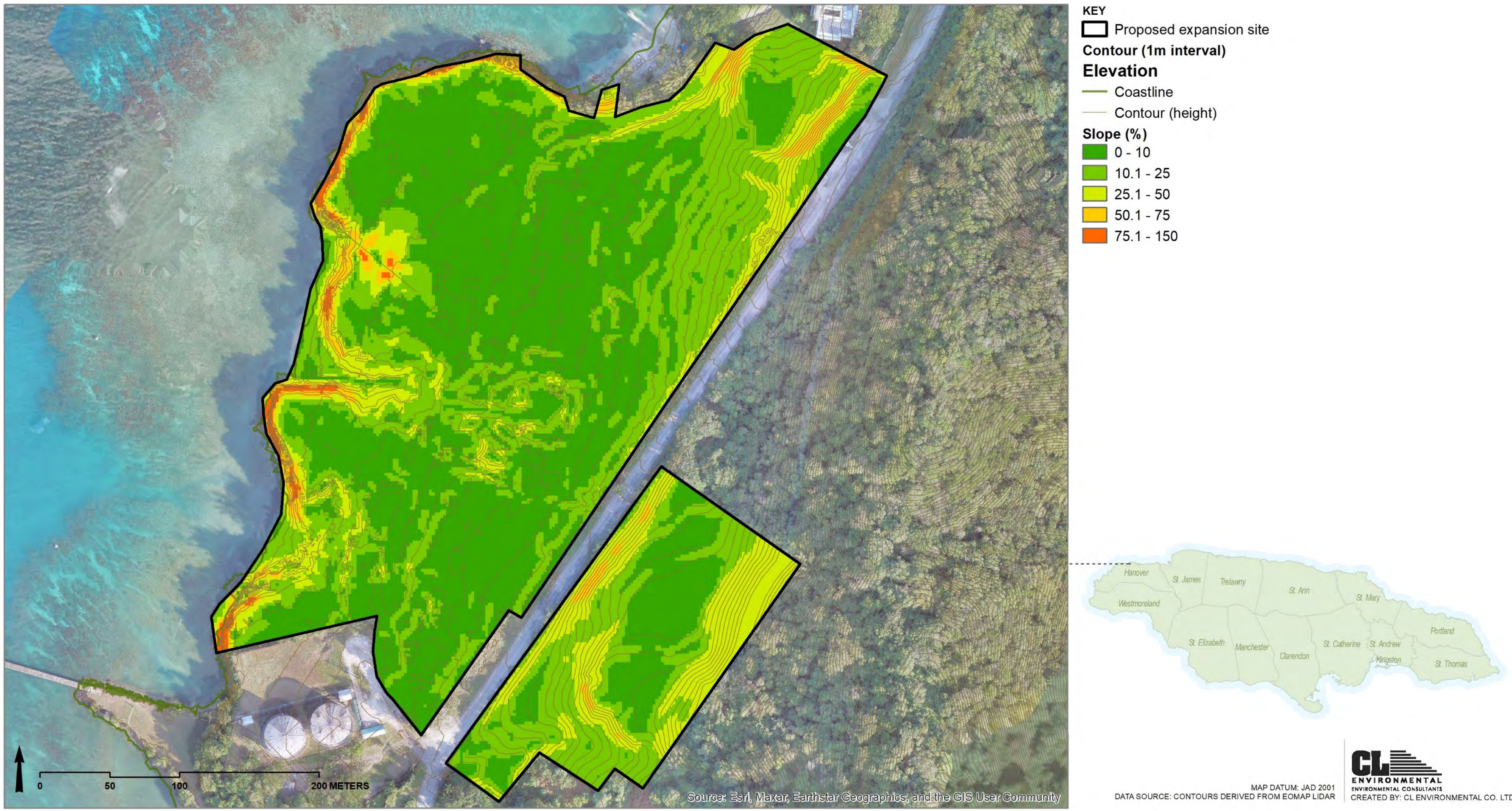


Figure 5-2 Slope at the proposed Phase 2 expansion site

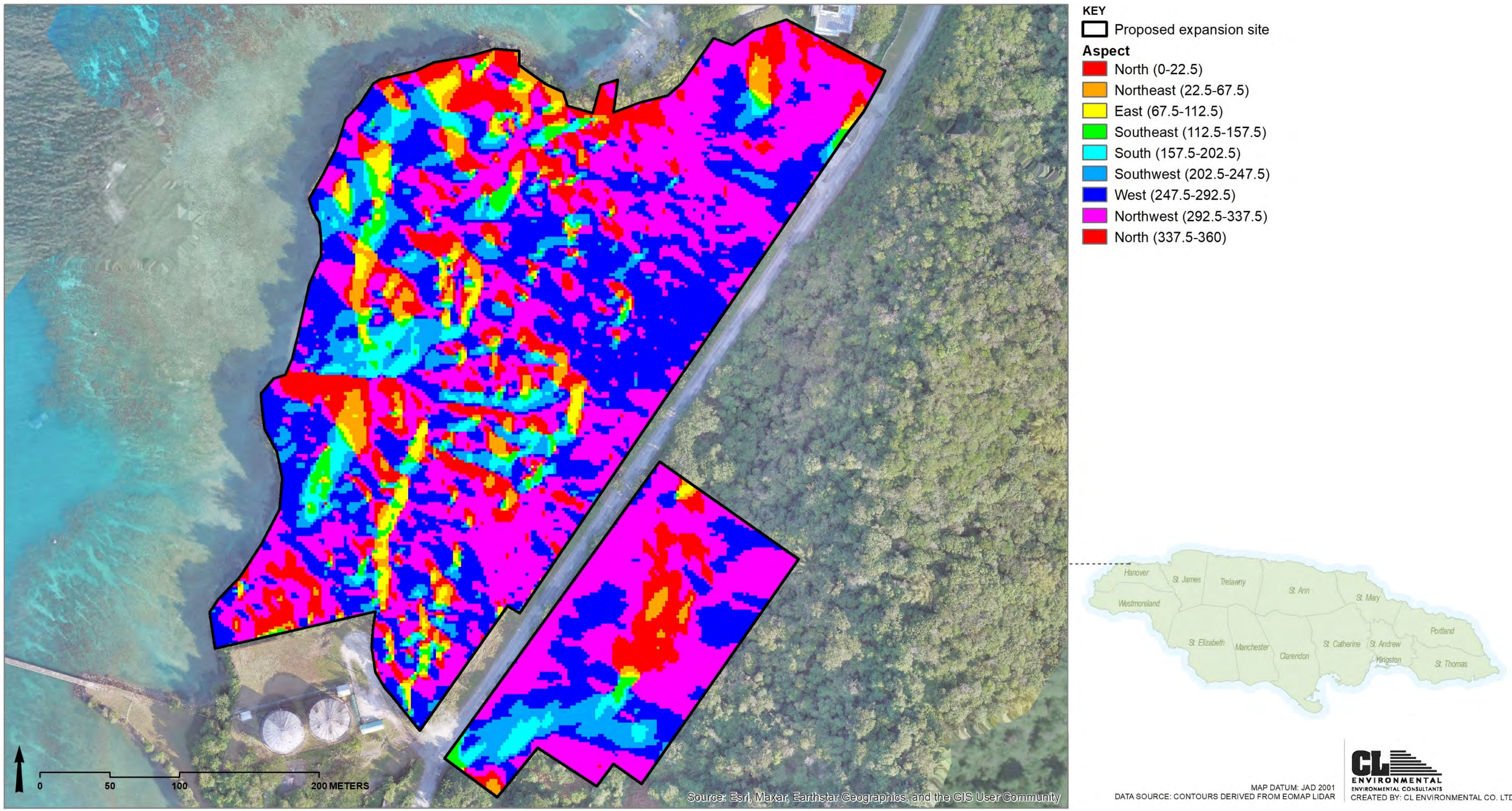


Figure 5-3 Aspect at the proposed Phase 2 expansion site

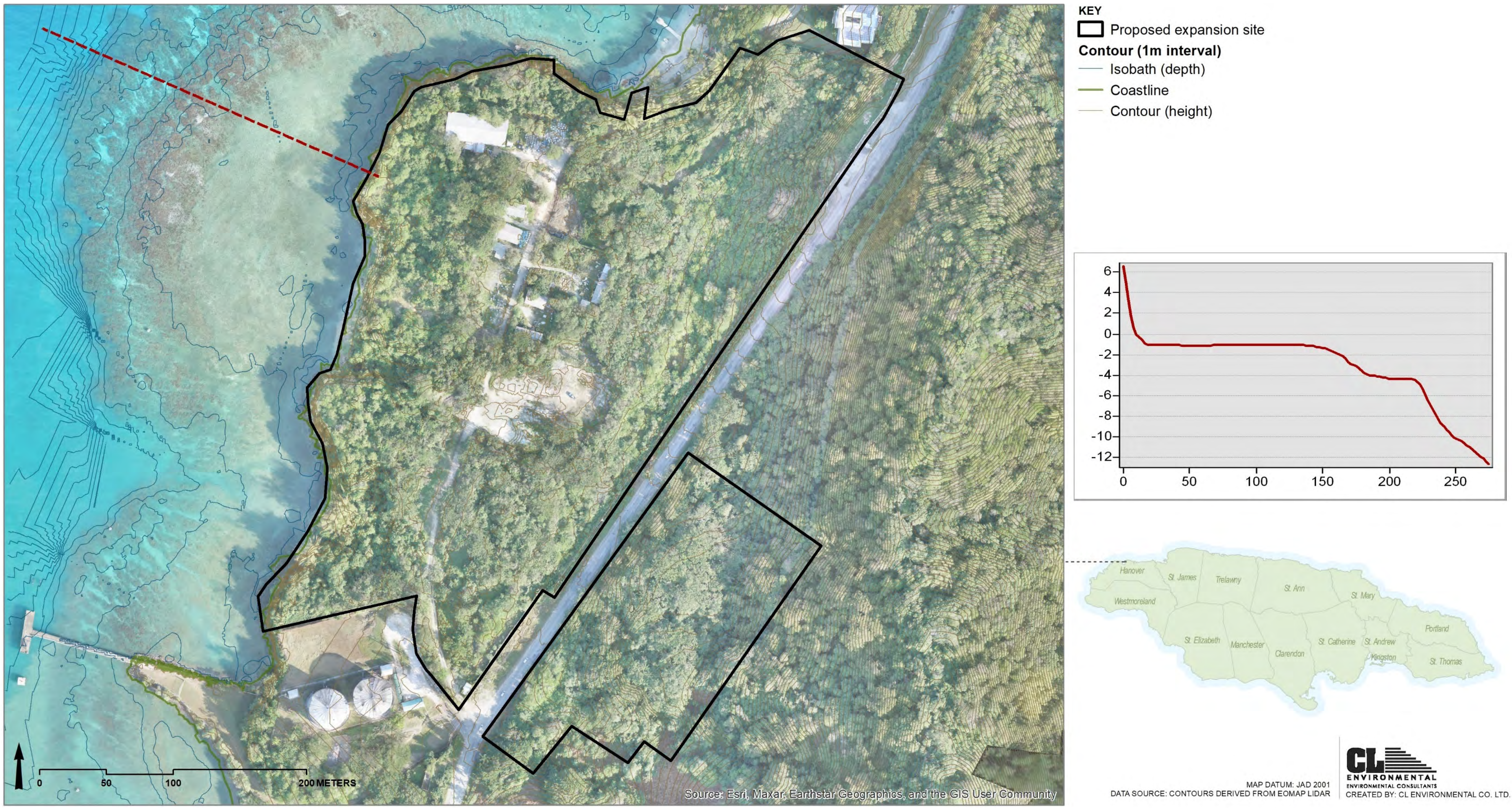


Figure 5-4 Bathymetric profile at the proposed Phase 2 expansion site

5.1.2 Sedimentology

5.1.2.1 Coastal Sedimentology

The coastal area of the Phase site may be categorised into two distinct areas: sandy shoreline and vegetated coastal cliff (Smith Warner International Limited, 2023). A narrow sandy shoreline exists, measuring 7-12m wide, formed by sand accumulation in the shelter of a functional shallow reef platform (Plate 5-1). The presence of sand on the narrow beach is likely a result of the adjacent reef's erosion, facilitated by the calm conditions created by this natural barrier. Acting as a protective feature, the reef diminishes wave energy, allowing sediments to settle and form the sandy shoreline (Smith Warner International Limited, 2023).

A vegetated coastal cliff, adorned with trees, thickets, and bushes, was also noted (Plate 5-2) (Smith Warner International Limited, 2023). The formation of rocky cliff shorelines in limestone is a geological process involving the dissolution of limestone by acidic water. As the limestone dissolves, small cracks and fissures widen, creating gaps and cavities. The erosive action of waves further shapes the rocky shoreline, resulting in rugged and distinctive features. This is the primary shoreline characteristic observed on the site (Smith Warner International Limited, 2023).

Source: (Smith Warner International Limited, 2023)

Plate 5-1 Coraline sand at the shoreline

Source: (Smith Warner International Limited, 2023)

Plate 5-2 Rocky cliff shoreline

5.1.2.2 Benthic Sediment Chemistry

Introduction

Benthic sediment chemistry involves studying the chemical composition and characteristics of sediments at the bottom of aquatic environments, like seas and rivers. This field is crucial for understanding ecological and environmental processes, including nutrient cycling, pollution, and habitat quality for benthic organisms. High concentrations of heavy metals such as lead and mercury are key indicators of pollution, helping to identify sources and levels of contamination.

Total Petroleum Hydrocarbons (TPH) is used to describe the number of petroleum-based hydrocarbons present in a sample. The range C8 to C40 indicates the number of carbon atoms in the hydrocarbon molecules that are being measured, from smaller, lighter hydrocarbons (C8) to larger, heavier hydrocarbons (C40).

Methodology

Four (4) sediment samples (Table 5-1, Figure 5-5) were taken from within the project area using a sediment grab sampler on September 9th, 2023, and analysed for heavy metals (Pb - lead, As - Arsenic, Cd - Cadmium, Hg - Mercury) and Total Petroleum Hydrocarbons (C8-C40). The samples were stored on ice in a cooler and transported to Test America Pensacola Laboratory in Florida for analyses.

Table 5-1 Benthic sediment sampling locations (JAD2001)

Station	Eastings	Northings
SP1	627847.4651	700516.3019
SP2	627837.5178	700455.7139
SP3	627823.0491	700368.9014
SP4	627837.5178	700324.5908

Results

Table 5-2 displays the sediment sampling results for the parameters at the various sampling locations and the laboratory sheets can be viewed in Appendix 9.

Arsenic and lead were detected at all four stations. Mercury was detected at station 1 and 2 and TPH C8-C40 was detected at station 2. No cadmium or hydrocarbons were detected at all other stations.

All current values detected were below the reported average for each metal when compared to the average levels found in Jamaican soil (ND- None Detected

Table 5-3).

Table 5-2 Marine benthic sediment values

STATION	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	TPH (C8 – C40) (mg/kg)	TPH (C8-10) (mg/kg)	TPH (C10-C28) (mg/kg)	TPH (C28-C40) (mg/kg)
1	5.0	ND	2.9	0.023	ND	ND	ND	ND
2	6.8	ND	3.2	ND	29	ND	ND	ND
3	7.6	ND	4.9	0.031	ND	ND	ND	ND
4	7.1	ND	3.7	ND	ND	ND	ND	ND

ND- None Detected

Table 5-3 Metal Concentrations in Jamaican Soil

Metal	Avg. Concentration (mg/KG)	Range (mg/Kg)	95^{th} Percentile (mg/KG)
Arsenic	25	1.4-203	<64.9
Cadmium	20	0.2-409	<77.6
Lead	46.5	6-897	<90
Mercury	0.2	0.04-0.83	<0.46

Source: A geochemical atlas of Jamaica, Centre for Nuclear Sciences, UWI, 1995, Canoe Press

Various factors may influence heavy metal sources within benthic sediments;

- Point source of pollution, such as runoff and waste disposal, which can lead to higher concentrations of contaminants in specific areas.
- Variations in sediment composition can influence the accumulation of heavy metals. Fine-grained sediments like clays and silts tend to bind and retain heavy metals more effectively than coarser sediments like sands.
- Differences in water flow, currents, and wave action can cause uneven distribution of contaminants. Areas with slower water movement might have more sedimentation and thus higher concentrations of heavy metals compared to areas with faster currents that disperse contaminants more widely.
- One site might have a history of contamination from past activities that no longer affect the surrounding areas, leading to higher residual concentrations of heavy metals.
- Biological activity, such as the presence of benthic organisms, can influence the distribution of heavy metals. Some organisms can bioaccumulate metals, affecting their concentration in the sediments.
- The chemical environment, such as pH and redox conditions, can affect the mobility and availability of heavy metals in sediments. Differences in these conditions between sites can lead to varying concentrations of heavy metals.

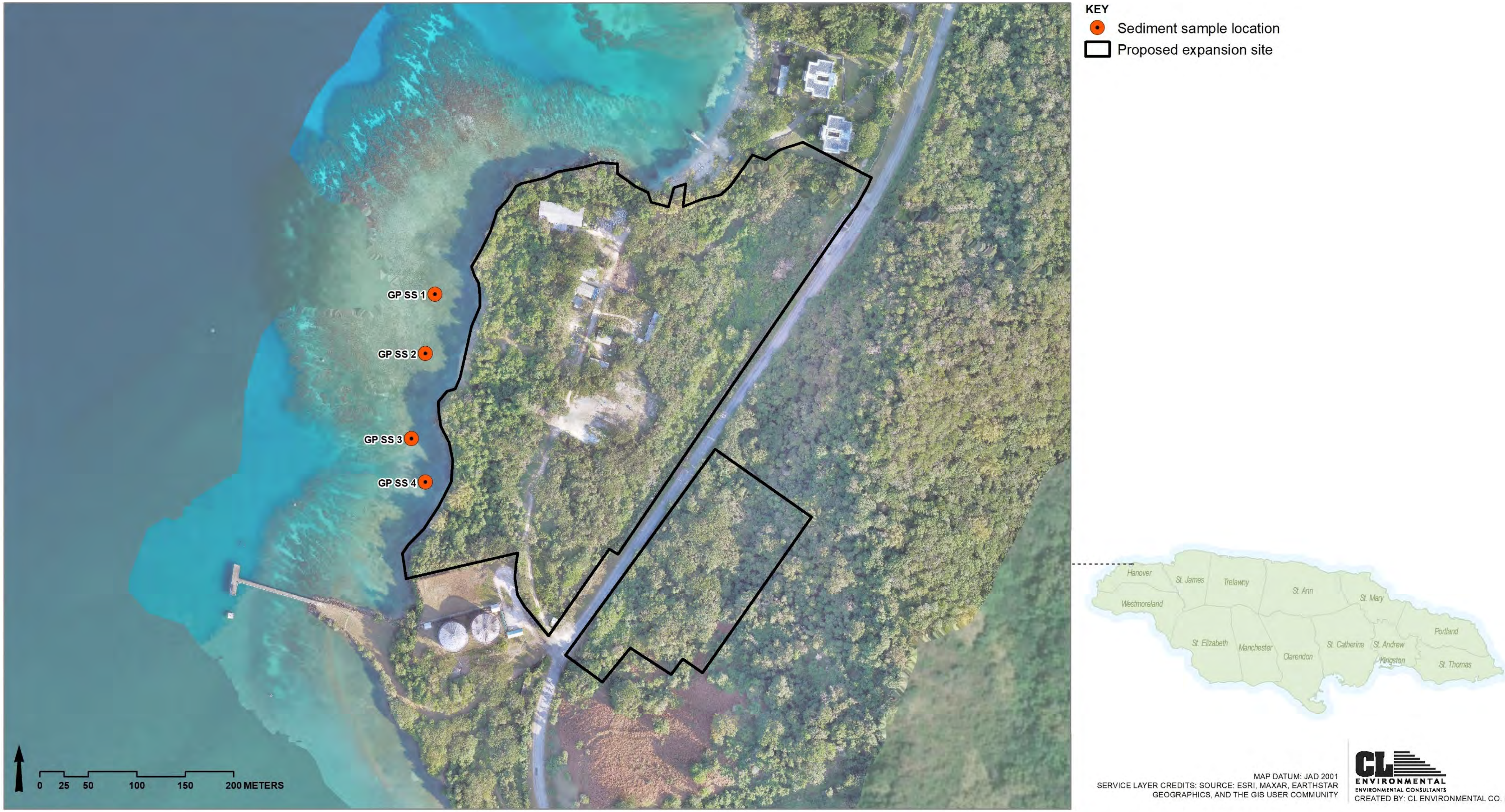


Figure 5-5 Marine benthic sediment sampling locations

5.1.2.3 Sediment Loading

Introduction

Sediment loading in benthic environments involves the deposition and accumulation of sediments on the floors of aquatic ecosystems, such as seas and rivers. This process is shaped by both natural and human activities and can significantly impact ecological and environmental conditions. Key factors in natural sediment loading include discharge from rivers, coastal erosion and weather events, while anthropogenic factors involve pollution, construction and land use, such as urbanisation or agriculture.

Increased sediment load can cause various issues, such as reducing water quality by decreasing clarity and light penetration, which affects photosynthesis in aquatic plants. It can alter benthic habitats by smothering organisms and carrying nutrients like nitrogen and phosphorus, contributing to eutrophication. Additionally, it can transport contaminants such as heavy metals and pesticides, posing risks to both aquatic and human health.

Methodology

Baseline sedimentation data was collected using sediment traps, approximately 21.4" (54.3 cm) long with an internal diameter of 3" (7.6 cm) (Plate 5-3). A total of four (4) sediment traps were deployed in and around the project area (Table 5-4 and Figure 5-6) on October 11th, 2023 . They were retrieved after 36 days on November 16th, 2023., and their contents analysed to determine the rate of sedimentation ($mg/cm^2/day$) in the area.

Plate 5-3 Example of sediment trap deployed

Table 5-4 Sediment trap location coordinates (JAD2001)

Station	Eastings	Northings
ST1	627939.5684	700730.9418
ST2	627811.7588	700461.0354
ST3	627786.6389	700222.9408
ST4	627658.3158	700549.7019

Sediment traps were taken to the Caribbean Environmental Testing and Monitoring Services Limited for analysis. The contents of the sediment traps were filtered through a filter paper, dried and then weighed. The results are represented in the form of "Mass of Sediment Recovered". Using the results retrieved from the laboratory, the sedimentation rate per day (mg/cm2/day) was calculated by dividing the mass of sediment recovered by the number of days deployed and the area of the sediment trap opening.

$$\textit{Sedimentation Rate per day} = \frac{\textit{Mass of Sediment Recovered}}{(\textit{\# of days deployed}) \times (\textit{area of trap opening})}$$

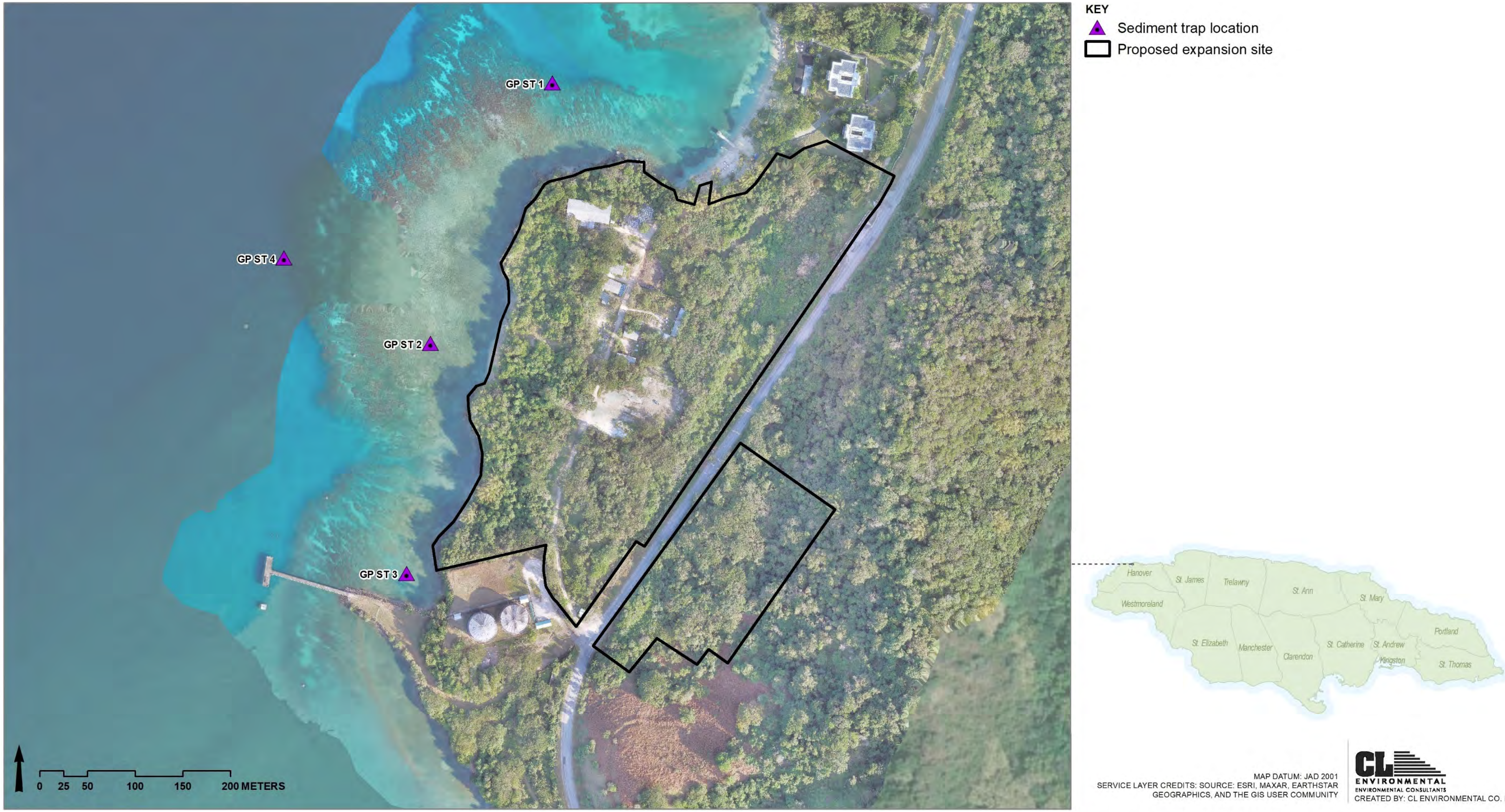


Figure 5-6 Sediment trap locations

Results

Sedimentation rates ranged from a low of 0.02132 mg/cm²/day at Station ST1, to a high of 0.18880 mg/cm²/day at Station ST3 (Table 5-5). The highest sedimentation rate was observed at Stations ST3. Station ST1, 2 and ST3 were located nearshore and in shallow water and thus will tend to have on average, higher sedimentation rates than those in the deeper waters due to the wave climate and subsurface currents having a greater effect on the stirring up of sediments in shallow depths. Station ST1, though nearshore was located far from shoreside drains and sheltered by the nearby reef, these factors may have played a role in the low sedimentation rate within that area. Stations 2 and 3 were located near drainage and runoff points within seagrass beds, and Station 3 was located within an area of muddy and silty substrate, these factors may have increased the sedimentation rates within these areas. Station 4 was located 40m below surface, located in deep water relative to the other stations, however at the time of sampling it was noted that the water was very turbid, this location may be highly influenced by the harbour and load from the surrounding rivers and gullies and may be a sediment catchment area, hence the relatively high sedimentation rates compared to Stations 1 and 2.

Table 5-5 Sedimentation rates at each location

Sediment Trap Locations	Mass of Sediment Recovered (mg)	Sedimentation Rate (mg/cm²/day)
ST1	35	**0.02132**
ST2	100	**0.06090**
ST3	310	**0.18880**
ST4	150	**0.09135**

5.1.3 Geology and Soils

The site is situated in an area classified as the Hanover Formation and Johns Hall Formation (Figure 5-7) and is predominantly characterized by Highgate clay with minimal erosion potential (Figure 5-8).

Western Jamaica, particularly Hanover, comprises a geological sequence characterized by Cretaceous sandstones, shales, and conglomerates, overlain by Tertiary-Pleistocene limestone formations extending from shelf edge to deep water (Jamaica National Heritage Trust, 2023). These formations are further overlaid by Pleistocene to Recent elevated reefs. The weathering of the Hanover Shale Formation results in alluvium consisting of unconsolidated clayey sand and clay, covering areas such as the "Point" and the hotel site. Adjacent to the Cretaceous Hanover Shales lies an outcrop of Coastal Limestone (MP), a raised reef formation. This reef borders the eastern coastline of the harbour and extends eastward from Duhaney's Point to Paradise. The raised reef formation is part of the Recent to Middle Miocene age Coastal Limestone Group (Jamaica National Heritage Trust, 2023).

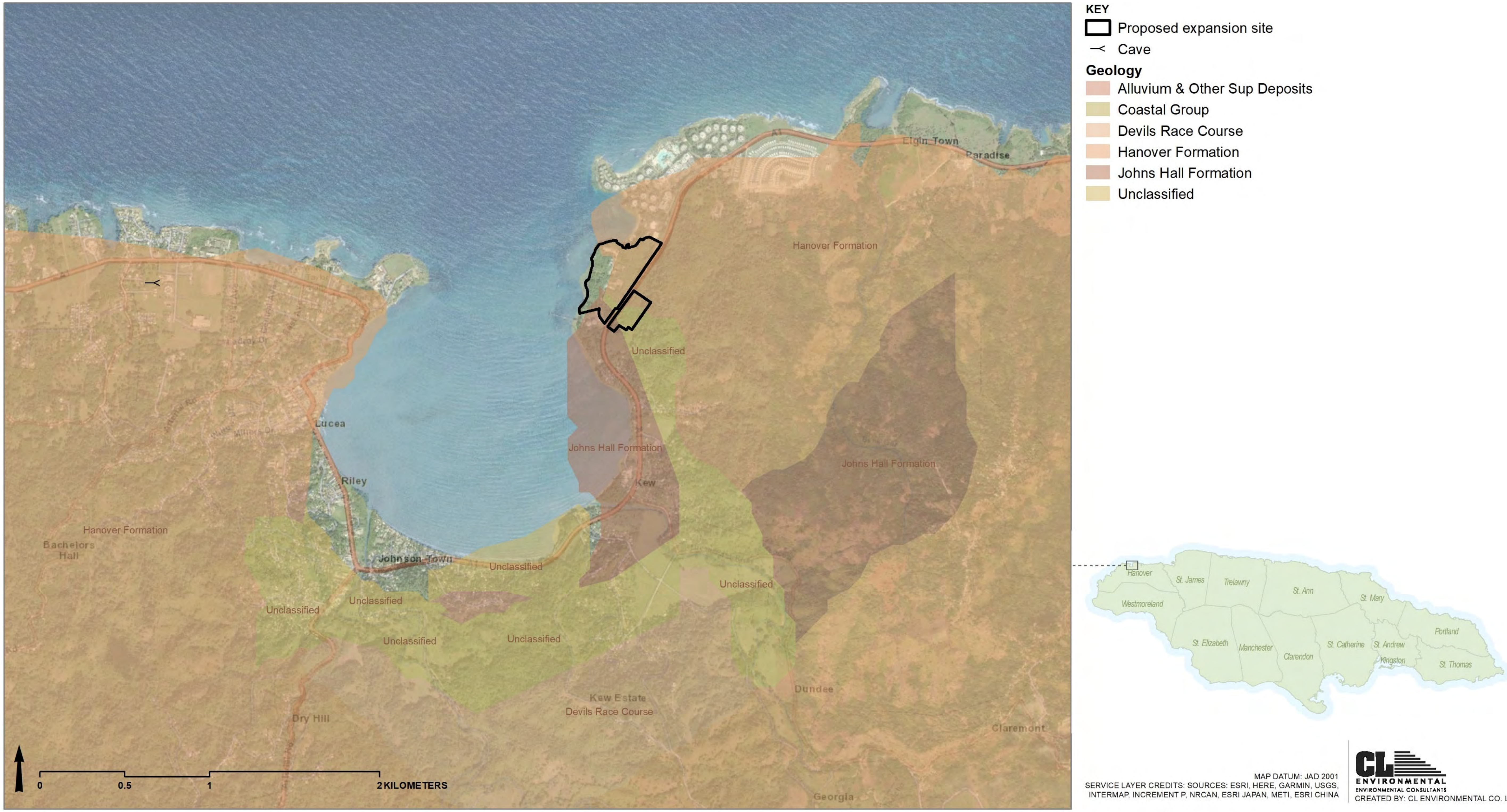


Figure 5-7 Geology in the project area

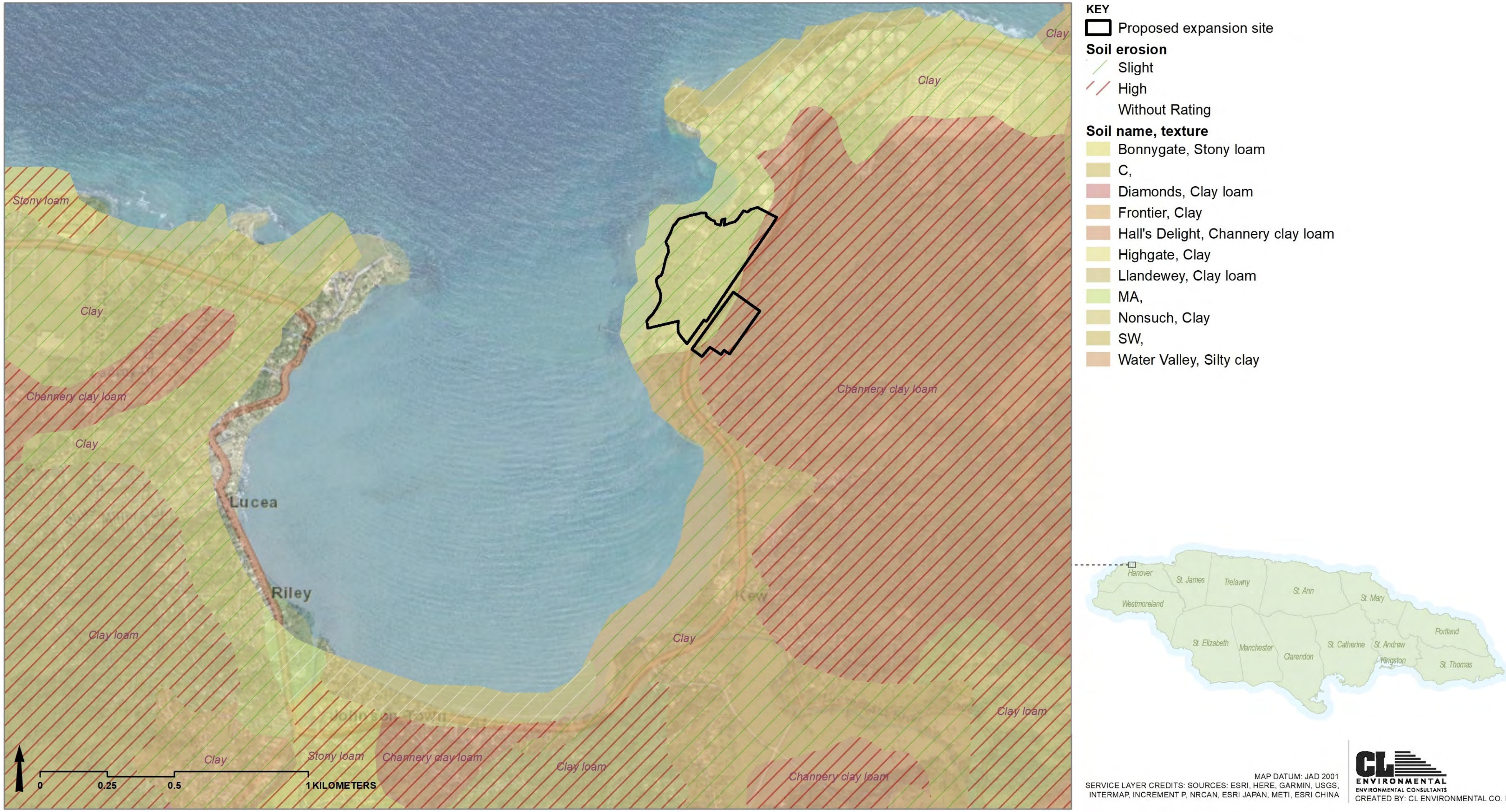


Figure 5-8 Soil type and erosion potential in the project area

5.1.4 Climate

Temperature, relative humidity, rainfall, and wind speed and direction were recorded over 8 months (August 6th, 2023 – March 29th, 2024), on the proposed project site, using a Davis Instruments wireless Vantage Pro2 weather system with a data logger and a complete system shelter erected on a tripod. Data were collected every fifteen minutes and stored on the data logger. This information was downloaded using the WeatherLink 6.0 software.

The following were the summarized results of the assessment over the data collection period:

- Average temperature recorded was 22.8°C and ranged from a low of 14.6°C to a high of 32.9°C.
- Average relative humidity was 84% and ranged from a low of 34% to a high of 99%.
- Average rainfall was 0.01 mm and ranged from a low of 0 mm – 15.24 mm.
- Average wind speed was 0.32 m/s and ranged from a low of 0 m/s to a high of 4.5 m/s.
- Dominant wind direction was from the northwest.

January to March were slightly warmer months, while October and November had slightly higher humidities (Table 5-6). August, December and February had the highest wind speeds while March had the most rainfall (Figure 5-9 to Figure 5-12).

Table 5-6 Monthly weather station data over the assessment period

Month	Avg. Temperature (°C)	Avg. Relative Humidity (%)	Avg. Wind Speed (m/s)	Total Rainfall (mm)
Aug-23	21.2	85.5	0.6	0
Sep-23	21.2	83.7	0.19	0
Oct-23	22.5	86.4	0.2	0
Nov-23	20	85.5	0.28	0
Dec-23	19.1	83	0.56	41.34
Jan-24	25.5	83.5	0.35	16.98
Feb-24	24.9	78.8	0.6	60.89
Mar-24	26.2	84.3	0.34	84.03

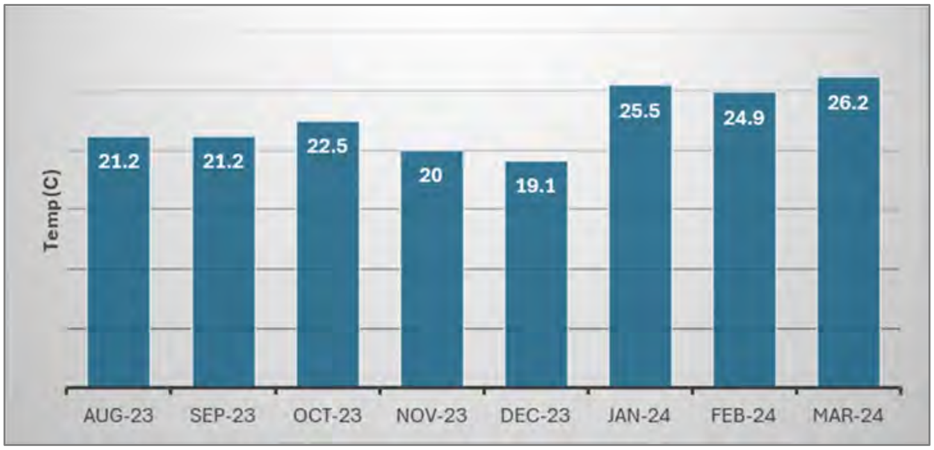


Figure 5-9 **Average monthly temperature over the assessment period**

Figure 5-10 **Average monthly relative humidity over the assessment period**

Figure 5-11 **Average monthly wind speed over the assessment period**

Figure 5-12 **Monthly rainfall over the assessment period**

It is important to note that the year 2023 was the warmest year since global records began in 1850 at 1.18°C above the 20th-century average of 13.9°C. This value is 0.15°C more than the previous record set in 2016. The ten (10) warmest years in the 174-year record have all occurred during the last decade (2014–2023) (Figure 5-13) (NOAA, 2024). Figure 5-13 shows yearly average temperature since 1976 compared to the 20th-century average. It has been forty-seven (47) years since Earth's temperature was colder than average. 2023 set a new warmest-year record by a wide margin (NOAA, 2024).

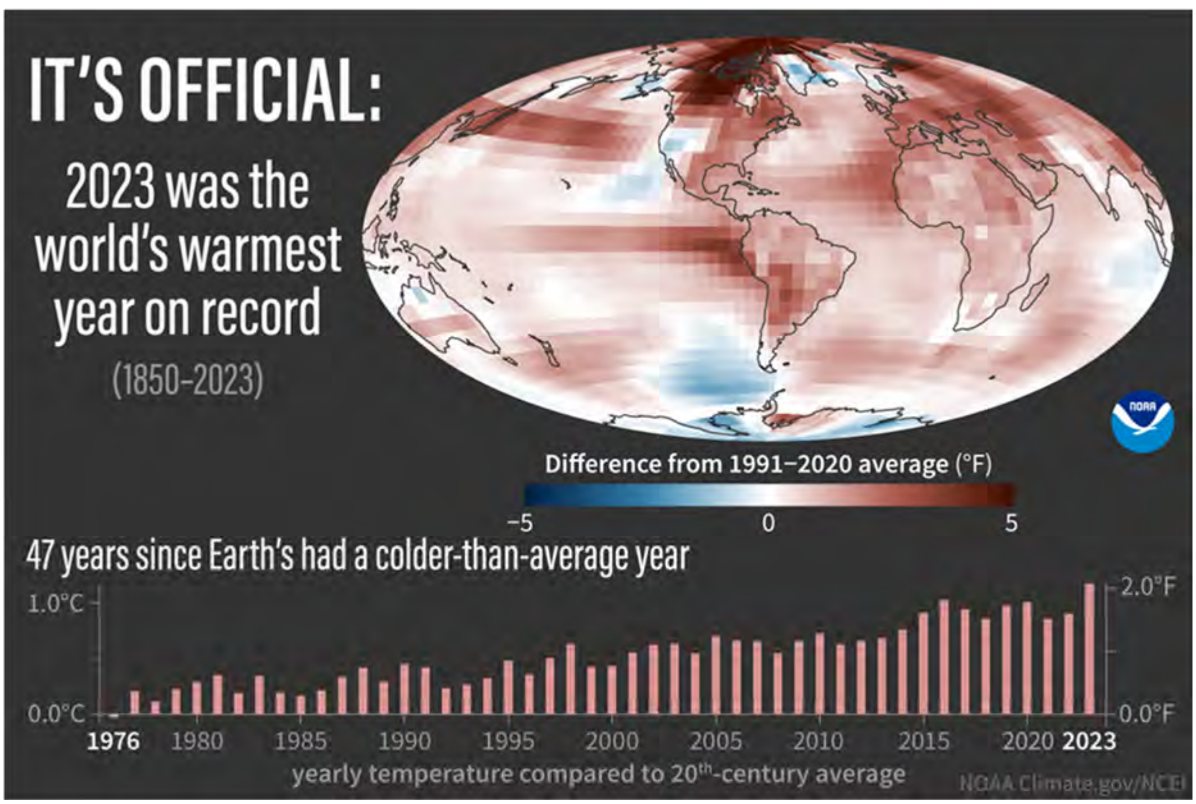


Figure 5-13 **Yearly temperatures compared to 20th century average (NOAA, 2024).**

5.1.5 Drainage and Hydrology

5.1.5.1 Watershed Runoff Process

The site is situated within the Mosquito Cove Sub-Water Management Unit (WMU), which is part of the broader Lucea River watershed (Figure 5-14).

The response of a watershed is influenced by both the precipitation received by the watershed and the evapo-transpiration rates. Precipitation can be determined either by observed rainfall data from historical events or by hypothetical rainfall events based on frequency analysis. For extreme rainfall events, data on 24-hour rainfall for return periods of 1 in 2, 5, 10, 25, 50, and 100 years were obtained from the National Meteorological Service of Jamaica (Smith Warner International Limited, 2023).

Drainage design guidelines are established according to the National Works Agency (NWA) 2015 Guidelines for Preparing Hydrologic and Hydraulic Design. These guidelines recommend using a 1 in 10-year frequency for catchment areas not exceeding 250 hectares, while a 1 in 25-year frequency is suggested for larger catchment areas. However, analyses that incorporate both lower and higher intensity events are conducted to ensure proper inflow management (lower range) and to identify potential flood-prone areas (higher range) (Smith Warner International Limited, 2023).

Regarding rainfall distribution, the 24-hour rainfall distribution curve plays a critical role in hydrographic analysis as it delineates precipitation patterns. Although several options exist for fitting rainfall data, the JaBx distribution specific to Jamaica was chosen for this analysis (Smith Warner International Limited, 2023).

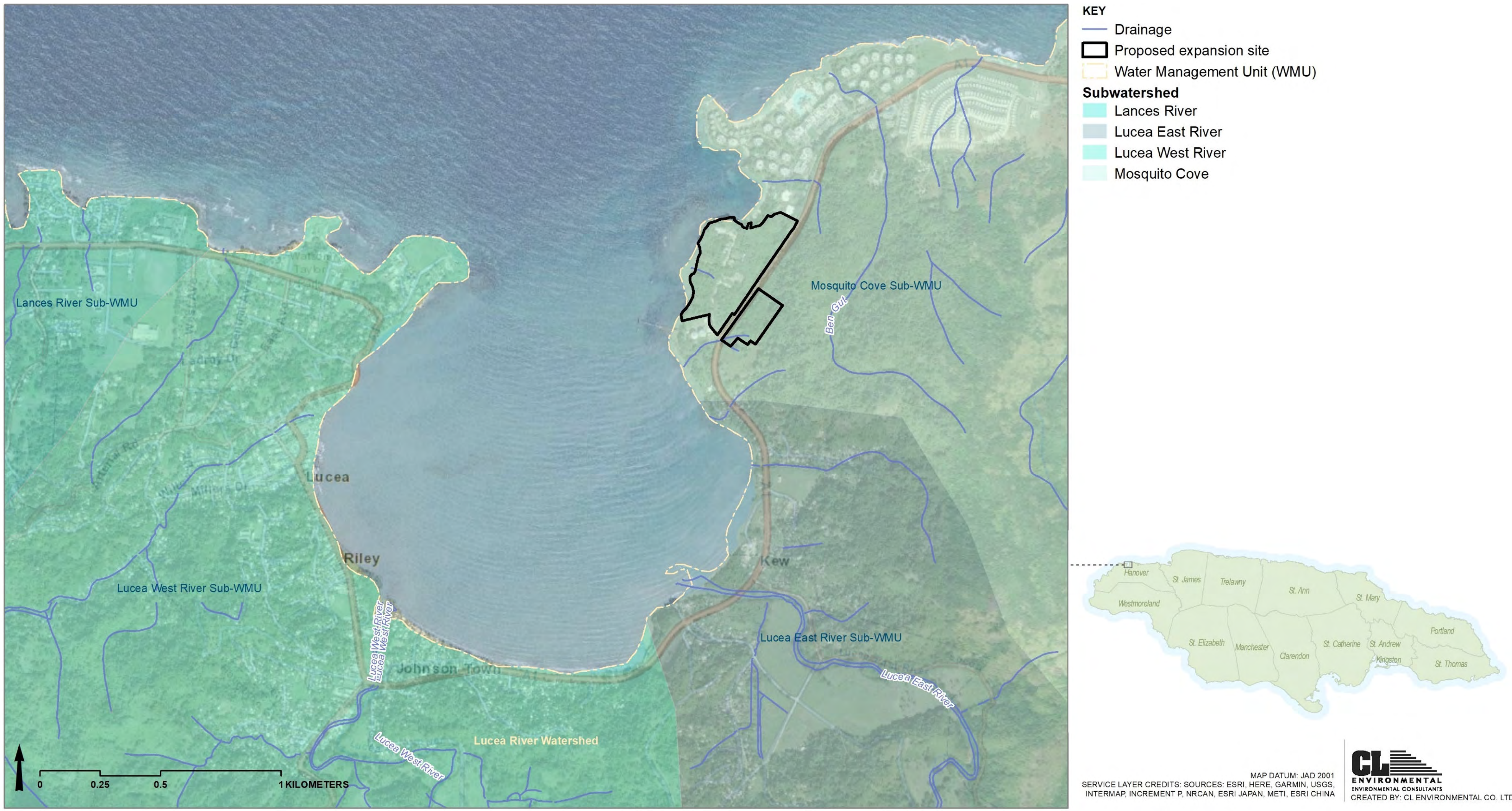
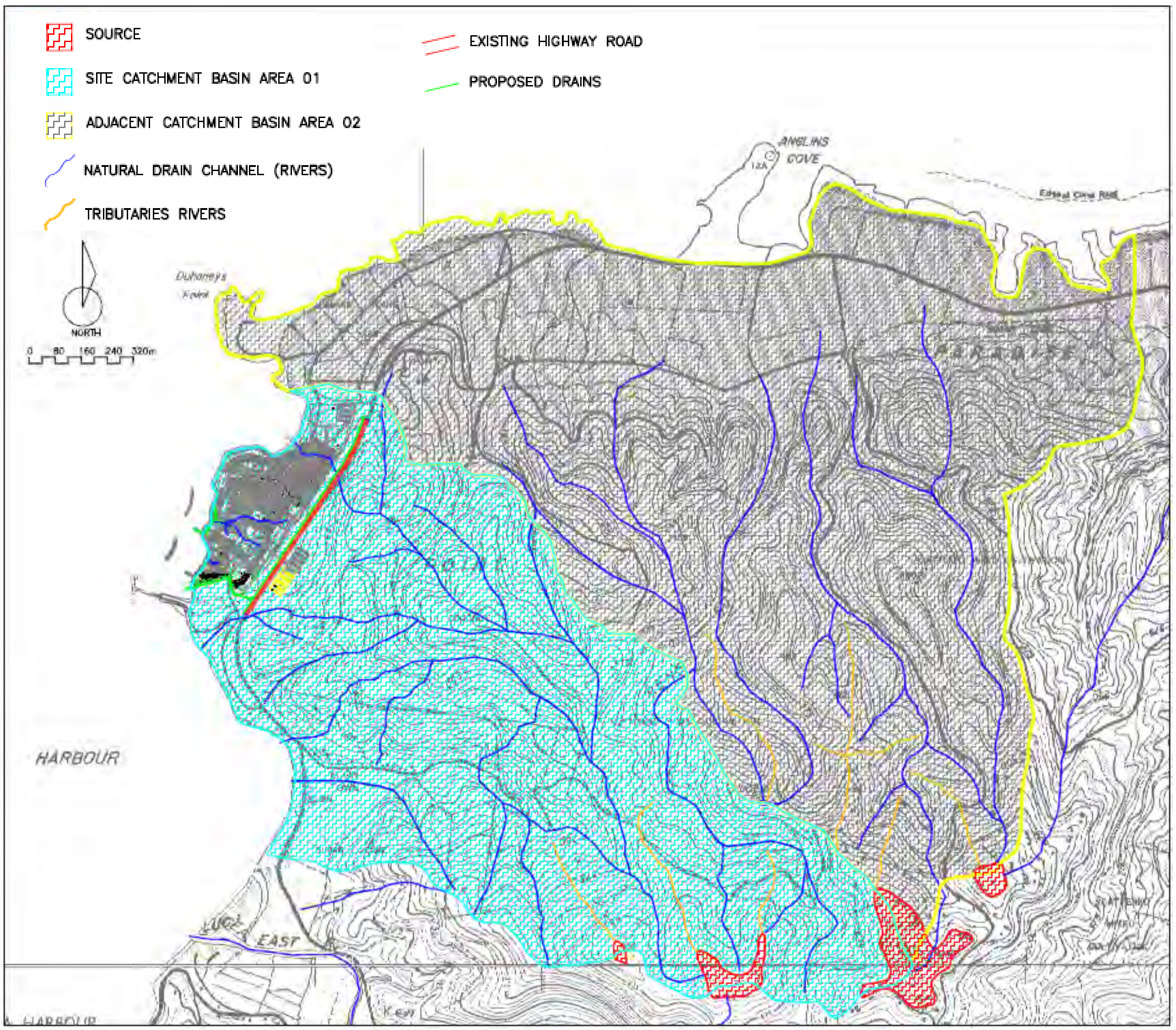


Figure 5-14 Hydrological features in the project area

5.1.5.2 Drainage Basin Areas

Grand Palladium and its broader catchment area spans approximately 1,374 acres (about 560 hectares). The main drainage sub-basins are delineated, divided into two sections. The southern portion, containing Phase II, is the primary focus of the drainage basin, although it comprises further divisions within it. The peak system of the hills, outlined in red in Figure 5-15, reaches approximately 300 meters above sea level and marks the catchment boundary extending to Englin Town in the west and the various coves along the shoreline between Anglin's Cove and Mosquito Cove to the north (Smith Warner International Limited, 2023).



Source: (Smith Warner International Limited, 2023)

Figure 5-15 Representation of the larger catchment area of Grand Palladium

5.1.5.3 Establishment of Flow

After delineating the catchment area, a "Curve Number" was assigned based on two parameters: the Hydrologic Soil Group (HSG) and the Land Use. Understanding and classifying the notable drainage features on site are essential for deriving this Curve Number. The drainage basin consists of two primary soil types: #43 Highgate Clay and #46 Hall's Delight Channery Clay Loam, with the latter being more prevalent. This classification, obtained from the Ministry of Agriculture's Rural and Physical Planning Department, categorizes the drainage sub-basins into Hydrological Soil Group C. The analysis of land use involved utilizing land-use maps from the Forestry Department, aerial photographs, and satellite imagery. The upper catchment area is characterized by hilly terrain with mixed vegetation, while the lower sub-catchments are designated as urban residential, in alignment with the proposed hotel development plans for those regions (Smith Warner International Limited, 2023).

For assessing stormwater runoff and peak flows, the SCS (Graphical Peak Discharge) Method was utilised. It was determined that the runoff values for the 1/25 year event are 21.609 m^3/s for the roadway basin and 4.358 m^3/s for the hotel property (Table 5-7).

Table 5-7 The peak flows (m3/sec) calculated from the Graphical Peak discharge method

	1/2 yr	1/5 yr	1/10 yr	1/25 yr	1/50 yr	1/100 yr
Roadway Basin	5.441	11.085	15.392	21.609	25.817	32.863
Hotel Property	1.378	2.411	3.220	4.358	5.092	6.321

Design return period is highlighted
Source: (Smith Warner International Limited, 2023)

5.1.6 Oceanography and Hydrodynamics

5.1.6.1 Overview

The northwest coast of Jamaica experiences two distinct wave climates: the operational wave climate, driven by day-to-day waves from the northeast Trade Winds and seasonal swell waves, and the extreme wave climate, characterized by occasional hurricanes that generate significantly higher waves (Smith Warner International Limited, 2023).

The operational wave climate delineates the typical distribution of wave heights, periods, and directions on a daily basis at a specific location. These waves influence sediment transport along the coastline and contribute to long-term morphological changes. Conversely, the extreme wave climate encompasses waves associated with tropical storms and hurricanes, prevalent in the Caribbean region from June to November annually. These storms can cause rapid and significant alterations to the coastline. Coastal protection structures are typically designed to withstand wave impact from such extreme events; the severity of the design storm event, measured by its return period, is determined based on the acceptable level of risk of damage or failure. A 50-year return period is often deemed a reasonable balance between capital investment and maintenance costs (Smith Warner International Limited, 2023).

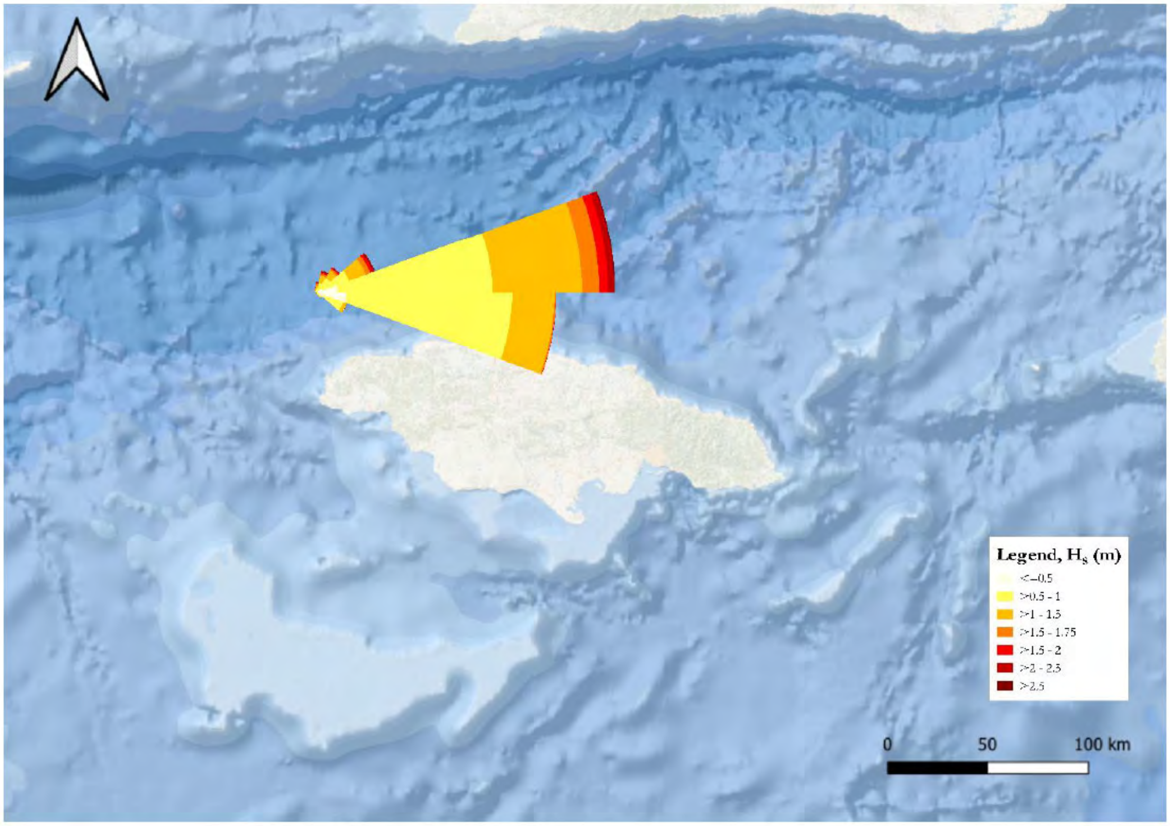
5.1.6.2 Offshore Operational Wave Conditions

Wind-generated waves originating offshore approach Jamaica from the east, predominantly blowing from the northeast to the southeast. The majority of these waves, propelled by the northeast Trade Winds, wrap around the island and ultimately reach the project site's shoreline from the northwest. Alongside the operational wave climate driven by the prevailing Trade Winds, the area experiences seasonal swell events, characterized by long-period waves. These swells are generated by winter storms traversing North America and extreme weather events like hurricanes. These varied wave types significantly influence the configuration and morphology of the shoreline (Smith Warner International Limited, 2023).

The project shoreline is exposed to both shorter-period waves from the east and northeast Trade Winds and longer-period Atlantic swell waves from the North Atlantic. This operational wave climate plays a pivotal role in shaping the long-term morphological changes along the shoreline (Smith Warner International Limited, 2023).

Data on the deep-water operational climate, detailing day-to-day wave conditions, was fed into an ERA5 global wave model calibrated with information from offshore buoys and satellite altimetry. This model aimed to forecast wave conditions hourly throughout the day, covering a span of 44 years (1979-2023). Waves at the project site predominantly originate from the east-northeast, with significant wave heights ranging from 0.5m to 2.5m (Figure 5-16). Concurrently, wind data extracted from the same node indicates easterly winds with speeds ranging from 6 to 10m/s (Smith Warner International Limited, 2023).

There is a significant contrast between the minimum and maximum values observed from June to October, which can be attributed to the hurricane season and its impact on wave conditions. From January to June, there is a gradual decrease in wave heights, followed by a resurgence from October to December. This resurgence is influenced by northerly swell waves affecting the Caribbean during the winter months (November to March) (Smith Warner International Limited, 2023).



Source: (Smith Warner International Limited, 2023)

Figure 5-16 Wave and wind rose plots at the selected node near Jamaica (1979-2023)

5.1.6.3 Nearshore Wave Conditions

Nearshore wave conditions for the Grand Palladium area were determined using the MIKE 21 Spectral Wave module. A comprehensive analysis was conducted on 44 years of wave data (since 1979) using tri-variate frequency analysis, which categorized conditions based on wave height, period, direction, wind speed, and direction. This analysis resulted in 2,303 distinct conditions or "events," each representing a unique combination of these parameters and their respective frequencies over the 44-year period. The model was then run in a semi-stationary mode using boundary inputs of wave heights, periods, and directions (Smith Warner International Limited, 2023).

The deep-water wave conditions were propagated from offshore to the nearshore areas and extended to the project site using the MIKE 21 SW module. This model operated in a semi-stationary mode, incorporating time-varying inputs of spectral wave parameters such as significant wave height (Hs), peak wave period (Tp), mean wave direction, as well as wind speed and direction sourced from the ERA5 wave database. The process of transforming these waves is elaborated in the subsequent section (Smith Warner International Limited, 2023).

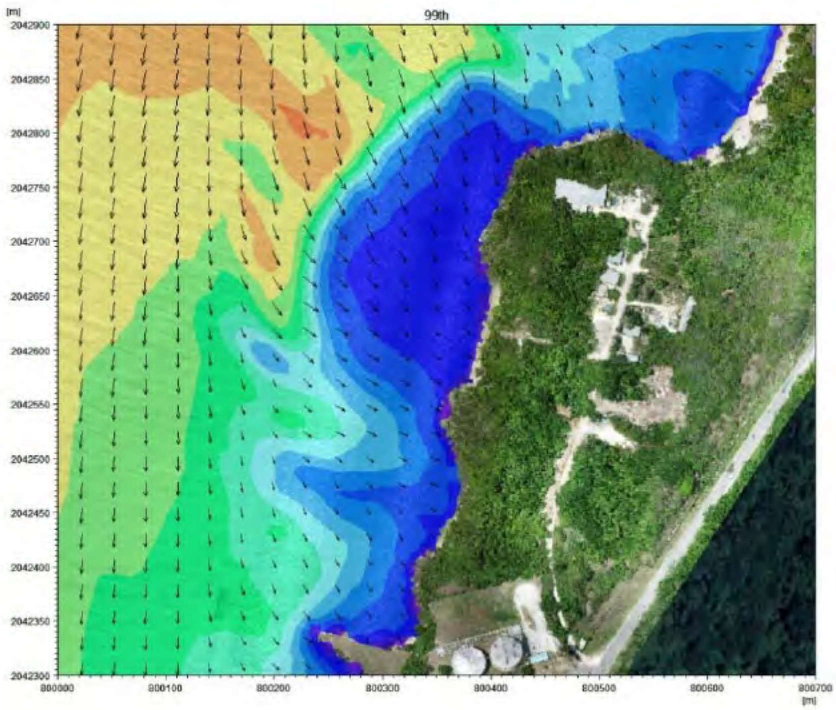
Mean Wave Conditions and Statistically Significant Events

The predominant wave approach toward the site originates from the east, emerging offshore at depths of around 100 meters. Notably higher waves are observed directly north, with wave heights typically ranging from 0.5 to 0.9 meters, indicating energetic waves capable of generating significant nearshore run-up. Conversely, the majority of waves approach the nearshore area of Phase 2 from the northwest. This directional shift is attributed to various refractive and diffractive processes associated with the reef platform and the headland of the existing Grand Palladium Property. These waves are generally smaller, predominantly ranging from 0.3 to 0.4 meters (Smith Warner International Limited, 2023).

The 99th percentile wave condition modelled represents extreme storm events, such as north swells, occurring approximately 1% of the time, which typically result in significant shoreline erosion during the winter months. Conversely, the mean annual wave climate characterizes the average wave heights and directions observed annually. In the southern portion of the Phase 2 project site, wave heights are generally smaller, measuring less than 0.2 meters (Figure 5-17). However, during 99th percentile conditions, wave heights range from 0.45 to 0.9 meters (Figure 5-18). Analysis indicates that the primary direction of wave approach is from the northeast, with waves under 1 meter reaching the project site shoreline. During storm-like events akin to the 99th percentile conditions, mean wave heights along the shoreline can increase by over 350%. This suggests that while the reef provides some protection during typical (mean wave) conditions, its effectiveness may diminish under extreme wave conditions. Moreover, heightened water levels resulting from low-pressure systems or tidal fluctuations further reduce the reef's efficacy (Smith Warner International Limited, 2023).

Source: (Smith Warner International Limited, 2023)

Figure 5-17 Phase 2 Annual wave conditions for 50th percentile

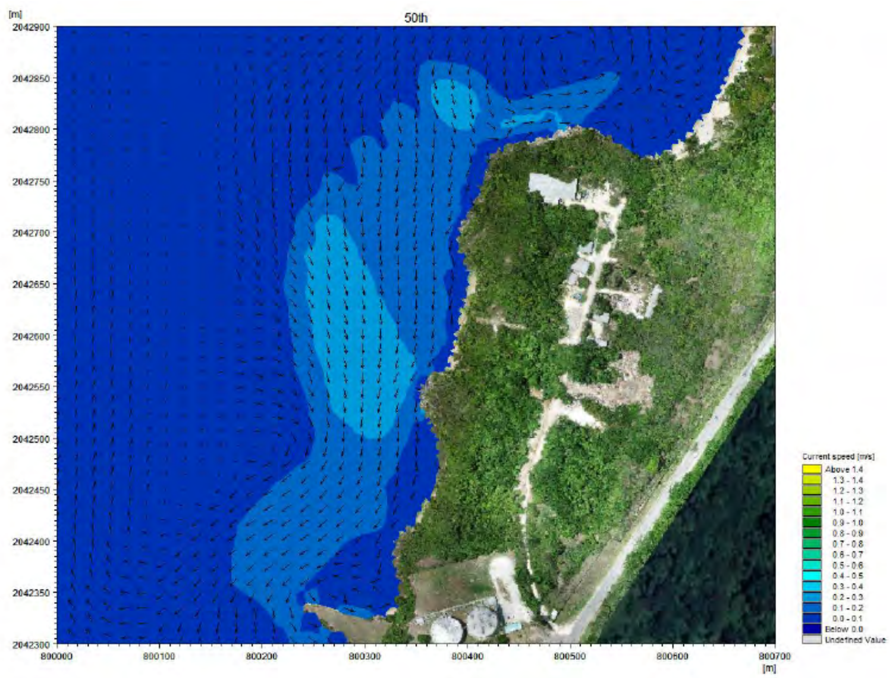


Source: (Smith Warner International Limited, 2023)

Figure 5-18 Phase 2 Annual wave conditions for 99th percentile

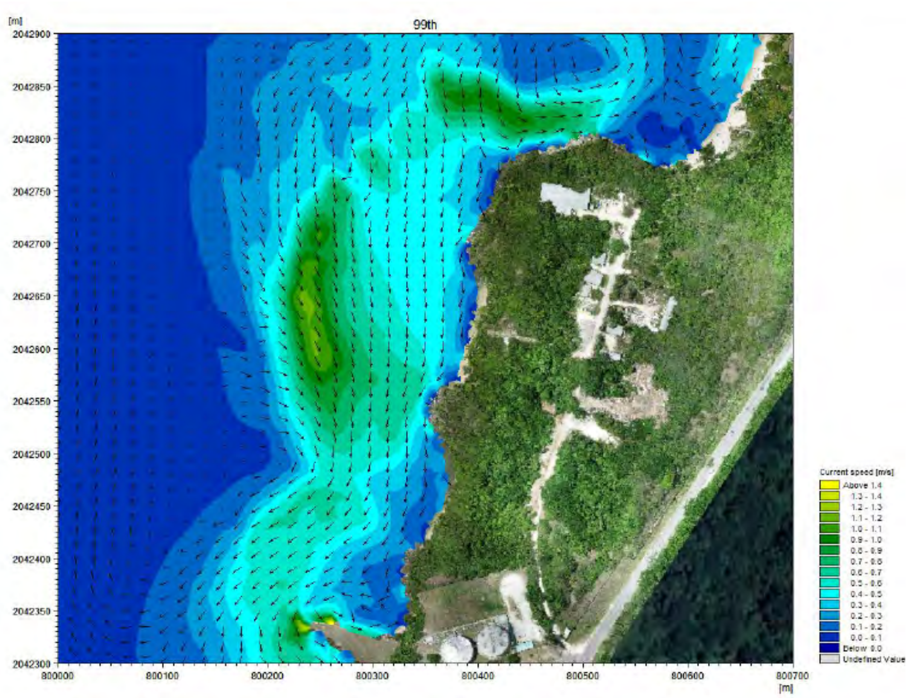
Mean Current Conditions and Statistically Significant Events

Wave-driven currents interact with the cliffs situated to the north, generating a circular motion offshore before proceeding southward towards Phase 2 at speeds ranging from 0.2m/s to 0.4m/s. During uncommon circumstances, these southward currents can accelerate to speeds between 0.5m/s and 1.0m/s. With the prevailing flow directed towards the south, sediment transport is also expected to occur in the same direction. Consequently, any structures positioned in this vicinity must carefully consider potential impacts on alongshore drift. The significant current velocities indicate substantial mixing and water exchange, mitigating the risk of stagnation. Furthermore, natural drainage pathways in the area are likely to discharge here, implying a potential for pollution if runoff from the site is not effectively managed.



Source: (Smith Warner International Limited, 2023)

Figure 5-19 Phase 2 annual current speeds for 50th percentile



Source: (Smith Warner International Limited, 2023)

Figure 5-20 Phase 2 annual current speeds for 99th percentile

5.1.7 Water Quality

5.1.7.1 Background

Marine and coastal water quality sampling involves the collection and analysis of water samples from marine and coastal environments to assess various physical, chemical, and biological parameters. This process is crucial for understanding the health of ecosystems, identifying pollution sources, and ensuring compliance with environmental regulations. Some key parameters include physical parameters such as temperature and salinity; chemical parameters such as pH, nutrients and dissolved oxygen; and biological parameters such as faecal coliform. For example, water quality monitoring is used to detect eutrophication, a process where water bodies receive excess nutrients, primarily nitrogen and phosphorus, leading to an overgrowth of algae. This overgrowth can deplete oxygen levels, harming fish and other marine life, and potentially leading to dead zones.

Historical data, gathered over a three-year period from 2006 to 2008 during the hotel's phase 1 construction, was used for an in-depth analysis of temporal and spatial changes in water quality (CL Environmental Co. Ltd., 2006-2008). This data served as a baseline for parameters, in order to identify temporal changes in the area, particularly at Stations 1, 4, and 6.

5.1.7.2 Methodology

Water Quality Sampling

Seven (7) water quality stations were sampled at varying intervals over a six month period capturing both wet and dry seasons (Table 5-8, Table 5-9 and Figure 5-21).

Table 5-8 Sample dates, Season and weather conditions

Date	Weather	Season
June 21 2023	Fair and sunny	Rainy
August 24 2023	Fair and sunny	Rainy
October 11 2023	Fair and sunny	Rainy
November 16 2023	Overcast and rainy	Rainy
March 20 2024	Fair and sunny	Dry
May 22 2024	Fair and sunny	Dry

Table 5-9 Water quality sampling locations (JAD2001)

Station	Eastings	Northings	Water Depth(m)	Notes
GP WQ 1	628106.314	700718.967	2.5	Beach, historical location
GP WQ 2	627873.6803	700626.3743	1	Shallow reef
GP WQ 3	627844.1837	700448.4102	1	Drainage outflow
GP WQ 4	627799.275	700308.853	1	Historical location
GP WQ 5	627785.3695	700224.6321	1	Sheltered area beside pier
GP WQ 6	627819.469	699990.796	1	Southernmost point, historical location
GP WQ 7	627249.2278	701020.0613	15	Background Station

A Hydrolab DataSonde-5 water quality multi probe meter was used to collect the following in-situ parameters: Temperature, Conductivity, Salinity, Dissolved Oxygen, Turbidity, Photosynthetically Active Radiation (PAR) – Light Irradiance, Total Dissolved Solids and pH were collected. Light extinction through the water column was calculated from PAR values recorded.

Whole water samples were collected in pre-sterilized bottles, stored on ice and taken to Caribbean Environmental Testing and Monitoring Services Limited (CETMS Ltd.) for analysis of Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), nitrate, phosphate and faecal coliform, some samples were also taken to Environmental Technical & Analytical Services Ltd (ETAS) for the analysis of Biochemical Oxygen Demand (BOD). Samples were also shipped to International Analytical Group (IAG) Eurofins in Pensacola for analyses of Total Petroleum Hydrocarbons (TPH).

Statistical Analysis

The data was initially analysed to confirm it followed a normal distribution. To achieve this, some data sets were transformed using Log Normal and Log(ln) transformations. Subsequently, One-way ANOVA and Tukey's Honest Significant Difference (HSD) tests were conducted on the normalized data. These tests were used to identify any significant spatial, vertical, or seasonal differences in the water quality data collected before and during the project. A p-value of less than 0.05 was considered indicative of significant differences.

Forward Stepwise Multiple Regression was also conducted on the data in order to better understand the contributions of each parameter to various conditions.

Statistical analyses (ANOVA, Turkey's (HSD) and Forward Stepwise Multiple Regression) were conducted using the statistical programme Statistica version 14.0 for Windows by TIBCO Software Inc. 1995-2020.

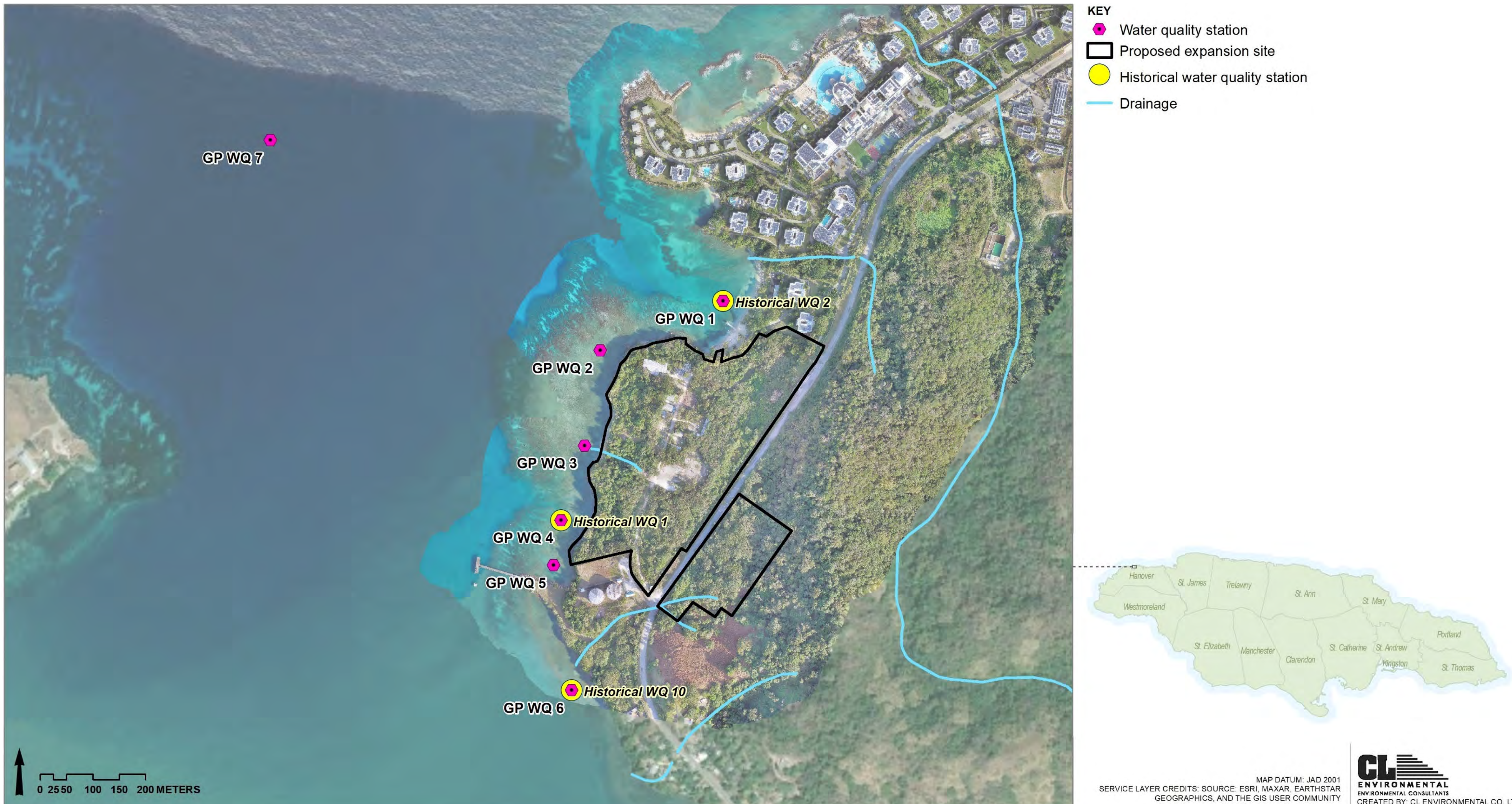


Figure 5-21 Water quality sampling stations

5.1.7.3 Analysis of Results

Results Summary

Table 5-10 outlines the average *in-situ* data results, while Table 5-11 displays the average laboratory data results, all stations were compared with NRCA Marine Water Quality Standards. Appendix 7 and Appendix 8 provide the full list of results obtained from *in-situ* measurements and the various laboratories.

IN SITU DATA

Most water quality parameters fell within expected ranges and standards. Some stations were influenced by their proximity to drainage outfalls and possibly upwellings. Microhabitat variations may also influence various parameters.

Average water temperatures recorded were higher than the typical tropical marine range of 24–29°C, ranging from 29.30 to 29.88°C. These elevated temperatures are above the usual range for tropical marine waters, which may reflect broader climatic trends.

Salinity, conductivity, and Total Dissolved Solids (TDS) values remained within normal ranges for tropical marine environments at all stations

All average DO values were above the critical threshold of 3 mg/l (United States Environmental Protection Agency, 2016) indicating adequate oxygen levels for aquatic life. However, the lowest recorded D.O. value was 3.70 mg/l at Station 5, which is situated near a low circulation area close to the southern pier. This station may have experienced high nutrient input and organic matter decomposition, contributing to lower D.O. levels.

Average pH values were consistent with normal seawater conditions and met the NRCA marine water quality standards, indicating stable acid-base conditions.

Overall turbidity levels were low across all stations. The highest turbidity was observed at Station 6, located nearshore with a muddy substrate and proximity to drainage outfalls, resulting in a turbidity of 3.16 NTU.

Light extinction coefficients ranged from 0.0865 to 0.4855, reflecting varying degrees of light attenuation. In oceanic waters, which generally have fewer suspended particles, lower extinction coefficients were observed, indicating better light transmission. In contrast, coastal areas, particularly those with muddy substrates or higher turbidity, exhibited higher extinction coefficients.

Table 5-10 Average in-situ water quality data (2023-2024)

Stn.	Temp. (°C)	Cond. (mS/cm)	Salinity (ppt)	pH	D.O. (mg/l)	Turbidity (NTU)	TDS (g/l)	Light Extinction
1	29.74	53.61	35.49	8.14	5.16	1.39	34.31	0.2469
2	29.60	53.51	35.41	8.10	4.74	0.30	34.25	0.1663
3	29.43	53.41	35.35	8.09	4.80	0.69	34.19	0.1863
4	29.64	53.47	35.39	8.13	4.98	1.43	34.21	0.2130

Stn.	Temp. (°C)	Cond. (mS/cm)	Salinity (ppt)	pH	D.O. (mg/l)	Turbidity (NTU)	TDS (g/l)	Light Extinction
5	29.30	53.44	35.36	8.01	3.70	1.49	34.20	0.4107
6	29.54	53.42	35.36	8.12	5.07	3.16	34.19	0.4855
7	29.88	53.63	35.50	8.20	6.14	1.54	34.33	0.0865
NRCA Marine Water Standard	-	-	-	8 - 8.4	-	-	-	-

LABORATORY DATA

Faecal coliform and Biochemical Oxygen Demand (BOD) values varied across the study area, with some locations meeting NRCA standards while others exceeded acceptable limits. Elevated faecal coliform levels and high BOD values were typically associated with areas of limited water circulation and potential anthropogenic pollution sources.

Total Suspended Solids (TSS) levels were low overall, consistent with the low turbidity observed, indicating generally clear water.

Nitrate and phosphate levels were consistently non-compliant with NRCA standards which is common for Jamaica's nearshore coastal waters.

No traces of total petroleum hydrocarbons (TPH) were detected at any of the stations.

Table 5-11 Average laboratory water quality data

Stn.	BOD (mg/l)	TSS (mg/l)	NIT (mg/l)	PHOS (mg/l)	F.COLI (MPN/100ml)	TPH (mg/l)
1	1.13	3.50	2.32	0.08	7.70	ND
2	0.98	3.50	2.42	0.11	2.75	ND
3	1.34	3.83	2.13	0.07	23.55	ND
4	1.05	4.67	2.35	0.07	6.92	ND
5	1.16	3.83	2.13	0.09	67.02	ND
6	1.22	4.00	2.17	0.09	31.37	ND
7	0.76	3.67	2.13	0.08	22.57	ND
NRCA Marine Water Standard	1.16	-	0.007-0.014	0.001-0.003	<2-13	-

NB. Numbers in red are non-compliant with the standard/guideline.

ND –None Detected

Temperature

Recorded temperatures during the survey exceeded the typical tropical marine water range of 24°C to 29°C for the Caribbean Sea. In the cooler part of the year (December to February), the sea temperature is usually around 24°C to 26°C, while in the hotter part of the year (June to August), it typically rises to about 27°C to 29°C.

The highest average temperature was Station 7, which was the background station located furthest offshore. The higher temperatures observed at this station may have had the least influence from nearshore influences such as freshwater input. The lowest average temperature observed was 29.30°C at station 5, which is sheltered beside the southern pier (Figure 5-22). Freshwater influx from nearby drains, particularly at stations 3 and 6, likely contributed to slightly lower temperatures in those areas.

The global warming phenomenon has led to a gradual increase in sea temperatures. Notably, 2023 was recorded as the warmest year since 1967, surpassing the previous record set in 2016 (Copernicus, 2024). This highlights the importance of monitoring and mitigating the impacts of rising temperatures on marine ecosystems.

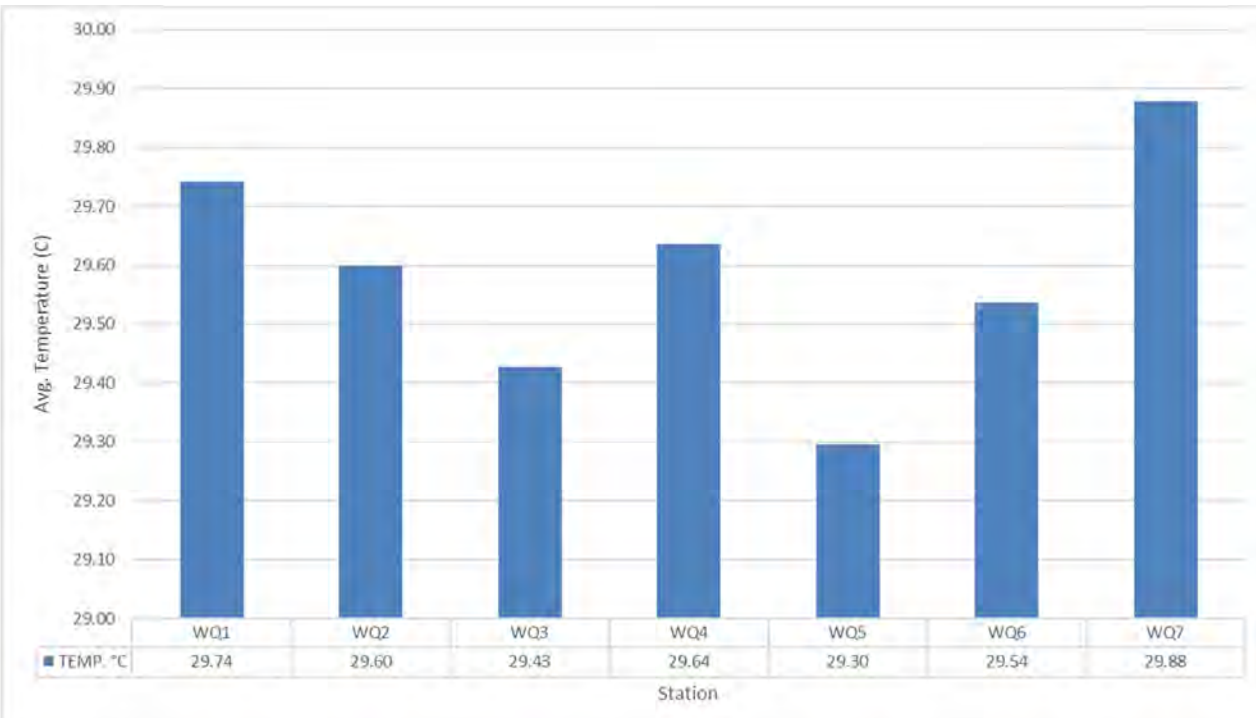


Figure 5-22 Average temperature (°C) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (TEMPERATURE)

Current Study

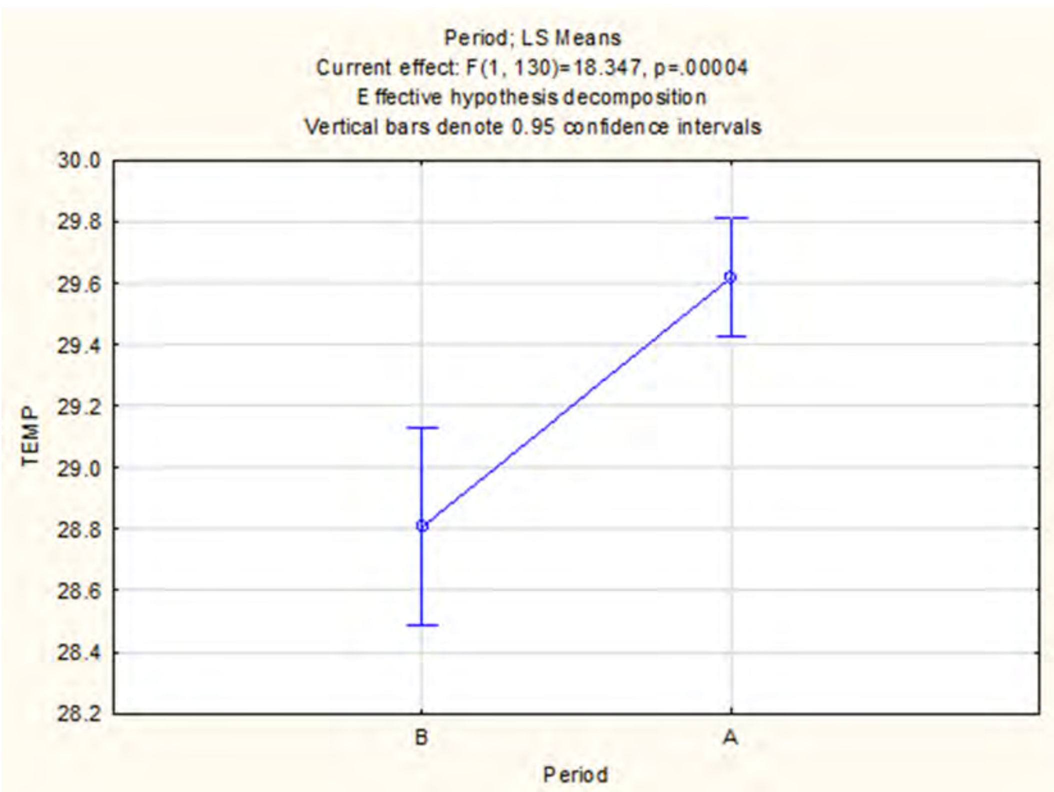
The mean temperature for the current study was 29.62°C, with low fluctuations about the mean, demonstrated by a low coefficient of variation (3.01%CV). The spatial coefficient of variations across the seven stations sampled demonstrated low fluctuations with %CV values ranging from 0.30% to 1.37% with higher results for the temporal values, which ranged from 2.65% to 3.40% across the six runs. These results indicate that there was minor variation across the seven stations at any particular time.

Historical

There were no significant spatial differences in temperature (ANOVA p>0.05), however, there were significant differences in temporal differences (ANOVA p<0.05). These significant differences showed increased temperatures between the historical and current data, and seasonal changes throughout the year, with higher temperatures during the May to November period. Temperature values peaked during October, while the lowest temperatures were observed during January.

The mean temperature value at the surface in 2008 was 28.81°C and was 29.62°C in 2023. Figure 5-23 shows the significant mean temperature differences with p<0.05. No patterns could be established within the project area for temperature and variations in water depth.

The low fluctuations about the mean were demonstrated by the low coefficient of variation 3.07% and there were no significant horizontal or vertical differences in temperature (ANOVA p>0.05).



NB: – The period B represent 2006-2008 and A represents 2023-2024

Figure 5-23 Mean temperature differences between historical and present data

The temperature values were significantly different when comparing the months (ANOVA p<0.05), with values peaking during October (31.43°C) while lowest temperatures were observed during the months of

January and December (26.70°C). Comparisons indicate two seasons, a colder December to January and the other being warmer July to October, with transition months between the two seasons (Figure 5-24).

Tukey's HSD test was also used to confirm these findings, showing similar values between months January in relation to December, and March to September. Tukey's test was also used to differentiate the temporal data and showed that 2023 had significantly higher temperatures than any other tested year.

A multiple regression exercise was conducted with temperature as the dependant variable, results observed showed no significant relationship between temperature and any other parameter with a p value > 0.05 for all parameters. Therefore, temperature was not directly related to any other water quality parameter and was most likely as a result of climate change.

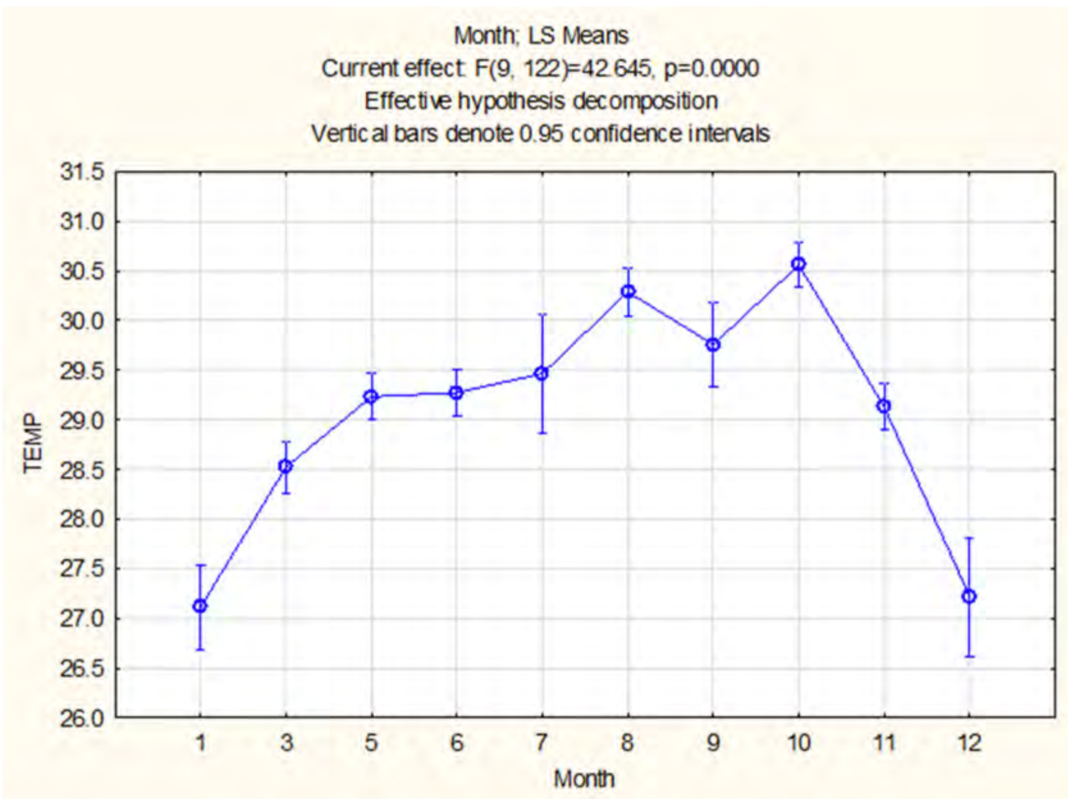


Figure 5-24 **Mean temperature differences between months**

Conductivity

Conductivity is a measure of the number of free ions within a given water sample and, in conjunction with salinity, is used to gauge whether the water sample is saline/marine or non-saline/fresh water. Typically, higher conductivity readings indicate a greater presence of free ions in the water sample, which is common in saline water compared to fresh water.

Figure 5-25 shows the average conductivity readings measured for all seven stations, with stations 3, 5 and 6 having the lowest conductivity, this is most likely due to freshwater inflow from the nearby drainage points along the beach.

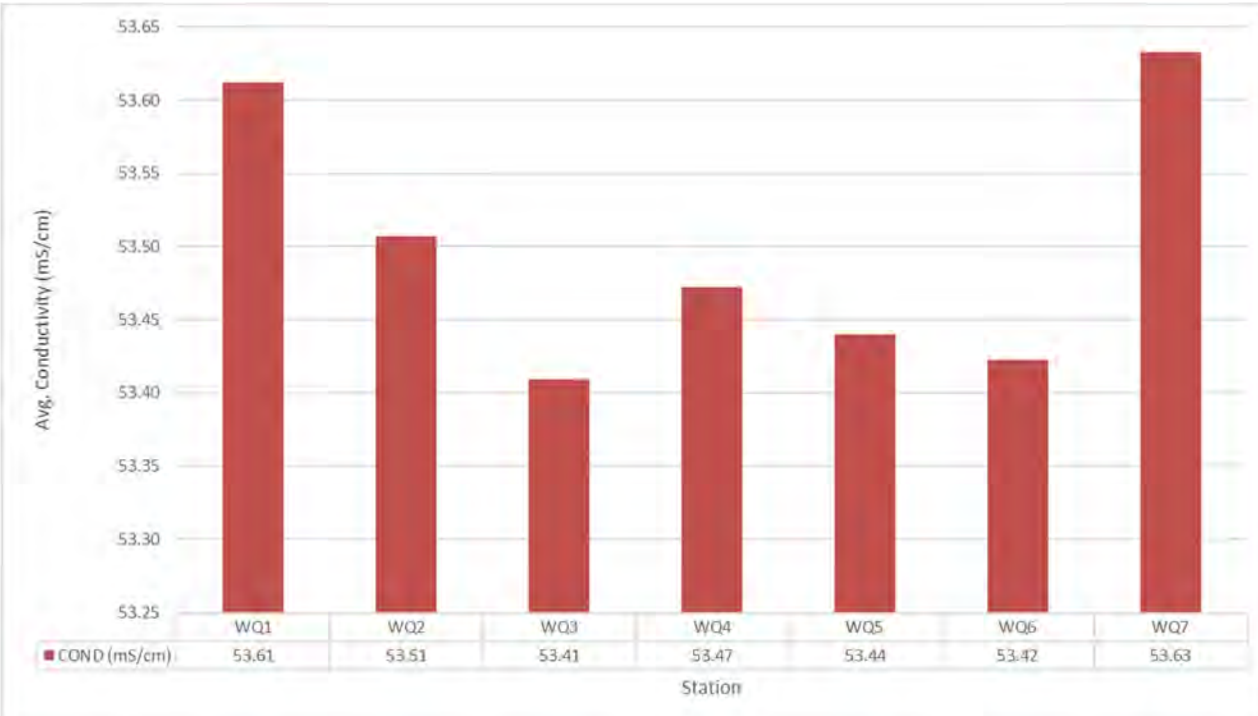


Figure 5-25 Average conductivity (mS/cm) at the seven stations sampled (2023 - 2024)

STATISTICAL ANALYSIS (CONDUCTIVITY)

Current Study

The mean conductivity was 53.50 ms/cm, with low fluctuations about the mean, demonstrated by a low coefficient of variation (1.21%CV). The spatial coefficient of variation across the seven stations sampled demonstrated low fluctuations with %CV values ranging from 0.30% to 1.37% with higher results for the temporal values, which ranged from 2.65% to 3.40% across six runs. These results indicate that there was minor variation across the seven stations for the six months sampled, however there was a higher temporal variation.

There were no significant spatial differences in conductivity (ANOVA $p>0.05$) however there were significant temporal values between months. Conductivity values peaked during March, while the lowest conductivities were observed in June, August and October. These lower conductivity values may have been due to those months being in the rainy season.

Historical

There was no historical data for conductivity values.

Salinity

Salinity values recorded (and trends noted) were similar to that of conductivity readings obtained during the monitoring exercise. This is most likely due to freshwater inflow from the nearby drainage points along the beach and support the general inferences discussed under the section on Conductivity.

Figure 5-26 shows the average salinity readings recorded for all seven stations, with the lowest readings occurring at station 3.

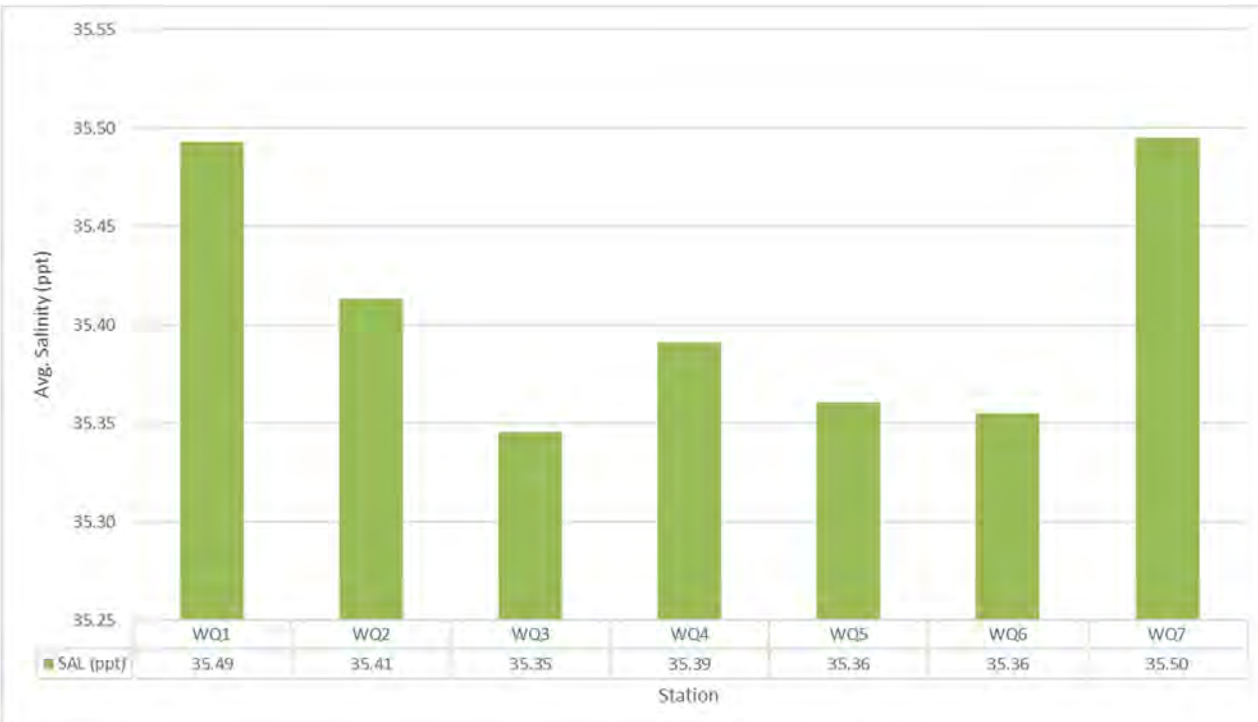


Figure 5-26 **Average salinity (ppt) at the seven stations sampled (2023-2024)**

STATISTICAL ANALYSIS (SALINITY)

Current Study

The mean salinity for the current study was 35.40(ppt), with low fluctuations about the mean, demonstrated by a low coefficient of variation (1.35%CV). The spatial coefficient of variations across the seven stations sampled demonstrated low fluctuations with %CV values ranging from 0.23% to 0.48% with comparable results for the temporal values, which ranged from 1.26% to 1.52% across the six runs.

Historical

There were no significant spatial differences in salinity (ANOVA p>0.05). However slight variations were observed between months:

- Salinity values peaked during March, while the lowest salinities were observed during October.

- The low salinity values observed at stations 3, 5 and 6 may have been due to freshwater input from the nearby drainage points. Stations 3 and 6 were directly influenced by these outflow points, while Station 5 was in a more sheltered area and is also influenced by the harbour(the outfalls by station 6 in particular appear to be influencing this station).

There were temporal differences between the historical and current data, with significantly higher salinity in the present. Higher salinity may be due to likely due to changes in drainage patterns and climate change.

pH

pH is a measure of how acidic or basic a substance is, average seawater pH is around 8.1, with the NEPA marine water quality standard being 8.0-8.4.

Figure 5-27 shows the average pH values for the seven stations, all stations were compliant with the NEPA marine water quality standard, with station 5 having the lowest value. Lower pH can be caused by runoff containing various chemicals or decomposition of organic matter, which can produce carbon dioxide CO_2. Station 5 was located within a more sheltered spot beside the southern pier, this location may have been influential in a lower pH due to the aforementioned points.

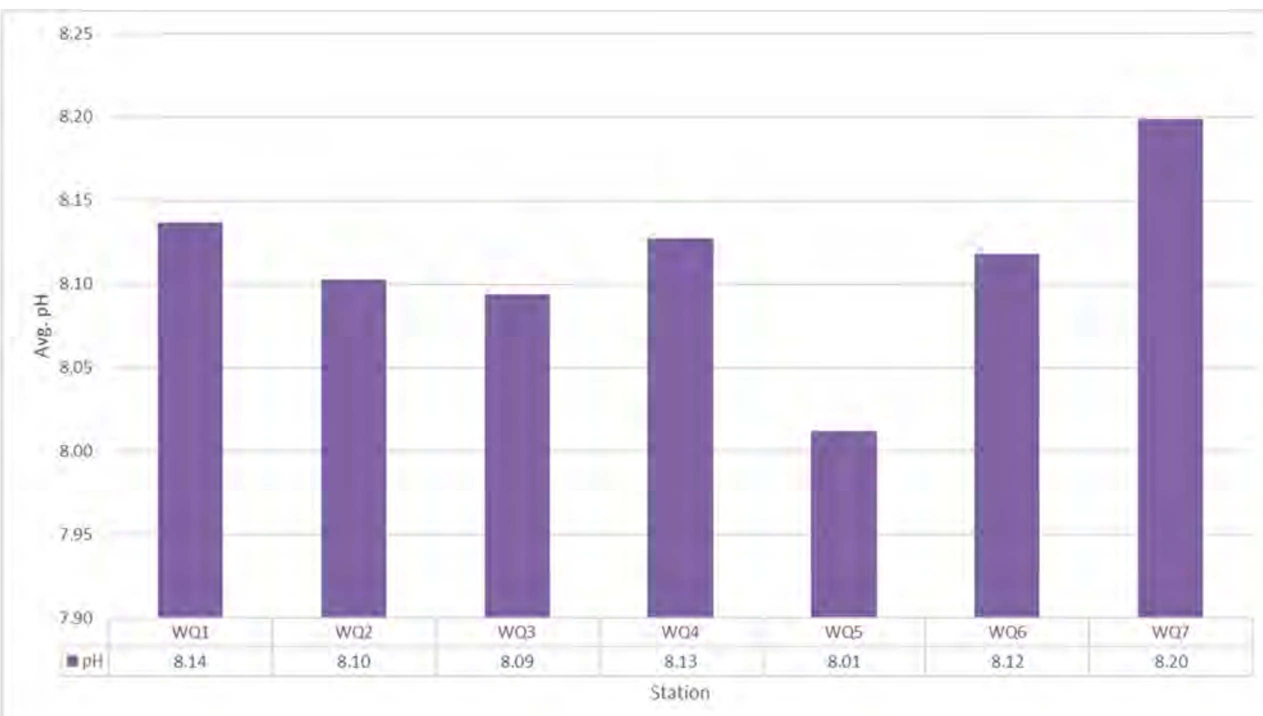


Figure 5-27 Average pH at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (PH)

Current Study

The mean pH was 8.12, with low fluctuations about the mean, demonstrated by a low coefficient of variation (2.07%CV). The spatial coefficient of variations across the seven stations sampled demonstrated low fluctuations with %CV values ranging from 0.49% to 1.03% with comparable results for the temporal values, which ranged from 1.60% to 2.61%. These results indicate that there was minor variation across the seven stations during the study.

There were significant spatial and temporal differences in pH (ANOVA $p<0.05$). Station 5 had a significantly lower pH when compared to stations 1, 4, 6 and 7, with the greatest difference being between the background station, station 7. Lower pH is an indication of more acidic environment which may be as a result of low circulation/flushing, decomposition of organic matter.

Much of the study area is in or nearby seagrass areas. The presence of seagrass can influence the pH of the surrounding water in various ways. Seagrass meadows are known for their role in coastal ecosystems, and they can have a significant impact on the local pH levels due to their biological processes:

Seagrasses influence pH levels in coastal waters through several processes:

- Daytime Photosynthesis: Absorbs CO_2, releases oxygen, and raises pH.
- Nighttime Respiration: Releases CO_2, lowers pH slightly.
- Carbon Sequestration: Stores CO_2 in biomass and sediments, reducing acidity.
- Buffering Capacity: Absorbs excess nutrients and organic matter, stabilizing pH.
- Root and Rhizome Structures: Trap sediments and organic matter, affecting microbial processes and pH.

Overall, seagrass meadows moderate pH fluctuations, creating more stable and slightly higher pH levels, benefiting marine organism's sensitive to acidity changes.

Dissolved Oxygen (DO)

Dissolved oxygen (DO) is a measure of how much oxygen is dissolved in water, or the amount of oxygen which is available to living aquatic organisms. DO is often used as a measure to water quality, as moving water tends to have more DO than stagnant water. Additionally bacterial respiration and organic matter decay causes the depletion of DO. Low dissolved oxygen (DO) levels can significantly impact marine communities by causing stress in marine life, leading to reduced growth, impaired reproduction, and increased disease susceptibility. They can alter species composition and reduce biodiversity, as sensitive species decline, and more tolerant or invasive species dominate. Essential habitats like seagrass beds, coral reefs, and mangroves degrade, further reducing biodiversity and ecosystem services. Low DO levels can create hypoxic "dead zones" and cause behavioural changes in marine organisms, affecting their feeding, breeding, and migration patterns.

Figure 5-28 shows the average DO values , all of which were to be above the minimal value (< 3 mg/l) considered detrimental to aquatic life (United States Environmental Protection Agency, 2016). The lowest DO value was recorded at Station 5.

Station 5 results further indicate that this area is influenced by nearby drains and or upwellings. This area also appears to be more sheltered with a silty muddy substrate and deposition of organic material.

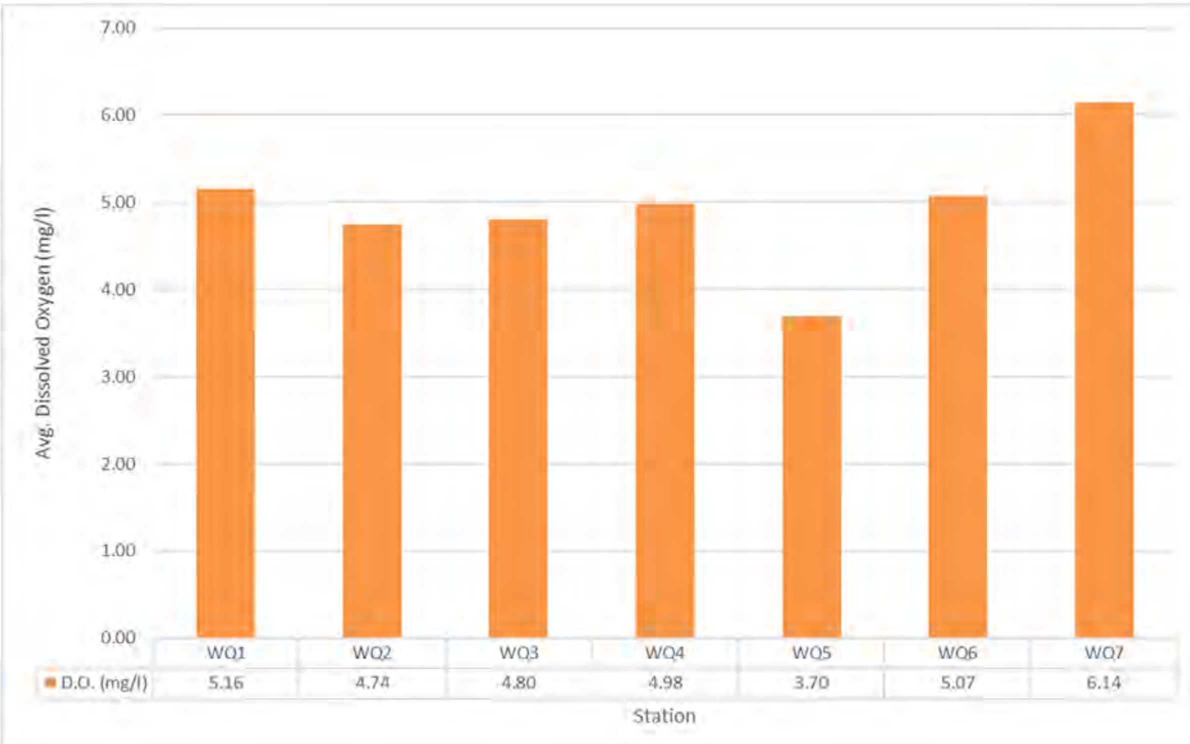


Figure 5-28 Average dissolved oxygen (mg/l) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (DO)

Current Study

The mean DO was 5.05 (mg/l), with high fluctuations about the mean, demonstrated by a high coefficient of variation (22.30%CV). The spatial coefficient of variations across all stations sampled demonstrated high fluctuations with %CV values ranging from 10.64% to 26.74% with comparable results for the temporal values, which ranged from 3.55% to 32.00% across the six runs. These results indicate that there was high variation across stations for the six months sampled.

Historical

There were significant spatial and temporal differences in DO (ANOVA $p<0.05$). DO values were significantly lower for Station 5 when compared to most other stations and Station 7 had a significantly higher DO value when compared to most other stations. Station 5 may have been influenced by upwellings as well as nearby outflow points. Station 7 was less influenced by runoff and other pollution sources influencing the nearshore areas.

There were significant temporal differences for three months (August, October and November) which had significantly lower DO values (ANOVA $p<0.05$). These months represent rainy season samples. Rainer periods may result in increased outflow from nearby drainage points, potentially carrying excess nutrients, sedimentation and other pollutants leading to more eutrophic conditions and lower DO. Conversely the highest DO value was recorded in July, during the dry season.

Turbidity

Turbidity is a measure of the cloudiness or haziness of a liquid caused by the presence of suspended particles, such as silt, clay, algae, organic matter, and microorganisms. These particles scatter and absorb light, reducing the clarity of the water. The level of turbidity is an important indicator of water quality in both freshwater and marine environments.

Turbidity was low across all stations, with the lowest at Station 2 and the highest at station 6. The higher value at station 6 was most likely due to its proximity to the harbour and 2 drainage points. Station 6 was also very shallow with a silty substrate. Soft, silty sediments are easily resuspended (by wave action and boat activity during sampling). Station 2 had the lowest turbidity value. Station 2 is located a reef area with hard consolidated substrate and away from drainage points. Figure 5-29 shows the average turbidity values for the seven stations.

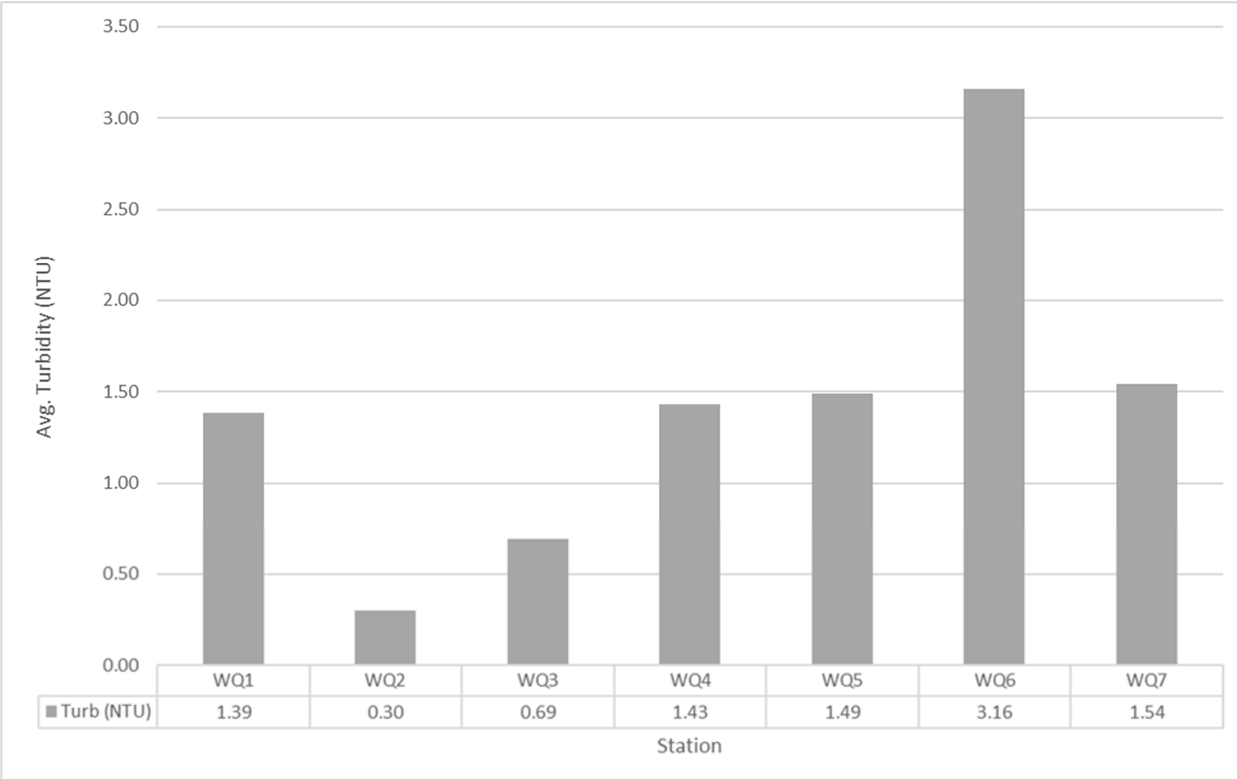


Figure 5-29 Average turbidity (NTU) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (TURBIDITY)

Current Study

The mean turbidity was 1.31 NTU. There was significant mean temporal variation between months (ANOVA $p<0.05$), with values peaking during March ,12.90NTU (dry reason) and the lowest values recorded in May (dry), August (wet) and November(wet) (0.00NTU). There were no significant spatial differences in turbidity (ANOVA $p<0.05$) between stations

Historical

No historical data was available for turbidity.

Total Dissolved Solids (TDS)

Total dissolved solids (TDS) is a measure of dissolved combined content, organic and inorganic substances, within the water. Seawater typically contains TDS concentrations between 30,000-35,000 mg/l . These high TDS values are due to the high concentrations of various salts and minerals in seawater (Table 5-12ool).

TDS is closely related to salinity and conductivity.

Table 5-12 Typical TDS readings in several types of water

Types of Water	Total Dissolved Solids (mg/L)
Distilled Water	0-10 mg/L
Rainwater	2-20 mg/L
Tap Water	100-500 mg/L
Lakes and Rivers	50-1,500 mg/L
Ground Water	200-1,000 mg/L
Brackish Water	1,000-10,000 mg/L
Seawater	30,000-35,000 mg/L

Station 7 had the highest TDS, and as expected it also had the highest conductivity and salinity . Stations 3 and 6 had the lowest TDS values which was most likely due to freshwater influence form the nearby drains. All TDS values were found to be acceptable and within the expected range. Figure 5 22 shows the average TDS

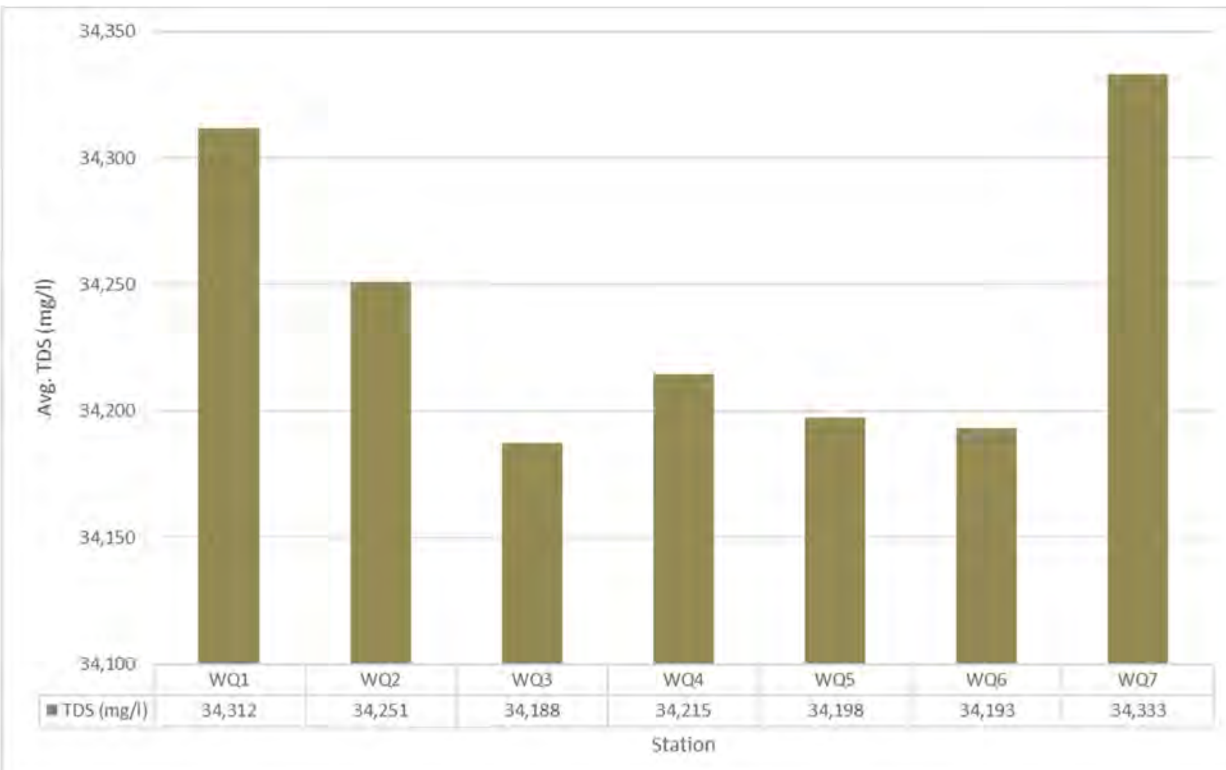


Figure 5-30 Average total dissolved solid (g/l) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (TDS)

Current Study

There was no spatial and temporal difference in TDS values. There were only minor spatial variation and moderate temporal variation. The mean TDS was 34.24(g/l), with low fluctuations about the mean, demonstrated by a low coefficient of variation (1.22%CV). The spatial coefficient of variations across the seven stations sampled demonstrated low fluctuations with %CV values ranging from 0.10% to 0.44% with similar but higher results for the temporal values, which ranged from 1.14% to 1.36% .

There were no significant spatial differences in TDS (ANOVA $p>0.05$) however there were significant temporal differences, with TDS values peaking during March and November, however the lowest TDS values were observed during June, August and October. TDS values are directly related to conductivity and salinity values, variations are most likely due to changes in freshwater input into a system. The significant temporal differences were most likely due to seasonality, as the lowest values were observed during the rainy season.

Historical

There was no historical data available for TDS.

Light Extinction Coefficient (EC)

Photosynthetically active radiation (PAR) refers to the part of the light spectrum which typically drives photosynthesis, the differences between two PAR values at different depths of water is used to calculate the relative light extinction coefficient. Light Extinction Coefficient (EC) refers to measures of light attenuation within water or the rate of loss of light with depth. The larger the extinction coefficient the more particles (Biological or Non-Biological) are present within the water column which affect light penetration.

Station 7 had the lowest EC value, this was expected as it was located in more oceanic water, which had little turbidity and was very clear. Other stations were closer to land and pollution sources, in particular Station 6 which was most heavily influenced by the harbour and surrounding drains. Station 6 had the highest value, which is showed the greatest loss of light with depth. This indicated a greater presence of particles (Figure 5-31). Station 6 was also the turbid.

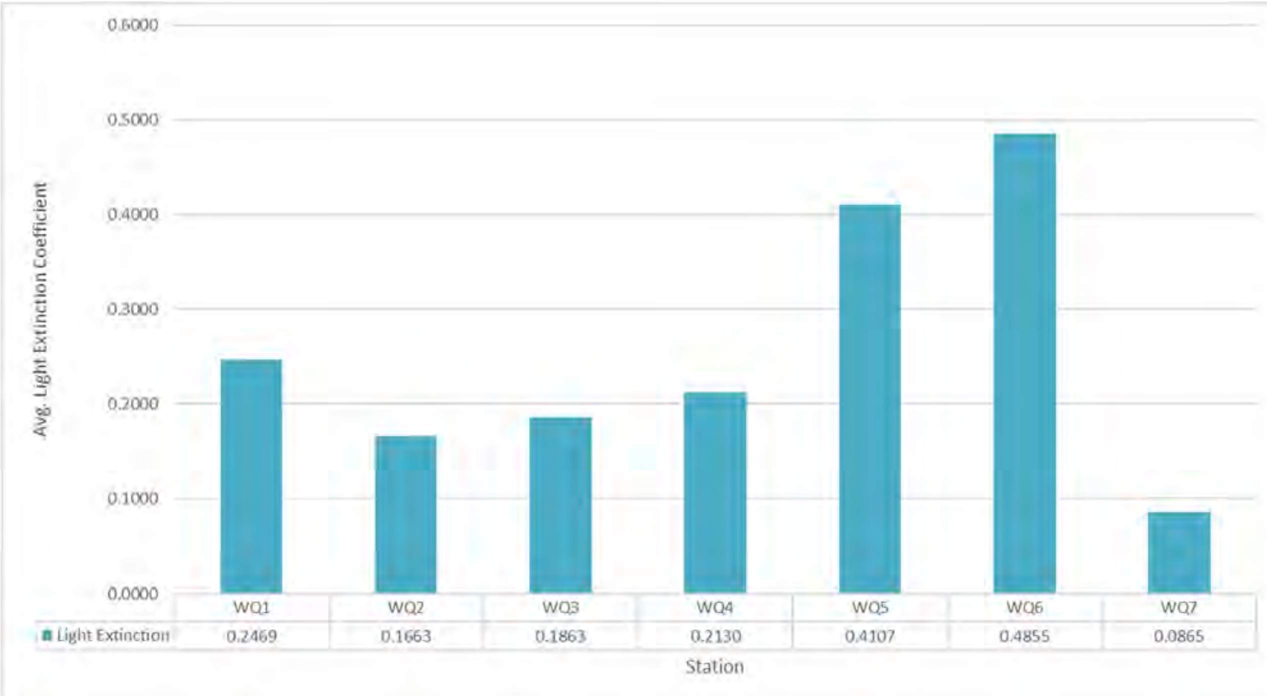


Figure 5-31 Average light extinction at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (EC)

Current Study

There were temporal and spatial variations in EC values. The mean Extinction coefficient was 0.2665, with high fluctuations about the mean, demonstrated by a high coefficient of variation (71.67%CV). The spatial coefficient of variations across the seven stations sampled demonstrated high fluctuations with %CV values ranging from 60.84% to 84.33% with lower results for the temporal values, which ranged from 27.98% to 64.45% across the six runs.

There were no significant spatial or temporal differences in EC (ANOVA $p>0.05$), the lowest EC values were observed during November. Variation in extinction coefficient values in seawater pertains to the variability in light absorption and scattering as it travels through the water column. Suspended sediments and dissolved organic matter primarily influence these coefficients. Similar extinction coefficient values suggest that differences in factors that could impact them, like turbidity, were not significant.

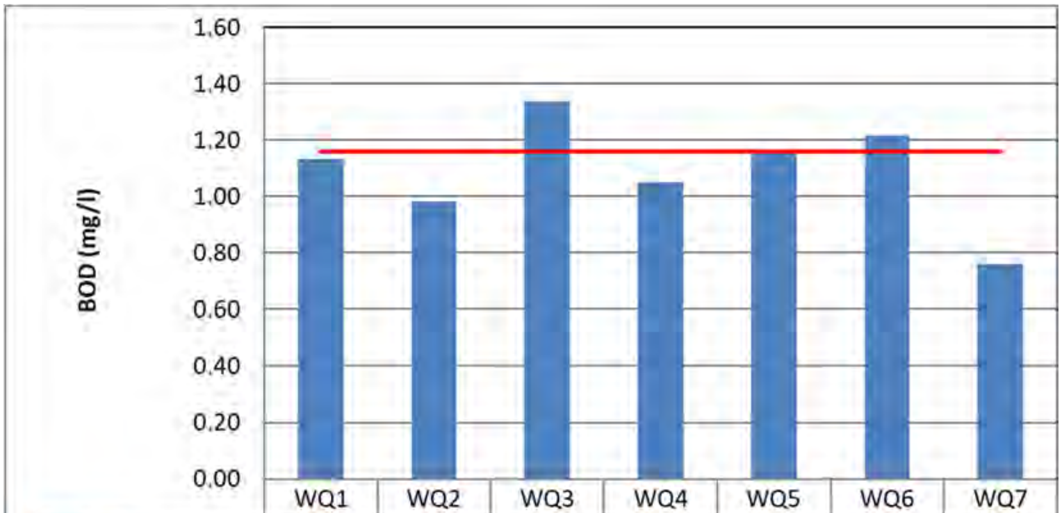
Historical

There was no historical data for extinction coefficient.

Biological Oxygen Demand (BOD)

Biological oxygen demand (BOD) represents the amount of oxygen which is consumed by bacteria and other microorganisms while they decompose organic matter. Some common BOD sources include decomposing plants and animals, wastewater and urban and terrestrial run off. High BOD values may indicate pollution and degraded water quality, whereas low BOD values suggest better water quality conditions conducive to supporting life and ecosystem functions.

Average BOD values were compliant for all stations except stations 3, and 6 which were slightly above the NEPA Standard (Figure 5-32). Both Stations 3 to 6 are likely influenced by nearshore runoff and pollution from drains. Station 3 had the highest average BOD, was located closest to a large drainage.



	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7
BOD	1.13	0.98	1.34	1.05	1.16	1.22	0.76
NEPA std.(high)	1.16	1.16	1.16	1.16	1.16	1.16	1.16

Figure 5-32 Average Biological Oxygen Demand (mg/l) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (BOD)

Current Study

There was high temporal and spatial variations in BOD values. The mean BOD was 1.09(mg/l), with high fluctuations about the mean, demonstrated by a high coefficient of variation (82.67%CV). The spatial coefficient of variations across all stations, demonstrated high fluctuations with %CV values ranging from 15.18% to 75.10% with higher results for the temporal values, which ranged from 55.96% to 112.14% across. These results indicate that there was high variation across the seven stations for the six months sampled.

There were no significant spatial differences in BOD (ANOVA $p>0.05$) however there was significant differences between temporal variations. June(wet) was significantly higher than May(dry), August (wet) and October(wet). which had peak BOD values, while the lowest BOD values were observed during May, August and October.

Significantly higher BOD observed in June compared to May, August, and October is likely due to increased organic material input from rainfall runoff, higher temperatures enhancing microbial activity, and changes in hydrodynamic conditions during the wet season. These factors combine to create conditions that elevate BOD levels, reflecting a higher demand for oxygen due to the decomposition of organic matter.

Historical

There was no historical data available for BOD.

Total Suspended Solids (TSS)

TSS measures the concentration of particulate matter suspended in the water column that exceed 2 microns in size. TSS values lower than 20mg/l often indicate clear water.

All average TSS values low (Figure 5-33), This indicates clear water through the study area, which is further illustrated by low turbidity levels.

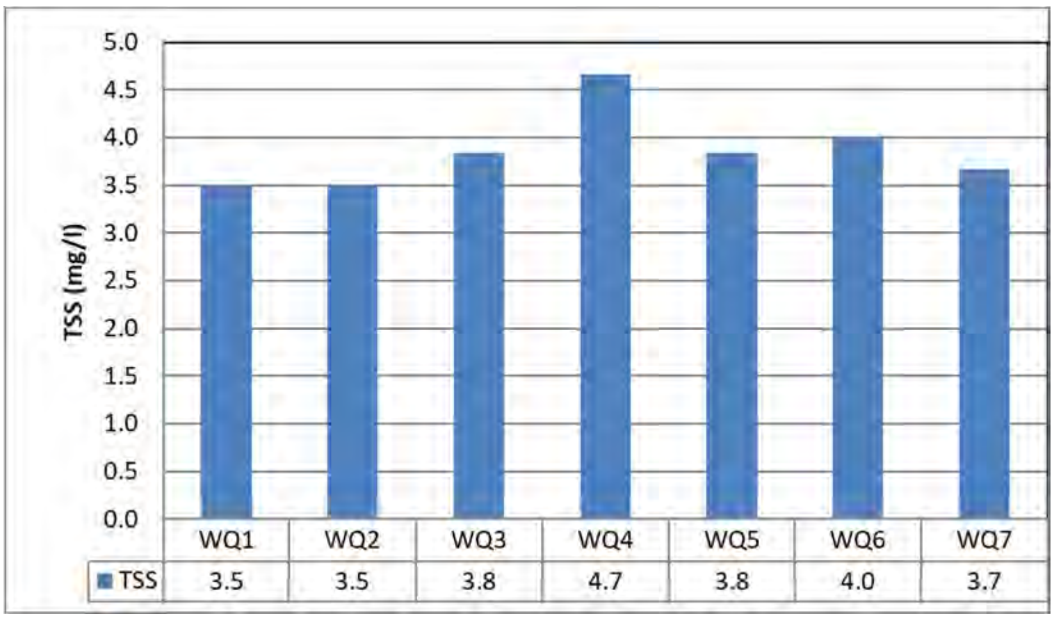


Figure 5-33 Average Total Suspended Solid (mg/l) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (TSS)

Current Study

There was minimal temporal and spatial variation in TSS. The mean TSS was 3.86(mg/l), with low fluctuations about the mean, demonstrated by a low coefficient of variation (1.38%CV). The spatial coefficient of variations across stations demonstrated low fluctuations with %CV values ranging from 0.00% to 1.67% with comparable results for the temporal values, which ranged from 0.30% to 2.18%. These results indicate that there was minor variation across the seven stations for the six months sampled.

Historical

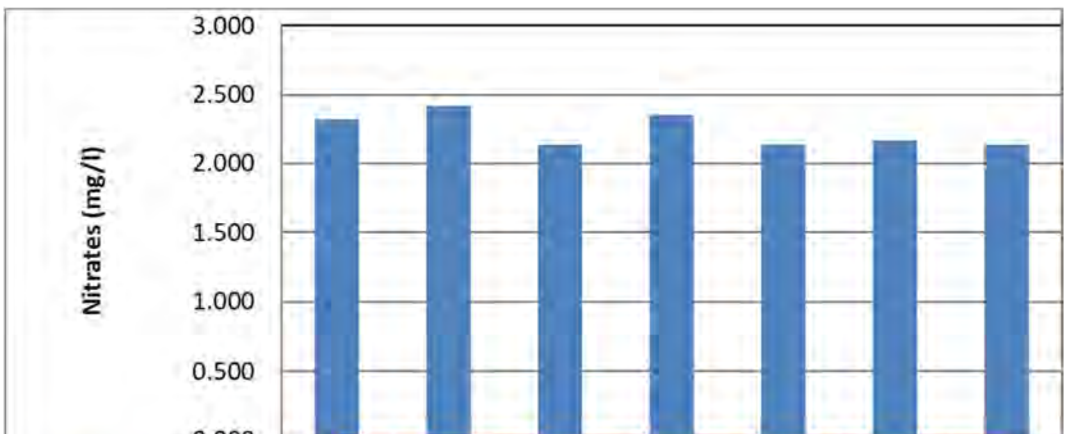
There were no significant spatial differences in TSS (ANOVA p>0.05), however there were significant temporal differences. TSS values were significantly higher historically when compared to the current study. The decrease in TSS may be as a result of the observed decrease in TSS values in the current study compared to historical data may be due to improvements in drainage made during Phase 1 of the hotel as well as.

Nitrates

Nitrates are essential nutrients for plant growth, but excessive amounts in marine water environments can lead to various environmental problems. High nitrate levels are due to water contamination from wastewater, land run-off via drains and gullies or fertilizers and can cause increased growth of algae which can result in decreased levels of dissolved oxygen leading to eutrophication.

Jamaica's coastal waters frequently exceed standard nitrate levels due to factors such as agricultural runoff, wastewater discharge, and land-based pollution. This ongoing issue contributes to nutrient enrichment, leading to potential eutrophication and adverse impacts on marine ecosystems and water quality.

All stations were non-compliant (above) NEPA standards for nitrates .(Figure 5-34).



	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7
NIT	2.317	2.417	2.133	2.350	2.133	2.167	2.133
NEPA std.(high)	0.014	0.014	0.014	0.014	0.014	0.014	0.014
NEPA std.(low)	0.007	0.007	0.007	0.007	0.007	0.007	0.007

Figure 5-34 Average Nitrate (mg/l) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (NITRATES)

Current Study

There was high temporal and spatial variation in nitrates. The mean nitrates was 2.24(mg/l), with fluctuations about the mean, demonstrated by a high coefficient of variation (18.05%CV). The spatial coefficient of variations all stations demonstrated high fluctuations with %CV values ranging from 8.97% to 28.13% with comparable results for the temporal values, which ranged from 8.84% to 36.15%. These results indicate that there was high variation across the seven stations for the six months sampled.

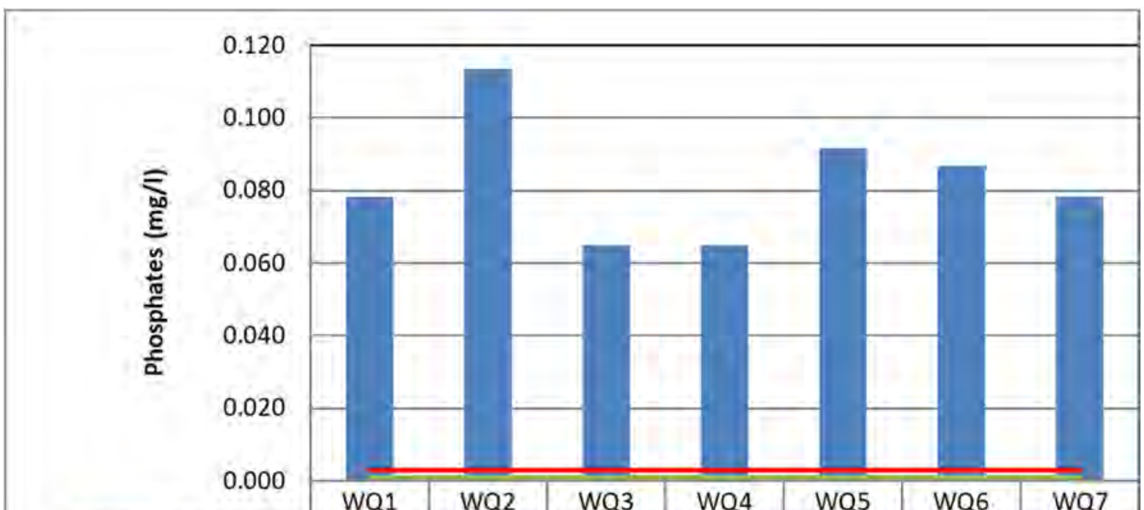
Historical

There were no significant spatial differences in nitrate levels (ANOVA $p>0.05$), but there was significant temporal variation, between 2007 and all other years. 2007 was significantly lower. This difference may be explained by variations in environmental conditions and natural processes; however, it is more likely as a result of lab analysis techniques and equipment.

Phosphates

Phosphates are essential nutrients for plant growth, but like nitrates, excessive amounts in can lead to various environmental problems. High phosphate levels are likely due to water contamination from poor agricultural practices, runoff from urban areas, or improper discharge from sewage treatment plants.

All stations were non-compliant (above) NEPA Standards of 0.001-0.003 mg/l. with phosphate values ranging from 0.065 – 0.112 mg/l above the NEPA standards. These results are consistent for nearshore coastal waters in Jamaica. (Figure 5-35).



	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7
PHOS	0.078	0.113	0.065	0.065	0.092	0.087	0.078
NEPA std.(low)	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEPA std.(high)	0.003	0.003	0.003	0.003	0.003	0.003	0.003

Figure 5-35 Average Phosphate (mg/l) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (PHOSPHATES)

Current Study

There was high spatial and temporal variation, the mean phosphate values were 0.08(mg/l). Fluctuations about the mean, demonstrated by a high coefficient of variation (68.47%CV). The spatial coefficient of variations across all stations demonstrated high fluctuations with %CV values ranging from 32.20% to 77.73% with similarly high results for the temporal values, which ranged from 45.97% to 95.95% across the six runs. These results indicate that there was high variation across all stations.

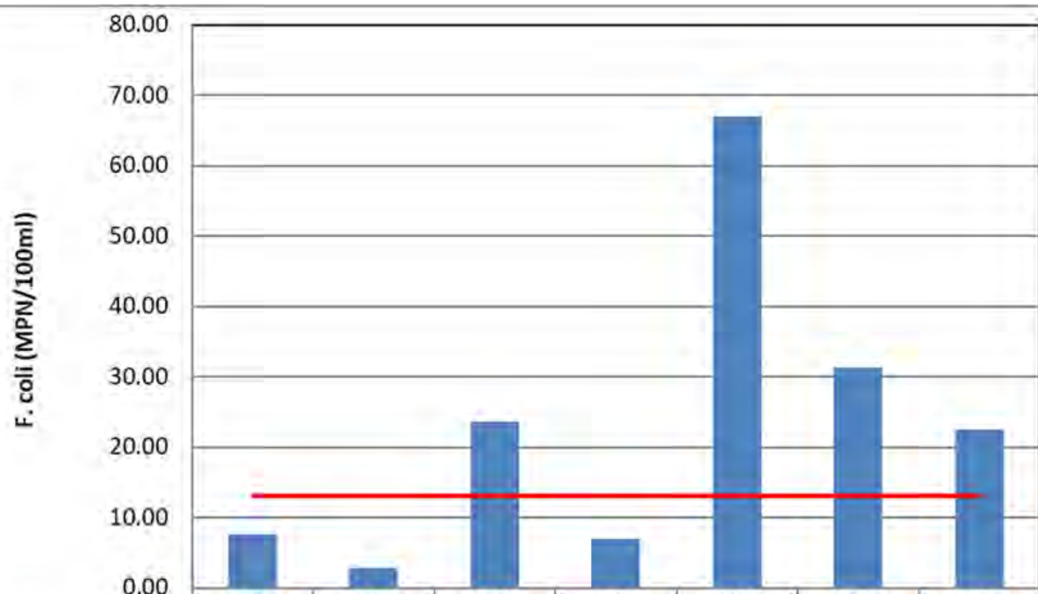
Historical

Phosphate levels have risen notably over time, with significant spatial variation observed specifically between Stations 2 and 6. However, ANOVA analysis revealed no significant spatial differences in phosphate levels across all other stations ($p>0.05$). This indicates that while there are marked differences in phosphate concentrations between certain stations, these differences are not consistent across all locations. The increased levels of phosphates over time may suggest changes in nutrient input or environmental conditions affecting the study area.

Faecal Coliform

Faecal coliforms are a subgroup of bacteria that are commonly found in the intestines of warm-blooded animals, including humans, and are excreted in their faeces. High faecal coliform levels are due to water contamination from wastewater and terrestrial run off.

Faecal coliform levels exceeded NEPA standards of <2 MPN/100mL at Stations 3, 5, 6, and 7, with the highest concentration observed at Station 5 (Figure 5-36). Notably, Station 5 also recorded the lowest pH and dissolved oxygen (DO) levels, suggesting that the location may be experiencing pollution from the two nearby outfalls and may have experienced upwellings



	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6	WQ7
F.COLI	7.70	2.75	23.55	6.92	67.02	31.37	22.57
NEPA std.(high)	13	13	13	13	13	13	13

Figure 5-36 Average Faecal Coliform (MPN/100m) at the seven stations sampled(2023 - 2024)

STATISTICAL ANALYSIS (FAECAL COLIFORM)

Current Study

The mean faecal coliform concentration was 23.12 MPN/100mL, with significant spatial and temporal variation. The coefficient of variation (CV) for faecal coliforms was notably high at 150.46%, indicating substantial fluctuations around the mean. Spatially, the CV ranged from 0.00% to 166.78% across the seven stations, while temporally, it ranged from 52.49% to 205.99% across six runs.

Among all sampled parameters, faecal coliform had the highest CV, likely due to the wide range of possible readings, from 1.1 to 120 MPN/100mL. These results highlight significant variability across all stations.

Historical

F. Coliform values have reduced significantly over time, (ANOVA $p<0.05$). There was no significant difference in spatial variation (ANOVA $p>0.05$). Reduced levels of F. Coliform may again suggest improvements in water quality as a result of changes to some drainage areas during phase 1 of the development.

Total Petroleum Hydrocarbons (TPH)

Total Petroleum Hydrocarbons (TPH) refer to a broad family of several hundred chemical compounds that originally come from crude oil. TPH is a mixture of hydrocarbons that are found in various forms, such as alkane, and aromatics. These compounds can be found in petroleum products like gasoline, diesel fuel, jet fuel, and heating oil.

TPH can enter the environment through spills, leaks, or improper disposal of petroleum products as well as Industrial processes, transportation, and improper handling of fuel and oil. This contamination can result in various environmental impacts as it can be toxic and carcinogenic, which can lead to detrimental effects on plant and animals and pose significant health risks to humans.

No traces of total petroleum hydrocarbons (TPH) were detected at any of the stations sampled (2023 - 2024).

5.1.7.4 Discussion

The study area can generally be classified as mesotrophic, reflecting moderate nutrient levels and balanced productivity. However, variability exists within the area, with specific locations showing tendencies toward different trophic states. Stations 3, 5, and 6 exhibit eutrophic characteristics, characterized by higher nutrient levels and productivity, which may lead to algal blooms and reduced water clarity. Conversely, Station 7, situated in more oceanic waters, displays oligotrophic traits, marked by low nutrient levels and high water clarity. Despite these observations, the overall analysis did not reveal statistically significant spatial differences in most parameters across the study area.

There were minimal significant spatial differences between stations (ANOVA $p>0.05$), indicating water quality homogeneity for most parameters. However, significant spatial variations were noted in pH, Dissolved Oxygen (DO), and Phosphates, likely influenced by anthropogenic pollution sources from drains located between Stations 3 and 6. Station 5, in particular, showed notably low DO and pH levels likely due to upwellings, influences from the harbour and low circulation. Microhabitat variations further contribute to the small spatial differences observed across the study area.

Temporal analysis comparing historical data from 2006 to 2008 with current samples from 2023 and 2024 showed significant changes for all parameters except nitrates. These results indicate that water quality has improved in some parameters and declined in others.

- Temperature: Increased temperatures, primarily due to climate change, have contributed to decreased water quality. Rising temperatures enhance thermal stress on marine organisms and disrupt their metabolic and reproductive processes.
- Salinity: Salinity levels have increased, likely due to changes in drainage patterns and climate change. While current levels are within safe thresholds, ongoing monitoring is necessary to prevent potential negative impacts.
- pH: The observed decrease in pH over time correlates with rising temperatures and ocean acidification. Lower pH values can adversely affect marine life, particularly those with calcareous shells or skeletons, by impeding their ability to maintain calcium carbonate structures.

- Dissolved Oxygen (DO): A decline in DO levels indicates eutrophic conditions, driven by excess nutrients from runoff and upwellings. Reduced DO levels can lead to hypoxic conditions, stressing marine life and disrupting ecological balance.
- Total Suspended Solids (TSS): A decrease in TSS levels is a positive sign of improved water quality, likely due to improved drainage patterns that have reduced sediment runoff and enhanced water clarity.
- Faecal Coliforms: A significant decrease in faecal coliform levels reflects improved water quality, attributed to better drainage management and reduced contamination from wastewater and other sources.
- Phosphates: Increased phosphate levels indicate reduced water quality, associated with runoff and upwellings. Elevated phosphates contribute to eutrophication, exacerbating algal blooms and further decreasing dissolved oxygen levels.

Overall, the project highlights both improvements and concerns in water quality parameters. Continued monitoring and adaptive management are essential to address the impacts of climate change and anthropogenic activities on the marine environment. While improving drainage in the area may help to improve water quality the study has also revealed that upwellings may be a source of excess nutrients and pollutants and therefore highlighting importance of improving land-based activities of surrounding communities.

5.1.8 Noise

5.1.8.1 Background

Sound is an integral part of everyday life. It provides enjoyable experiences such as listening to music or the singing of birds, facilitates spoken communication, and serves as an alert or warning system through sounds like ringing telephones or wailing sirens. Hearing, one of the five human senses, involves the ear, where sound stimulates structures that trigger nerve signals to the brain for processing. Additionally, sound aids in quality evaluations and diagnoses, such as identifying a chattering car valve, a squeaking wheel, or a heart murmur (Brüel & Kjær, 1984).

Noise, defined as unwanted sound lacking agreeable musical quality, becomes problematic when its effects are undesirable (Agarwal, 2009). Considered a pollutant, noise can be measured and has adverse effects on humans, their environment, including land, structures, domestic animals, and natural wildlife and ecological systems (Agarwal, 2009).

Types of Noise

Noise can be categorized into three main types (Campbell, 2014):

1. Continuous/Steady Noise: Characterized by small fluctuations in its level within the observation period.

2. Intermittent Noise: Noise levels that are interrupted by periods of low sound levels, which can be regular or irregular.
3. Impulse Noise: Noise that occurs almost instantaneously with a sharp sound, such as the bang of a gun or a pile driver.

Noise Propagation in Air and Water

Noise propagation differs significantly between air and water in terms of speed, attenuation, frequency range, and environmental factors.

SPEED OF SOUND

- Air: At room temperature (20°C or 68°F), sound travels at approximately 343 meters per second (m/s).
- Water: Sound travels much faster, around 1482 m/s at 20°C, with variations due to temperature, salinity, and pressure.

ATTENUATION

- Air: Sound attenuates quickly due to air's lower density and the presence of obstacles, with higher frequencies attenuating more rapidly.
- Water: Sound travels much farther before attenuating, especially at low frequencies, due to water's higher density and fewer obstructions in open water.

FREQUENCY RANGE

- Air: Human hearing ranges from approximately 20 Hz to 20 kHz, with effective propagation within this range, suitable for higher-frequency sounds.
- Water: Human hearing underwater is limited and shifts in frequency sensitivity. Underwater sounds, often from marine animals or sonar, use lower frequencies (10 Hz to a few kHz) for better long-distance propagation.

ENVIRONMENTAL FACTORS

- Air: Factors like humidity, wind, temperature gradients, and obstacles (buildings, trees) significantly affect sound propagation.
- Water: Sound propagation is influenced by temperature gradients (thermoclines), salinity (haloclines), and pressure, creating layers and channels that affect sound travel, often resulting in complex propagation paths.

In summary, sound travels faster and farther in water compared to air, with less attenuation, especially at lower frequencies. The environmental conditions affecting sound propagation differ significantly between the two media, influencing how sound is transmitted and perceived.

5.1.8.2 Methodology

Noise meters were set up at six (6) noise monitoring stations (Table 5-13 and Figure 5-37) in an outdoor measuring system. A windscreen (sponge) was placed over the microphone to prevent measurement errors due to wind noise. The microphone was positioned approximately 1.5 meters above the ground, with no vertical reflecting surfaces within 3 meters (10 feet). The noise meters were calibrated pre-and post-noise assessment by using a Brüel & Kjaer Type 4231 sound calibrator (Appendix 3).

Noise level readings were recorded using the Brüel & Kjaer noise analysers setup at each station for 72 hours, from 12:00am Wednesday July 5th, 2023, to 12:00am Saturday July 8th, 2023; one exception was the meter at Station 6, which ran for 48 hours from 12:00am Friday June 23rd, 2023, to 12:00am Sunday June 25th, 2023. The meters were programmed to collect third octave, average sound level (Leq) over the period, Lmin (the lowest level measured during the assessment) and Lmax (the highest level measured during the assessment) every second. The octave band analysis was conducted concurrently with the noise level measurements. Since measurements were taken in the third octave, it provided thirty-three (33) octave bands from 12.5 Hz to 20 kHz (low, medium and high frequency bands).

Noise statistics (L_{10} and L_{90}) were also calculated at each location.

Table 5-13 Noise and particulate monitoring location coordinates (JAD2001)

Station	Eastings	Northings	Notes
GP NP 1	627939.1032	700604.2463	Northwestern Boundary of Phase 2
GP NP 2	627885.8432	700446.8871	Southwestern Boundary of Phase 2
GP NP 3	628209.0349	700659.9273	Northern Boundary of Phase 2 (Existing Phase 1 hotel)
GP NP 4	628127.9343	700408.1525	Eastern Boundary of Phase 2
GP NP 5	627956.0496	700187.8495	Southern Boundary of Phase 2
GP NP 6	628021.4142	699921.5492	Offsite

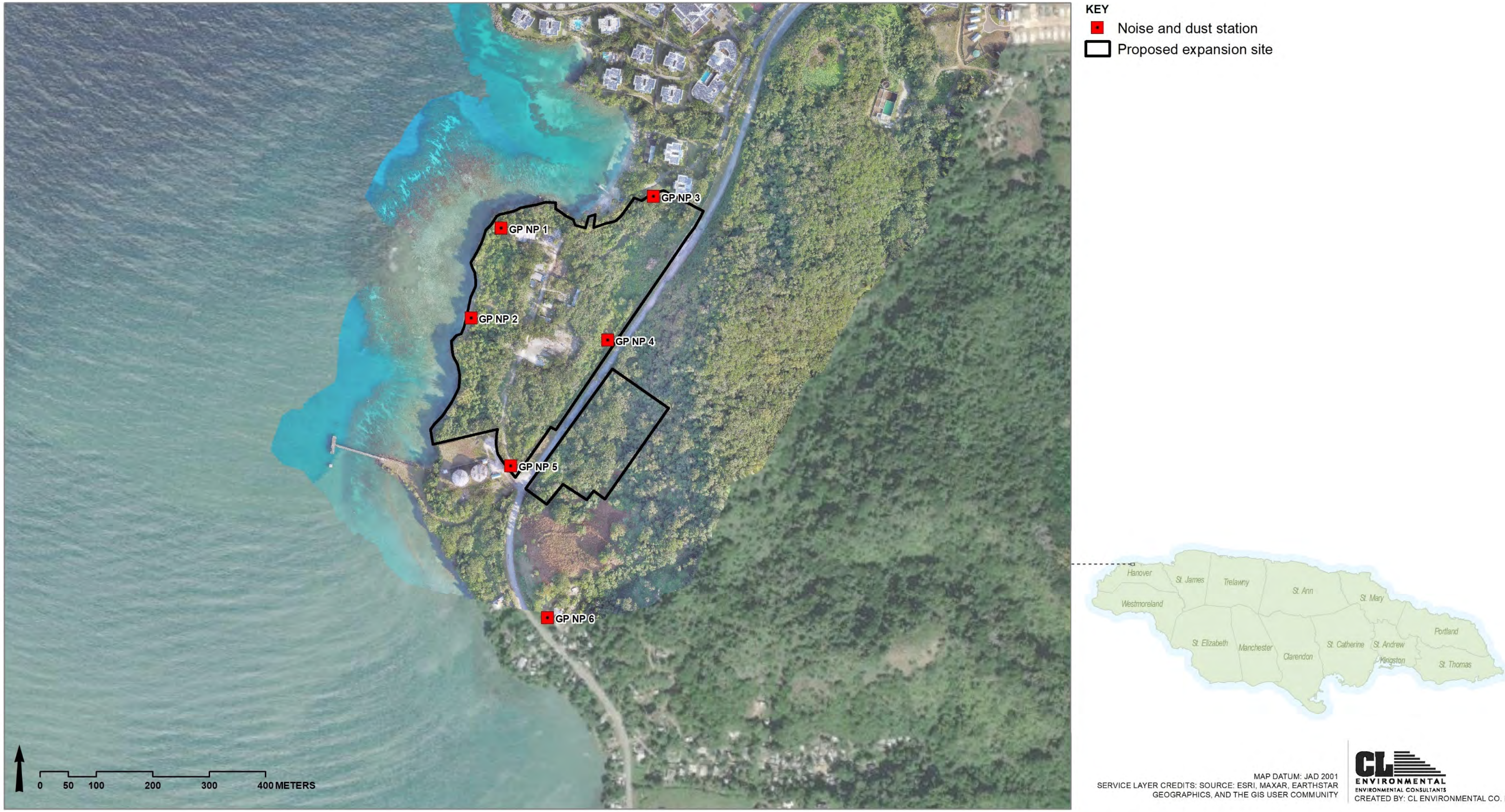


Figure 5-37 Location of noise and particulate monitoring stations

5.1.8.3 Results

Table 5-14 shows the minimum, maximum and average noise levels over the 72-hour assessment period, as well as the geometric mean centre frequencies obtained at each station. The meter at Station 6 ran for 48 hours from June 23-25, 2023.

Table 5-14 Ambient Noise data at all stations

Stn.#	Average Leq (72 hr)	Min (dBA)	Max (dBA)	Geometric Centre Frequency (Hz)	Octave Band Range (Hz)
N1	54.7	30.5	89.0	4000	3565-4488
N2	57.8	34.5	79.0	80, 4000	71-90, 3565-4488
N3	58.3	34.0	93.7	63	56-71
N4	65.8	31.2	101.3	63	56-71
N5	62.9	35.1	82.0	63	56-71
N6	64.8	28.5	103.0	63	56-71

STATION 1

During the assessment period, noise levels at this station ranged from a low (Lmin) of 30.5 dBA to a high (Lmax) of 89.0 dBA. Average noise level for this period was 54.7 L_{Aeq}. The fluctuation in noise levels over the period is depicted in Figure 5-38. The noise meter at this station only ran for 17 hours (from 12:00am – 7:00pm) due to battery failure.

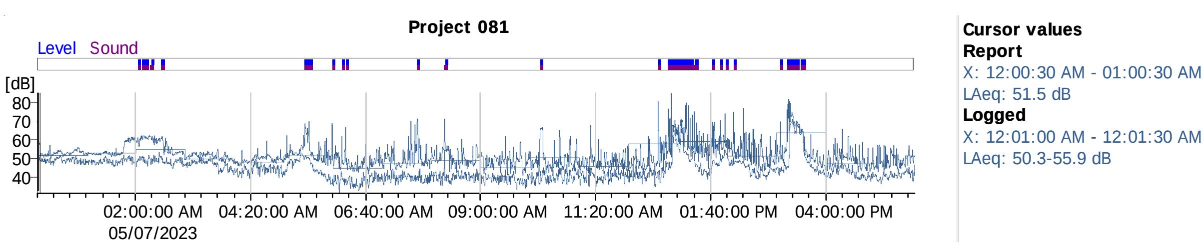


Figure 5-38 Noise fluctuation (Leq) at Station 1

OCTAVE BAND ANALYSIS AT STATION 1

The noise at this station during the assessment period was in the high frequency band with a dominant geometric mean frequency of 4000 Hz (Octave frequency range is 3565-4488 Hz) (Figure 5-39).

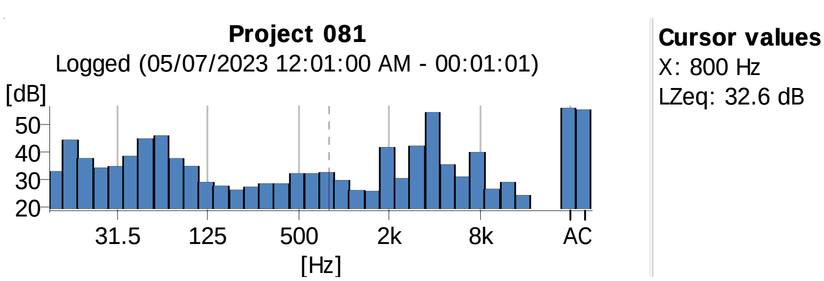


Figure 5-39 Octave band spectrum of noise at Station 1

L10 AND L90

The two most common $\mathbf{L_n}$ values used are $\mathbf{L_{10}}$ and $\mathbf{L_{90}}$ and these are sometimes called the 'annoyance level' and 'background level' respectively. $\mathbf{L_{10}}$ is almost the only statistical value used for the descriptor of the higher levels, but $\mathbf{L_{90}}$, is widely used to describe the ambient or background level. L10-L90 is often used to give a quantitative measure as to the spread or "how choppy" the sound was.

L10 is the noise level exceeded for 10% of the time of the measurement duration. This is often used to give an indication of the upper limit of fluctuating noise, such as that from road traffic. L90 is the noise level exceeded for 90% of the time of the measurement duration.

The overall L10 and L90 at this station for the time assessed were 53.5 dBA and 40.9 dBA respectively.

STATION 2

During the 72-hour period, noise levels at this station ranged from a low (Lmin) of 34.5 dBA to a high (Lmax) of 79.0 dBA. Average noise level for this period was 57.8 L_{Aeq} (72h). The fluctuation in noise levels over the 72-hour period is depicted in Figure 5-40.

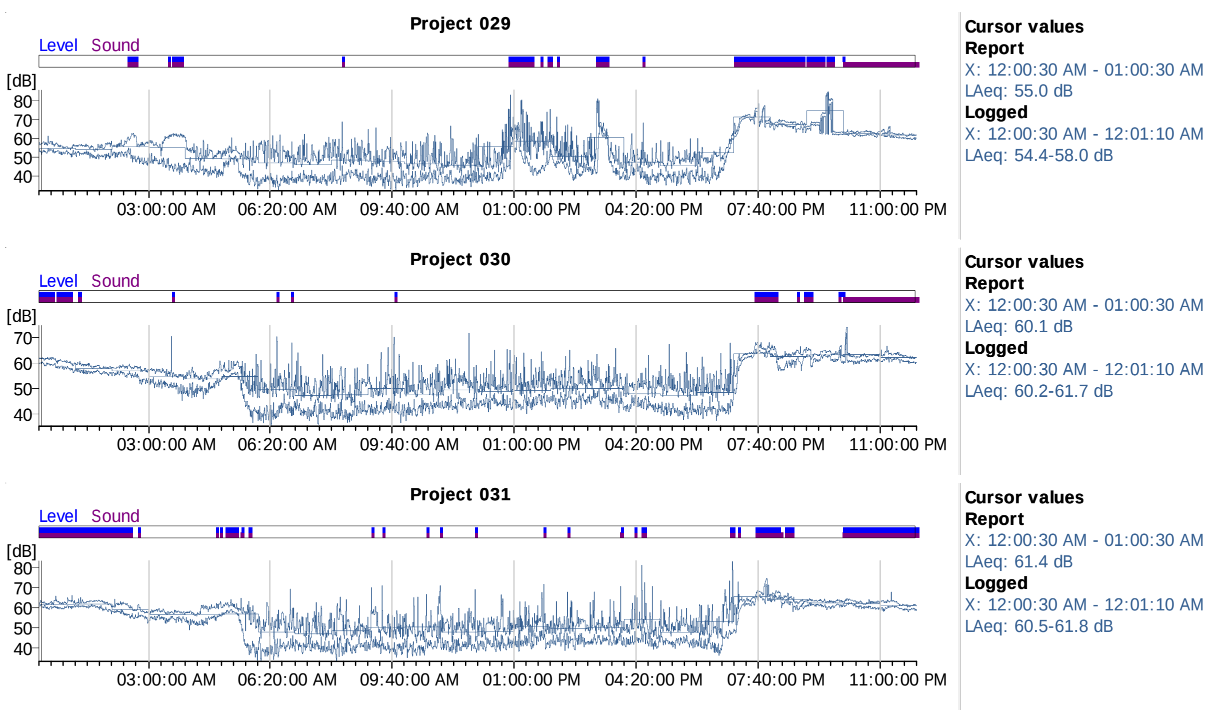


Figure 5-40 Noise fluctuation (Leq) over 72 hours at Station 2 (top: July 5, middle: July 6, bottom: July 7)

OCTAVE BAND ANALYSIS AT STATION 2

The noise at this station during the 72-hour period was in the low and high frequency band with a dominant geometric mean frequency of 80 Hz. (Octave frequency range is 71 - 90 Hz), and 4000 Hz (Octave frequency range is 3565-4488 Hz) (Figure 5-41).

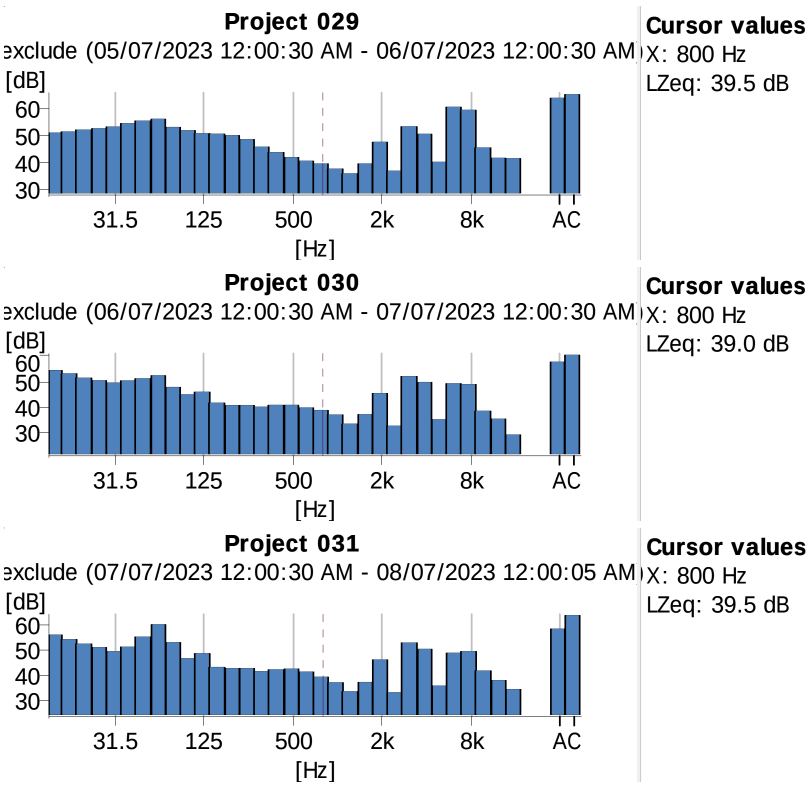


Figure 5-41 Octave band spectrum of noise at Station 2 (top: July 5, middle: July 6, bottom: July 7)

L10 AND L90

The overall L10 and L 90 at this station for the time assessed were 62.6 dBA and 43.5 dBA respectively.

STATION 3

During the 72-hour period, noise levels at this station ranged from a low (Lmin) of 34.0 dBA to a high (Lmax) of 93.7 dBA. Average noise level for this period was 58.3 L_{Aeq} (72h). The fluctuation in noise levels over the 72-hour period is depicted in Figure 5-42.

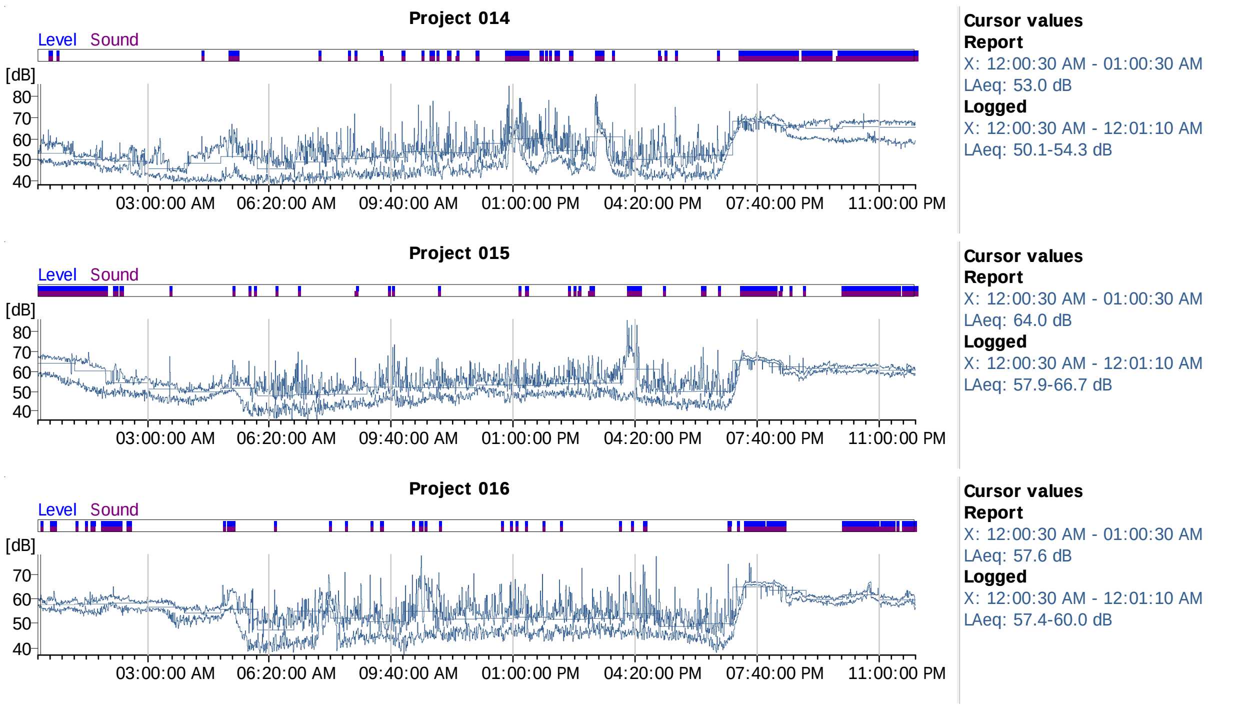


Figure 5-42 Noise fluctuation (Leq) over 72 hours at Station 3 (top: July 5, middle: July 6, bottom: July 7)

OCTAVE BAND ANALYSIS AT STATION 3

The noise at this station during the 72-hour period was in the low frequency band centred around the geometric mean frequency of 63 Hz. (Octave frequency range is 56 – 71 Hz) (Figure 5-43).

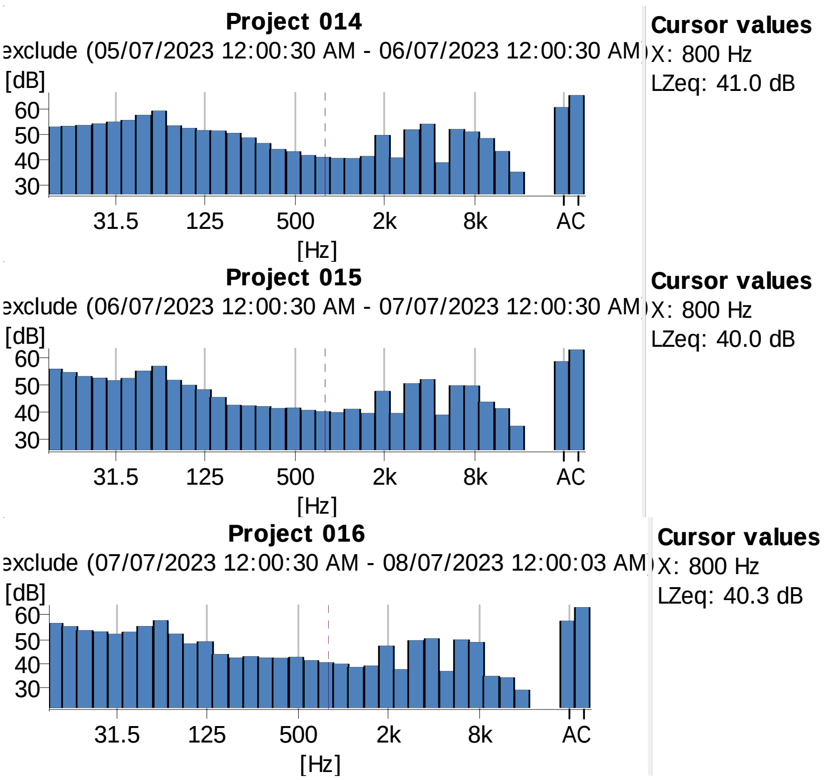


Figure 5-43 Octave band spectrum of noise at Station 3 (top: July 5, middle: July 6, bottom: July 7)

L10 AND L90

The overall L10 and L90 at this station for the time assessed were 62.8 dBA and 45.4 dBA respectively.

STATION 4

During the 72-hour period, noise levels at this station ranged from a low (Lmin) of 31.2 dBA to a high (Lmax) of 101.3 dBA. Average noise level for this period was 65.8 L_{Aeq} (72h). The fluctuation in noise levels over the 72-hour period is depicted in Figure 5-44.

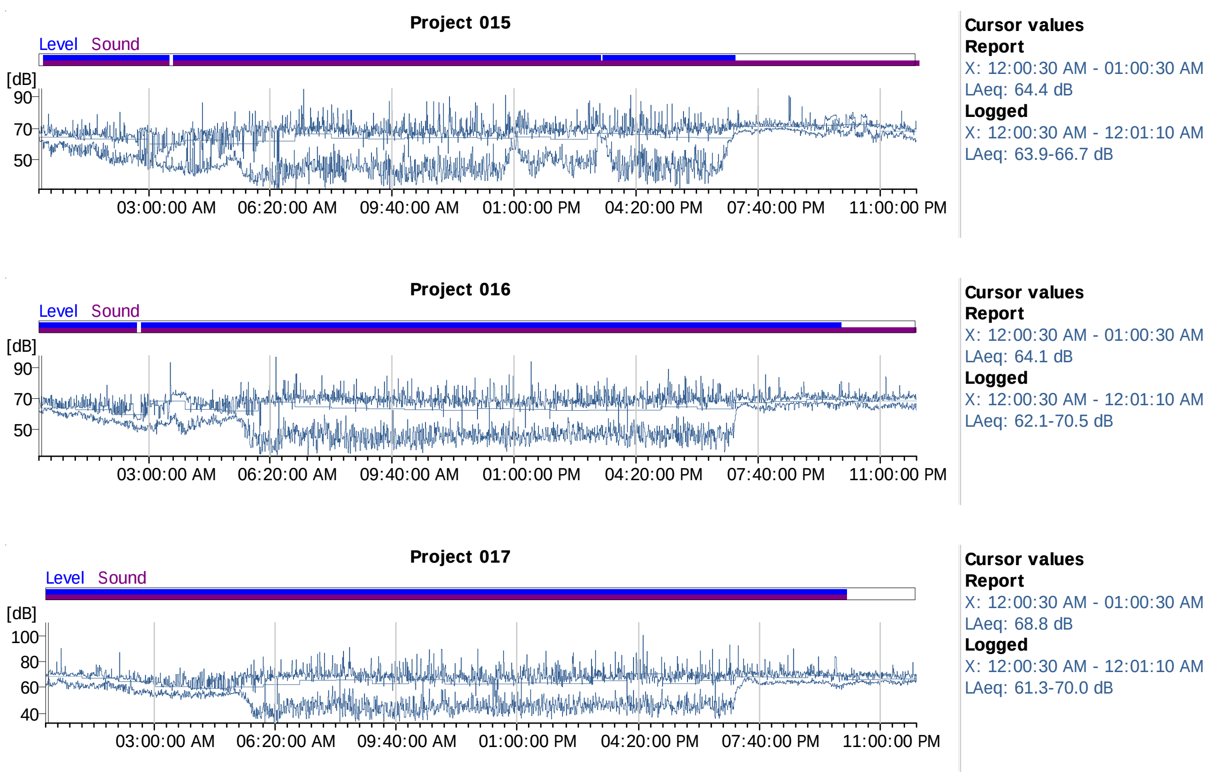


Figure 5-44 Noise fluctuation (Leq) over 72 hours at Station 4 (top: July 5, middle: July 6, bottom: July 7)

OCTAVE BAND ANALYSIS AT STATION 4

The noise at this station during the 72-hour period was in the low frequency band with a dominant geometric mean frequency of 63 Hz. (Octave frequency range is 56 - 71 Hz) (Figure 5-45).

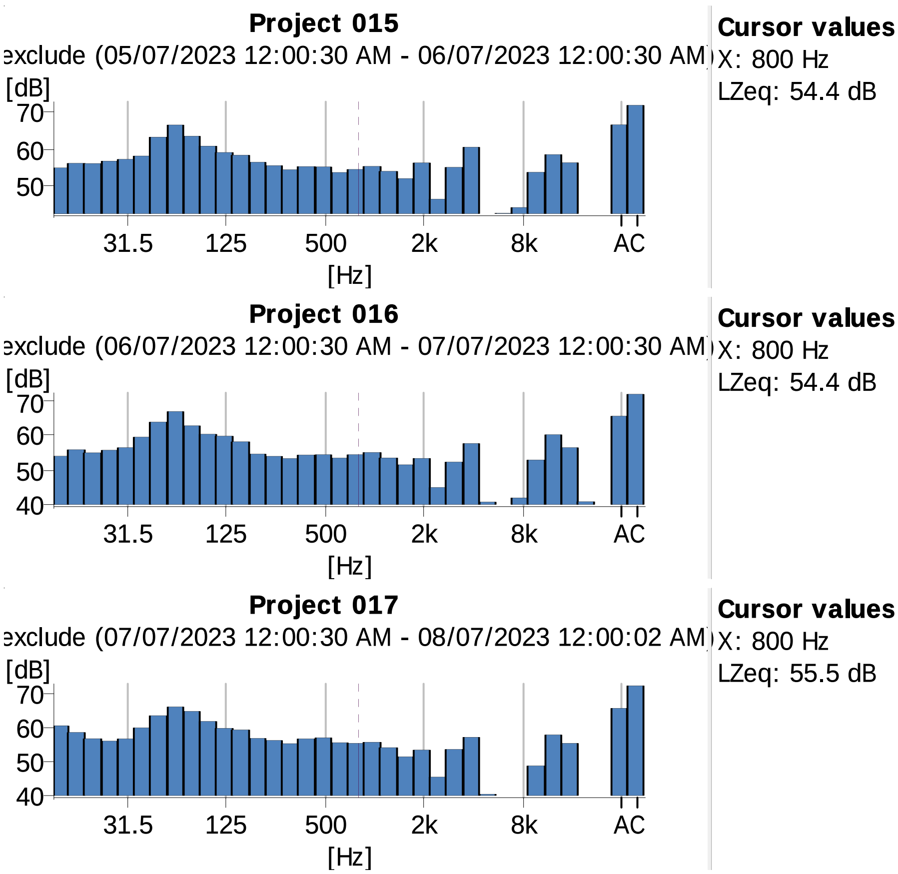


Figure 5-45 Octave band spectrum of noise at Station 4 (top: July 5, middle: July 6, bottom: July 7)

L10 AND L90

The overall L10 and L 90 at this station for the time assessed were 68.0 dBA and 47.3 dBA respectively.

STATION 5

During the 72-hour period, noise levels at this station ranged from a low (Lmin) of 35.1 dBA to a high (Lmax) of 82.0 dBA. Average noise level for this period was 62.9 L_{Aeq} (72h). The fluctuation in noise levels over the 72-hour period is depicted in Figure 5-46.

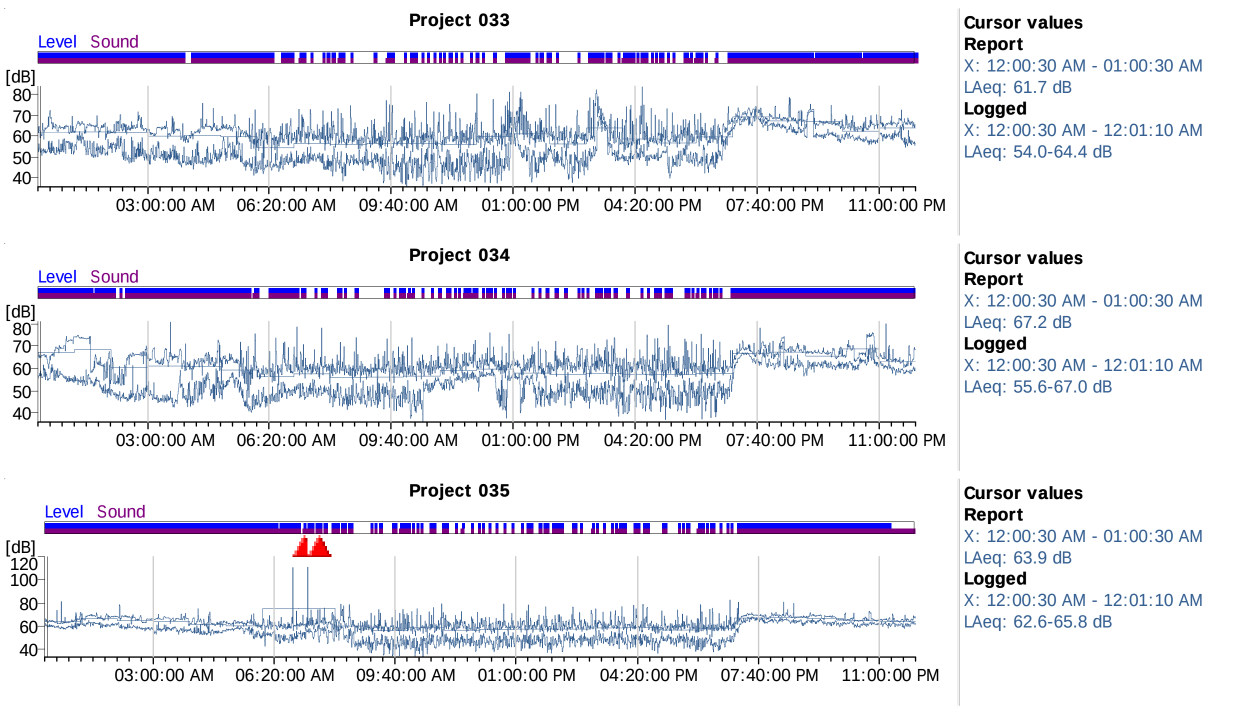


Figure 5-46 Noise fluctuation (Leq) over 72 hours at Station 5 (top: July 5, middle: July 6, bottom: July 7)

OCTAVE BAND ANALYSIS AT STATION 5

The noise at this station during the 72-hour period was in the low frequency band centred around the geometric mean frequency of 63 Hz (octave frequency range is 56 - 71 Hz) (Figure 5-47).

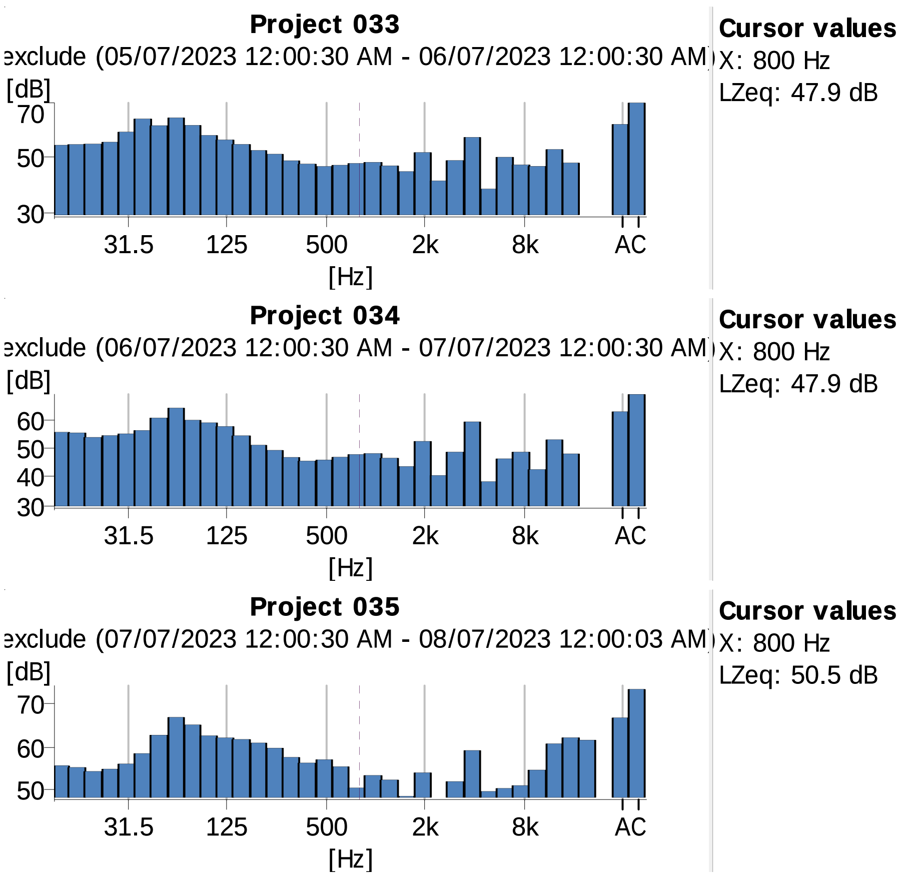


Figure 5-47 Octave band spectrum of noise at Station 5 (top: July 5, middle: July 6, bottom: July 7)

L10 AND L90

The overall L10 and L90 at this station for the time assessed were 66.6 dBA and 49.8 dBA respectively.

STATION 6

During the 48-hour period, noise levels at this station ranged from a low (Lmin) of 28.5 dBA to a high (Lmax) of 103.0 dBA. Average noise level for this period was 64.8 L_{Aeq} (48h). The fluctuation in noise levels over the 48-hour period is depicted in Figure 5-46.

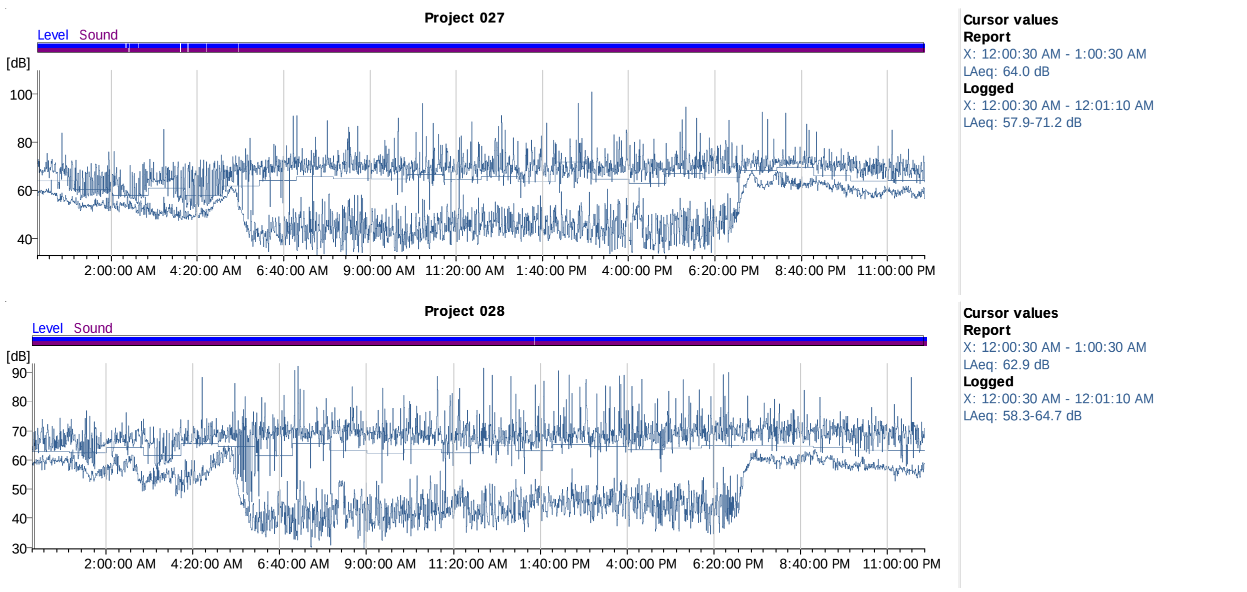


Figure 5-48 Noise fluctuation (Leq) over 48 hours at Station 6 (top: June 23rd, bottom: June 24th)

OCTAVE BAND ANALYSIS AT STATION 6

The noise at this station during the 48-hour period was in the low frequency band centred around the geometric mean frequency of 63 Hz (octave frequency range is 56 - 71 Hz) (Figure 5-47).

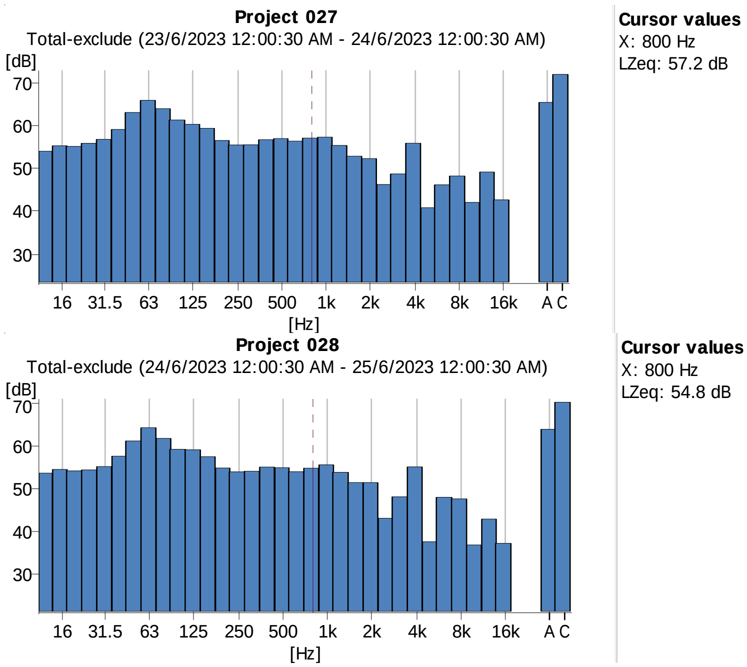


Figure 5-49 Octave band spectrum of noise at Station 6 (top: June 23rd, bottom: June 24th)

L10 AND L90

The overall L10 and L90 at this station for the time assessed were 67.2 dBA and 45.9 dBA respectively.

Comparisons of Ambient Noise Levels with NRCA Daytime and Night-Time Guidelines

Comparison of the ambient noise levels in the study area with the Natural Resources and Conservation Agency (NRCA) Standards are shown in Table 5-15. During the daytime, noise levels at all Stations were compliant with respective NRCA daytime standards, except Station 4 (65.4 dBA) and Station 6 (65.0 dBA). During the night-time, noise levels at all Stations were compliant with respective NRCA night-time standards, except Station 4 (63.9 dBA), Station 5 (62.8 dBA) and Station 6 (64.1 dBA).

Daytime noise sources detected which were above NRCA daytime guideline values, included: motor vehicle noises (from main road) and bird calls (Station 4 and Station 6).

Night time noise sources detected which were above NRCA night time guideline values, included: frogs calling, crickets chirping, motor vehicle noises (Stations 4, 5 and 6), and birds calling (Station 6).

Table 5-15 Comparison of daytime and night-time noise levels at the stations with the NRCA guidelines

Stn.#	Zone	7 am. - 10 pm (dBA)	NRCA Standard (dBA)	10 pm. - 7 am (dBA)	NRCA Standard (dBA)
1	Commercial	51.4	*65*	50.2	*60*
2	Commercial	51.5	*65*	57.0	*60*
3	Commercial	54.4	*65*	55.6	*60*
4	Commercial	65.4	*65*	63.9	*60*
5	Commercial	59.3	*65*	62.8	*60*
6	Residential	65.0	*55*	64.1	*50*

NB. Numbers in red are non-compliant with the standard/guideline.

5.1.9 Particulates

5.1.9.1 Definitions

Coarse particles are airborne pollutants that fall between 2.5 and 10 micrometres in diameter. Fine particle are airborne pollutants that fall below 2.5 micrometres in diameter. Sources of coarse particles include crushing or grinding operations and dust stirred up by vehicles traveling on roads. Sources of fine particles include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes.

5.1.9.2 Methodology

PM10 and PM2.5 particulate sampling exercises were conducted at the six (6) locations (where noise monitoring was conducted) for 24 hours each over the course of nine (9) months using Airmetrics Minivol Tactical Air Samplers (Calibration Certificate in Appendix 4). The locations are listed in Table 5-13 and illustrated in Figure 5-37. The sampling exercises were conducted from 12:00am – 12:00am, the PM2.5 being run on days coinciding with the US EPA 3-day cycle, and the PM10 being run on days coinciding with the US EPA 6-day PM10 cycle. Sampling days spanned 23 June 2023 to 28 March 2024, taking into account both wet and dry seasons.

5.1.9.3 Results

Average PM10

The averaged results of the PM10 sampling over the 9-month sampling period is shown in Table 5-16. All locations had average particulate PM10 values compliant with the 24-hour NRCA standard of 150 µg/m^3. Detailed PM10 data can be seen in Appendix 5.

There were no PM10 sampling days which occurred on days where rainfall was recorded by the on-site weather station (Appendix 5).

Table 5-16 Average PM 10 Results

STATION	AVERAGE PM10 RESULT (µg/m³)	RANGE (µg/m³)	NRCA STD. (µg/m³)
STN 1	36.36	1.81 – 133.47	150
STN 2	33.99	1.67 – 259.86	150
STN 3	26.21	0.28 – 68.06	150
STN 4	30.69	1.53 – 137.50	150
STN 5	32.21	0.97 – 139.03	150
STN 6	41.85	3.61 – 323.47	150

Values in red are non-compliant with NRCA standards

Average PM2.5

The averaged results of the PM2.5 sampling over the 9-month sampling period is shown in Table 5-17. All locations had average particulate PM2.5 values compliant with the 24-hour USEPA PM2.5 standard of 35µg/m³. Detailed PM2.5 data can be seen in Appendix 5.

There were two (2) PM2.5 sampling days (January 22, 2024, and March 4, 2024) which occurred on days where rainfall was recorded by the on-site weather station. 8.11 mm of rain was recorded on January 22nd, while 0.25 mm of rain was record on March 4th. On both of these days, PM2.5 concentrations were still elevated at all stations, relative to other sampling days on which there was no rainfall. Sources of PM2.5 fine particulates include all types of combustion, including motor vehicles, residential wood burning, and agricultural burning.

There were incidences of burning of bushes being commonly observed in proximity to Station 4. In addition, Stations 4 and 6 were in closest proximity to the main road and potentially impacted by vehicular exhaust emissions. Stations 3, 4 and 6 had the most incidences of non-compliant PM2.5 sampling days, equalling to six, four and four respectively, compared to the other stations which had no more than two days in which concentrations were non-compliant with the USEPA PM2.5 standard of 35 µg/m³. Although Station 3 had the most non-compliant sampling days (6), the overall average PM2.5 concentration remained low compared to the other stations. There is one outlier which occurred which elevates the average PM2.5 concentration for Station 3. This reading occurred on February 3rd, 2024, and had a PM2.5 concentration of 129.31 µg/m³.

Table 5-17 Average PM 2.5 Results

STATION	AVERAGE PM2.5 RESULT (µg/m³)	RANGE (µg/m³)	USEPA STD. (µg/m³)
STN 1	19.45	2.08 – 42.78	35
STN 2	17.42	0.28 – 37.92	35
STN 3	23.81	0.42 – 129.31	35
STN 4	20.06	0.14 – 45.28	35
STN 5	18.87	3.19 – 40.14	35
STN 6	22.80	4.86 – 55.14	35

Values in red are non-compliant with NRCA standards

5.1.10 Existing Pollution Sources

The marine environment in the study area is likely being impacted by multiple pollution sources. These sources may be contributing to the degradation of water quality and overall health of various ecosystems. The following are identified as pollution sources:

- Waste materials from market activities, including plastic, food waste, and other debris, are often improperly disposed of, leading to litter accumulation in the surrounding areas and ultimately in the marine environment (Plate 5-4).
- The Harbour has several drains and gullies which act as conduits for pollutants, including litter, oils, and other contaminants, which are washed into the marine environment during rainfall events or through direct discharge.
- Rivers flowing into the harbour carry various pollutants from upstream areas, including agricultural runoff and sewage. These contaminants contribute to the overall pollution load in the marine environment.
- Hotels and their guests generate litter, including single-use plastics and other waste materials which may enter the marine environment.
- Sections of the current project site have been used for years by Grand Palladium Hotel as a storage site and dump site for solid waste, plastics, construction debris, old tiles and old furniture etc. These have the ability to act as habitats and breeding grounds for mosquitos and disease-carrying vermin alike. Over time, rain water can dissolve contaminants contained in the various types of waste, resulting in these contaminants leaching into the soil and ultimately the groundwater.
- Contaminants from various sources, including agricultural activities and improper waste disposal, can leach into the groundwater. Polluted groundwater can then enter the marine environment through subsurface flows.
- Residential areas contribute to marine pollution through improper disposal of sewage and litter. Inadequate sewage treatment and disposal systems lead to direct discharge of untreated or partially treated sewage into the marine environment.
- Various commercial activities, including those from nearby garages, gas stations, and restaurants, may contribute to pollution. These operations can release oils, chemicals, and other waste materials that make their way into the marine environment through runoff and direct discharge.
- Operations associated with the port, including loading and unloading of goods, generate waste and pollutants. These activities can lead to spills and runoff.

Plate 5-4 **Example of solid waste and marine debris littered around Lucea Harbour**

5.2 BIOLOGICAL

5.2.1 Terrestrial Environment

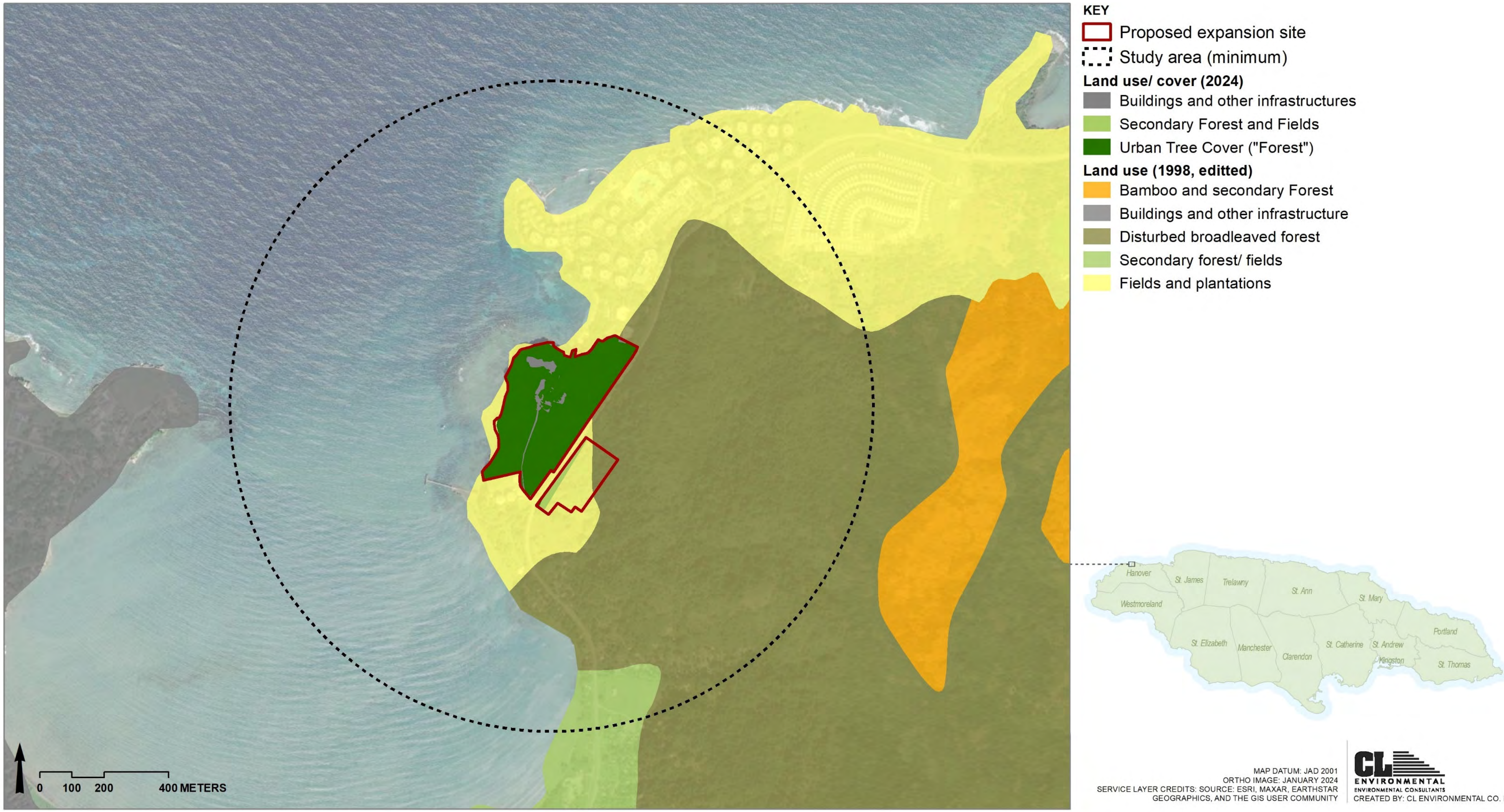
5.2.1.1 Terrestrial Vegetation

Classification

Based on the Forestry Department 1998 land use map, the 1km study area is dominated by disturbed broadleaved forest, with plantation type cover along the northern and western coastline. The general terrestrial vegetation within the bounds of the project site was classified primarily as urban tree cover (forest) (Forestry Department, 2023) (Figure 5-50).

The vegetation in the general area has also been categorized previously by Environmental Science & Technology Limited as follow: 1. A lowland coastal zone and 2. An elevated coastal zone s (Environmental Science & Technology Limited, 2005). The lowland coastal zone is said to have been characterized by vegetation, typically found along Jamaica's north coast; some of the coastal plant species that were recorded in that report included: Sea Grape (*Coccoloba uvifera*), White Mangrove (*Laguncularia racemosa*), Black mangrove (*Avicennia germinans*), Seaside purslane (*Sesuvium portucalastrum*) and Beach Morning Glory (*Ipomea pescaprae*). Some of the terrestrial plant species that were reported include: Guinep (*Melicoccus bijugatus*), Wild Poponox (*Acacia tortuosa*), Guango (*Samanea saman*) and West Indian Almond (*Terminalia catappa*).

Section 5.2.1.1provides a detailed current account of the terrestrial floral component in the project area.



Data source: Forestry Department (1998 and 2023)

Figure 5-50 Land vegetation cover within the 1km study area

Flora Survey

APPROACH

The flora assessment of the area interest involved two (2) main components: general vegetation assessment (to determine the flora composition), and a large tree assessment. The assessments were conducted between January 19th and 21st, 2024.

Vegetation Assessment

A comprehensive vegetation assessment was conducted to provide a detailed description of the flora at the site, with special emphasis on rare, endemic, protected, or endangered species. Six belt transects, T1 to T6, each spanning 100 meters in length, were established (Figure 5-51). The starting point for each transect was randomly determined within the project boundary. Along each 100-meter stretch, an area of 2.5m width on either side of the transect was assessed, resulting in a total surveyed area of 500m² per transect. All plant species encountered along each transect were recorded. The DAFOR scale of relative abundance was used to rank the flora identified in the study.

The common names of most of the species sighted were assigned in-situ. In the case of unknown species, voucher specimens were collected and identified using material at the University of the West Indies (UWI) Herbarium. All plants were identified to the species level by examining morphological features such as leaf arrangement, leaf pattern, and pattern of branching and morphology of floral and fruiting structure in conjunction with the use of Flowering Plants of Jamaica (Adams 1972).

Large Tree Assessment

An assessment of the large trees, defined as trees with diameter at breast height (DBH) > 25cm, was carried out on the property. For each tree encountered that fell into this category, the species, measured DBH reading and estimated height and GPS coordinate of its location was recorded. Pink flagging tape was used to mark each tree (Plate 5-5). In instances where endemic trees were encountered, they were similarly measured and recorded, but using orange flagging tape.

Plate 5-5 Large tree tagged and marked

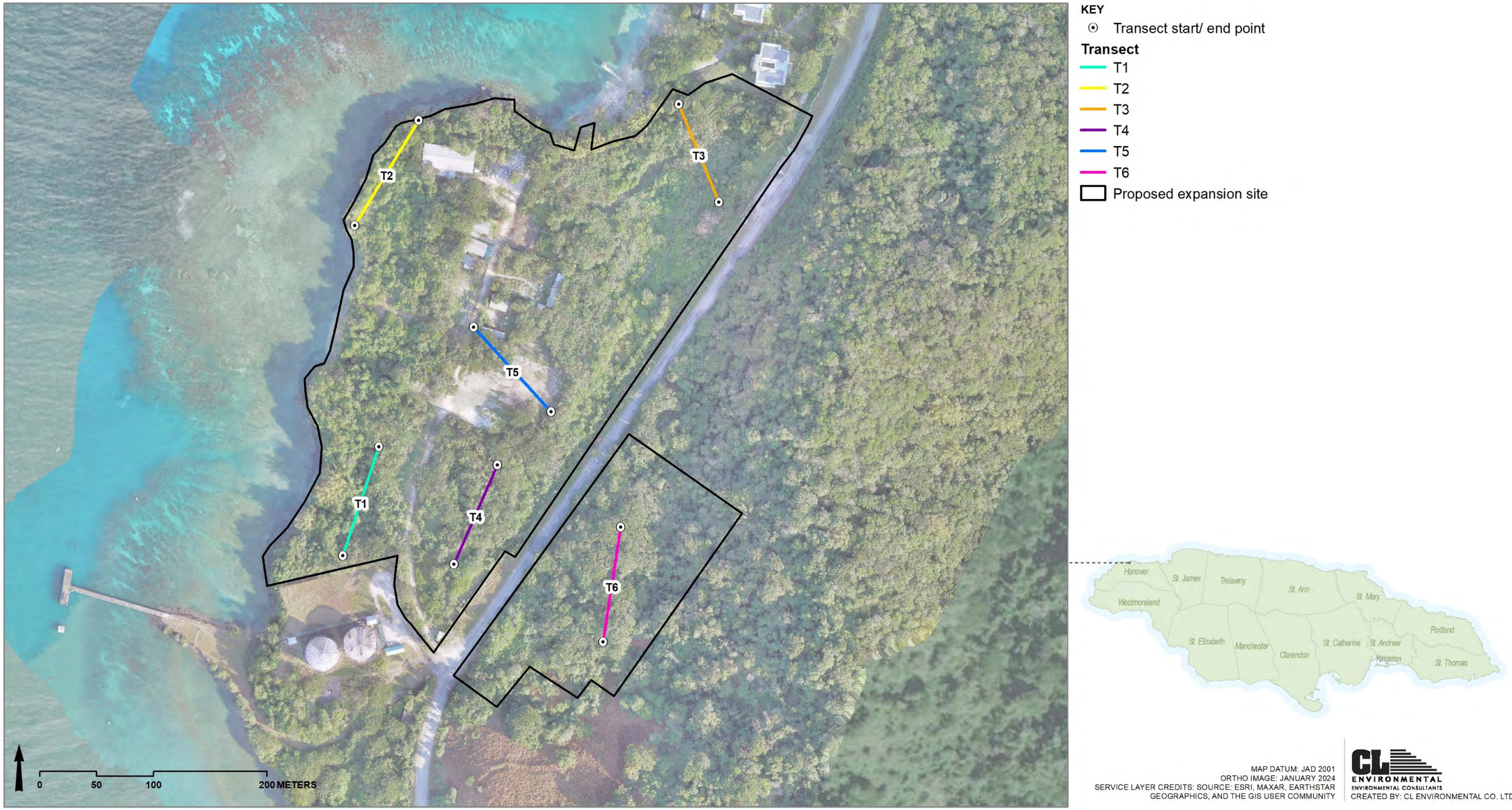


Figure 5-51 Terrestrial transect locations

RESULTS AND DISCUSSION

Vegetation Assessment

The proposed development area is comprised of land that can be characterised, for the most part, as degraded coastal forest (historically Dry Limestone Forest). The property has seemingly been subject to vast land clearance over the years, and the vegetation currently present is primarily secondary vegetation (Plate 5-6 and Plate 5-7).

Plate 5-6 Degraded coastal vegetation observed within the project boundary

Plate 5-7 Vast cleared area surrounded by secondary vegetation

The study area overall showed relatively high species diversity; a total of 128 plant species from 48 families were recorded across all transect combined (Table 5-18). Most of the plants observed were classified as trees and shrubs, along with a few climbers, and grasses. Most plant species encountered during the assessment are described (Adams, 1972) as commonly found in thickets, wastelands, and secondary woodlands. The majority of the plant species can further be classified as plants associated with anthropogenic disturbances, dry forest and coastal areas, and plants used for ornamental purposes.

Plate 5-8 Example of vegetation found on site (*Physalis angulate*)

Table 5-18 Plant species identified along each transect within the project area, along with the DAFOR ranking for each plant for the respective transect

*Key: *- Endemic Species; **- Invasive Alien Species (IAS): Please note: DAFOR scale (i.e., D=dominant, A= abundant, F= frequent, O=occasional and R=rare).*

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Fabaceae	*Abrus precatorius*	John Crow Bead	Common, in thickets, hedgerows and on fences, mostly in rather dry areas	O		F	F		O
Mimosaceae	*Acacia farnesiana*	Cassie Flower	Naturalized locally, in secondary woodlands and thickets on arid limestone		R				
Mimosaceae	*Acacia macracantha*	Park Nut	Common locally in secondary thickets on arid limestone	R		R	O		R
Mimosaceae	*Acacia tortuosa*	Wild Poponax	Locally very common, along the south coast and on some cays, on arid limestone and at salina margins	R		O		R	
Amaranthaceae	*Achyranthes indica*	Devil's Horsewhip	Common as a weed of cultivation and disturbed waste places					F	
Pteridaceae	*Adiantum pyramidale*	Pyramid Maidenhair		R					R
Sapindaceae	*Allophylus jamaicensis*		Occasional in the central and western parishes, in woodland on limestone						R

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Amaranthaceae	*Alternanthera ramosissima*		Occasional and often gregarious on roadside banks, probably originally escaped from gardens					R	
Fabaceae	*Alysicarpus vaginalis*	Medina	Frequent, in sandy waste places, cultivations and rough pastures					O	
Amaranthaceae	*Amaranthus viridis*	Callaloo	Common as a weed of grassy places and open ground					O	
Bromeliaceae	*Ananas comosus*	Pineapple	Widely grown in Jamaica, both commercially and in private gardens; sometimes becoming naturalized						R
Poaceae	*Andropogon pertusus*	Seymour Grass	Abundant in the drier more disturbed areas		O				R
Poaceae	*Arundo donax*	Giant Reed	Locally abundant, gregarious along sheltered or open streambanks and riverbanks					O	
Poaceae	*Bambusa vulgaris***	Common Bamboo	Cultivated and naturalized, forming extensive growths			R			
Caesalpiniaceae	*Bauhinia divaricata*	Bull Hoof	Common in thickets and open woodlands on limestone, mostly in rather dry or well-drained areas	O	R				R
Asteraceae	*Bidens pilosa*	Spanish Needle	A common weed of roadsides and waste places			R		O	
Acanthaceae	*Blechum pyramidatum*		Common as a weed of roadsides, field margins and waste places				F		
Sapindaceae	*Blighia sapida*	Ackee	Commonly cultivated and naturalized			O	R	R	O
Nyctaginaceae	*Boerhavia coccinea*	Hog Weed	Common, as a weed of rough disturbed pastures, waste places and sand dunes					R	
Nyctaginaceae	*Boerhavia diffusa*		Locally common in waste sandy or gravelly places					F	
Burseraceae	*Bursera simaruba*	Red Birch	Common in woodland on limestone	R	O				R
Cyperaceae	*Carex polystachya*		Locally common on path side banks and in rocky thickets and woodlands			R			
Caricaceae	*Carica papaya*	Papaya	Common in cultivation, hardly naturalized			R		R	
Moraceae	*Cecropia peltata*	Trumpet Tree	Common, especially on recently cleared forested land	O		O			R
Vitaceae	*Cissus sicyoides*	Soldier Wiss	Very common, on trees, walls, fences and in thickets			O	F		F
Cleomaceae	*Cleome spinosa*		Locally common weed of open ground, dry river beds, gully banks and roadsides			R			R
Cleomaceae	*Cleome viscosa*	Wild Caia	Common as a weed of disturbed ground and gravelly waste places			R		O	

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Polygonaceae	*Coccoloba swartzii*		Common in savannas, thickets and woodlands		O				R
Polygonaceae	*Coccoloba uvifera*	Sea Grape	Common and locally dominant along the seacoast on strand, sand dunes and in thickets, rare inland	R	F				
Arecaceae	*Cocos nucifera*	Coconut	Commonly cultivated			R			
Bignoniaceae	*Cordia collococca*	Clammy Cherry	Common in thickets and along roadsides and pasture margins	R		R	R		F
Boraginaceae	*Cordia gerascanthus*	Spanish Elm	Common on limestone hills mostly in dry areas	O		O	R	R	F
Bignoniaceae	*Crescentia cujete*	Calabash	Common along roadsides and in old pastures, thickets and woodland margins	R			R		R
Fabaceae	*Crotalaria verrucosa*	Blue Rattleweed	Common, along roadsides and in waste places and pasture margins			R		F	
Euphorbiaceae	*Croton linearis*	Wild Rosemary	Very common, mainly on coastal limestone rocks but also inland on well drained calcareous or serpentine soil	R	F		O		
Sapindaceae	*Cupania glabra*	Wild Ackee	Widely scattered and rather local in thickets and woodlands mostly in low-lying poorly drained areas	O			R		O
Asteraceae	*Cyanthillium cinereum*		Very common, a weed of pastures and waste places					F	
Poaceae	*Dactyloctenium aegyptium*		Occasional in open sandy or gravelly waste places and shingle near the sea, a weed					F	
Fabaceae	*Desmodium incanum*		Common in pastures and on banks				F		R
Fabaceae	*Desmodium scorpiurus*		Rather common, a weed of sandy pastures and roadsides and rocky or stony waste ground		R				
Fabaceae	*Desmodium tortuosum*		Rather common, on roadside banks and in waste places	R		F	O		
Fabaceae	*Desmodium triflorum*		Very common, in pastures, lawns and waste ground			O	F		O
Poaceae	*Echinochloa colonum*		Widely distributed and locally common in ditches, low-lying open waste places					O	
Myrtaceae	*Eugenia axillaris*	Black Cherry	Common in thickets, wooded hillsides and upland pastures	O	O	R			O
Asteraceae	*Eupatorium odoratum*	Jack in the Bush	Very common as a weed of pastures and clearings on limestone places generally		R		O	R	
Euphorbiaceae	*Euphorbia heterophylla*	Japanese Poinsettia	Occasional in the central and eastern parishes, a weed of roadside banks and open waste places			R			

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Euphorbiaceae	*Euphorbia hyssopifolia*		Common and abundant locally as weed of waste places					O	
Rutaceae	*Fagara martinicensis*	Prickly Yellow	Common, especially in secondary formations	R		O	R		R
Moraceae	*Ficus perforata*	Cherry Fig	Common as an epiphyte or in woodland margins on limestone	R	O				R
Moraceae	*Ficus pertusa*	Strangler Fig	Very common as epiphyte or in rocky woodland margins	R					R
Fabaceae	*Gliricidia sepium*	Quick Stick	Common, mostly planted in fences and hedgerows			R			
Sterculiaceae	*Guazuma ulmifolia*	Bastard Cedar	Very common along roadsides, in pastures and open secondary woodlands	D		D	D		D
Caesalpiniaceae	*Guilandia bonduc*	Sea Nickol	Common in thickets near the sea	R	O	R	O		
Caesalpiniaceae	*Haematoxylum campechianum***	Log Wood	Common on exposed limestone hillsides in dry secondary thickets	D	A	O			
Boraginaceae	*Heliotropium indicum*	Scorpion Tail	Common as a weed of pastures, cultivated ground and waste places					O	
Malvaceae	*Hibiscus tiliaceus*		Rather local in brackish swamps and inner margins of mangroves				R		
Convolvulaceae	*Ipomoea alba*	Moon Flower	Frequent on fences, roadside thickets and along riverbanks	O				O	R
Convolvulaceae	*Ipomoea horsfalliae*		Frequent in thickets and woodlands on limestone or shale				O		
Convolvulaceae	*Ipomoea nil*		Occasional on fences and in thickets and rough waste places					R	
Convolvulaceae	*Ipomoea tiliacea*	Wild Slip	Very common in woodland and thicket margins and rough grassy places			O			
Convolvulaceae	*Jacquemontia pentantha*		Locally common in the central and western parishes in thickets and rough waste places						R
Zygophyllaceae	*Kallstroemia maxima*		Common, a weed of lawns, field margins and waste places					O	
Verbenaceae	*Lantana camara*	Wild Sage	Very common in rough pastures, waste places and thickets	R	R		R	O	
Poaceae	*Lasiacis divaricata*		Very common in secondary thickets and margins of woodland, mostly on limestone			A		R	
Brassicaceae	*Lepidium virginicum*	Wild Peppergrass	Common as a weed of path sides, cultivations and waste gravelly ground			O			
Mimosaceae	*Leucaena leucocephala***	Lead Tree	Common along roadsides and in sandy waste places and thickets		O	O			

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Malpihiaceae	*Malpighia glabra*	Wild Cherry	Very common in rough pastures, thickets and on rocky ground	R			R		R
Anacardiaceae	*Mangifera indica*	Mango	Cultivated and naturalized	R		R			
Sapindiaceae	*Matayba apetala*	Coby wood	Widely distributed, in rough pastures, secondary woodlands and thickets along streambanks	R			R		O
Sapindaceae	*Melicoccus bijugatus*	Guinep	Common along roadsides and in secondary thickets and woodlands	O		R			O
Malvaceae	*Melochia nodiflora*		Common on limestone roadside and gully banks and in gravely waste places		F		F		
Convolvulaceae	*Merremia tuberosa*	Wood Rose	Occasional, probably originally a garden escape, in roadside thickets and on banks and trees			O			
Convolvulaceae	*Merremia umbellata*	Hog Weed	Common on fences and in thickets and waste places			F			O
Mimosaceae	*Mimosa pudica*	Shame Old Lady	A common weed of pastures and open stabilized waste places			O		O	
Rubiaceae	*Mitracarpus villosus*		Occasional to locally common, a weed of roadsides and waste places					O	
Rubiaceae	*Morinda citrifolia*	Noni	Locally common in open areas near the sea, cultivated inland	R	O			R	
Orchidaceae	*Oeceoclades maculata*	Spotted African Orchid		F			F		R
Onagraceae	*Oenothera sp.*							R	
Poaceae	*Panicum maximum***	Guinea Grass	Very common in rough pastures, ditches and sheltered thickets			D		F	O
Poaceae	*Paspalum vaginatum*		Common along all the seashores and on the cays, in brackish sand and swampy grasslands and on coral limestone		O			F	
Passifloraceae	*Passiflora suberosa*		Common in thickets and waste places, especially in semi-arid woodlands on limestone			O	R		
Sapindaceae	*Paullinia jamaicensis*	Supple Jack	Frequent, in thickets and on rocky limestone banks		O				R
Euphorbiaceae	*Phyllanthus amarus*	Carry-me-Seed	Very common as a weed of waste places and disturbed ground			O		F	R
Euphorbiaceae	*Phyllanthus angustifolius*	Seaside Laurel	Common on rocks, especially near the sea		O				
Euphorbiaceae	*Phyllanthus nutans*		Common and widespread, in rocky woodlands and on well drained slopes in limestone or shale areas		R				

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Solanaceae	*Physalis angulata*	Wild Gouma	Common as a weed of cultivations, alluvial gravel and pasture margins					O	
Myrtaceae	*Pimenta dioica*	Pimento	Common on wooded hillsides	O		R			F
Piperaceae	*Piper amalago*	Jointer	Very common, on gully banks, roadsides and in thickets and woodlands on limestone	O			R		O
Fabaceae	*Piscidia piscidia*	Dog Wood	Common in thickets and woodlands on limestone hills	R	O		R		
Nyctaginaceae	*Pisonia aculeata*	Cockspur	Common in secondary thickets and woodland margins mostly on limestone	O	O				
Mimosaceae	*Pithecellobium unguis-cati*	Bread and Cheese	Common in thickets on arid limestone and forming woodland at salina margins, cultivated as hedge	O			R		
Bignoniaceae	*Pithecoctenium echinatum*	Monkey Comb	Locally common on trees near streams and in gullies	O		R			F
Plumbaginaceae	*Plumbago scandens*	Wild Plumbago	Rather common in hedge banks, on fences and in thickets and waste places on sandy or gravelly soil					R	O
Portulacaceae	*Portulaca oleracea*	Pussley	Very common, a weed of cultivated ground and waste places			R		D	
Fabaceae	*Psophocarpus tetragonolobus*	Manila Bean	Cultivated			R		R	
Commelinaceae	*Rhoeo spathacea*	Mosses in the Bulrushes	Common, on limestone banks and in rocky thickets and woodland margins				R		R
Euphorbiaceae	*Ricinus communis*	Castor Oil	Common as cultivated plant and on waste ground			R		F	
Phytolaccaceae	*Rivina humilis*	Inflamation Weed	Common as a weed of light open woodlands and shaded waste places				R	O	
Arecaceae	*Roystonea princeps**	Morass Royal	Uncommon and rather local, restricted to the western parishes, in small colonies or as scattered individuals on poorly drained lowlands and in morass	O		R	R		F
Acanthaceae	*Ruellia tuberosa*	Duppy Gunshot	Very common in pastures and waste places and on roadside banks			O			
Mimosaceae	*Samanea saman*	Guango	Common in inhabited areas and in old pastures where planted, naturalized in riparian forest and in secondary communities on level ground	O	R	F	F		D

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Cactaceae	*Selenicereus grandiflorus*	Queen-of-the-Night	Common, climbing on trees and on rocks						R
Fabaceae	*Senna occidentalis*	Dandelion	Common in waste places, especially in coastal areas			R		R	
Poaceae	*Setaria palmifolia*		Locally common in the eastern parishes on shaded or open sheltered banks and streambanks					R	
Malvaceae	*Sida acuta*	Broom Weed	Very common in pastures, waste places and cultivation			O	F	F	
Solanaceae	*Solanum americanum*		Common weed of cultivations and disturbed ground	R		R		O	
Poaceae	*Sorghum halepense*	Johnson Grass	Locally common, gregarious and forming colonies, a persistent weed of some pastures and stony waste ground					F	
Bignoniaceae	*Spathodea campanulata***	African Tulip	Commonly planted			A	F	R	A
Asteraceae	*Sphagneticola trilobata*	Creeping Ox-eye	Common in damp pastures on roadside banks and in waste places, trailing on beaches in wet areas and on some of the cays			R	O	R	
Anacardiaceae	*Spondias mombin*	Hog Plum	Common, mostly along roadsides and field margins			R			R
Poaceae	*Stenotaphrum secundatum*	Crab Grass	Common in pastures on heavy poorly drained soils or on coral limestone near sea			R		O	
Malpighiaceae	*Stigmaphyllon emarginatum*		Common on shrubs and trees in thickets, especially near the sea	R	R				
Fabaceae	*Stylosanthes hamata*	Donkey Weed	Common, especially in waste places on limestone and exposed pastures near the sea		R			O	
Asteraceae	*Synedrella nodiflora*	Fatten Barrow	Common weed			F	O	O	
Araceae	*Syngonium auritum*	Three Finger	Very common on trees, rocks and sheltered banks	R		R			R
Apocynaceae	*Tabernaemontana laurifolia*		Common in coastal thickets and at mangrove margins on limestone		R				
Bignoniaceae	*Tecoma stans*		Locally abundant on cut-over limestone hillsides and waste sandy places	O	F		O	R	
Bignoniaceae	*Tecomaria capensis*		Naturalized locally and cultivated			R			
Combretaceae	*Terminalia catappa*	West Indian Almond	Commonly planted and naturalized	R		R	F		
Arecaceae	*Thrinax parviflora**	Broom Thatch	Very common in the central and western parishes, on well drained limestone	R					

Family	Scientific Name	Common Name	Range	T1	T2	T3	T4	T5	T6
Acanthaceae	*Thunbergia fragrans*		Widely naturalized on fences and in thickets and waste places			O			
Euphorbiaceae	*Tragia volubilis*	Cowitch	Common in pastures, thickets and woodland margins						R
Phytolaccaceae	*Trichostigma octandrum*	Basket Wiss	Common in thickets and woodland margins and on the cays	O	F	F	R		R
Turneraceae	*Turnera ulmifolia*	Ram Goat Dashalong	Common along roadsides and on waste ground and in thickets on limestone or coral sand near the sea, also on the cays	O	O				
Fabaceae	*Vigna luteola*		Common, at swamp margins and on banks and in ditches, mostly in sandy soil near the sea		R				
Malvaceae	*Waltheria indica*	Raichie	Common in open sandy ground and waste places, especially near the sea		O	R		O	
Asparagaceae	*Yucca aloifolia*	Spanish Dagger	Extensively cultivated and locally naturalized in pasture-margins and around habitations			R			
Poaceae	*Zoysia tenuifolia*		Cultivated for lawns			O		F	

For the vegetation assessment conducted within the project boundary, encompassing all plant forms (trees, shrubs, climbers, grasses, and epiphytes), the highest number of plant species (61) was recorded along transect T3, followed by T5 (51 species) and T6 (47 species) (Figure 5-52). The lowest number of species was recorded along transect T2 (32 species), followed by T4 (34 species) and T1 (45 species).

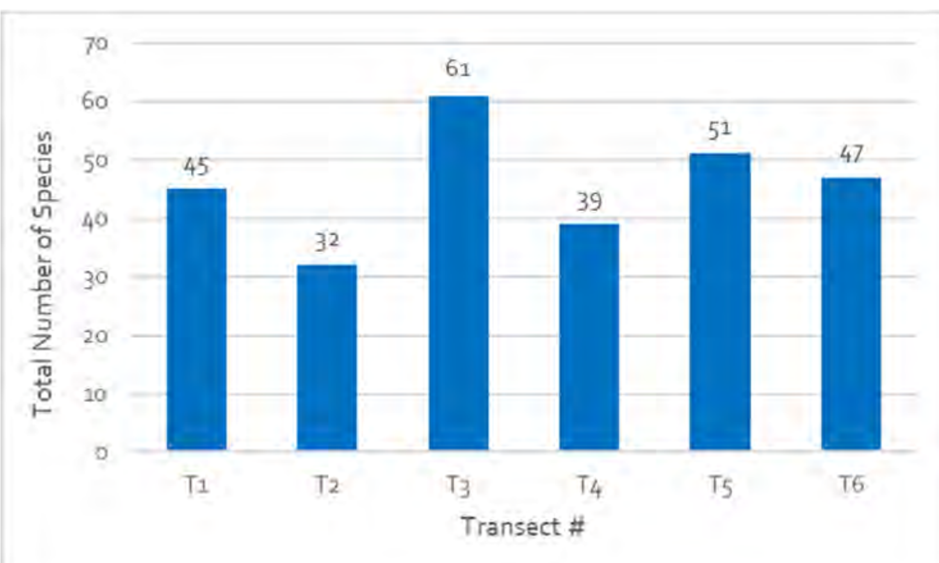


Figure 5-52 **Total number of plant species recorded at each transect**

Only two endemic plant species were recorded within the survey area: Morass Royal (*Roystonea princeps*) and Broom Thatch (*Thrinax parviflora*). Notably, two plant species found in the study area have special conservation status designations: Morass Royal (*Roystonea princeps*) and *Tabernaemontana laurifolia*, both listed as Near Threatened (NT) by the International Union for Conservation of Nature (IUCN).

Additionally, six Invasive Alien Species (IAS) were identified within the study area: *Oeceoclades maculata*, Guinea Grass (*Panicum maximum*), Logwood (*Haematoxylum campechianum*), Lead Tree (*Leucaena leucocephala*), Common Bamboo (Bambusa vulgaris), and African Tulip (*Spathodea campanulata*).

Large Tree Assessment

A total of 405 large trees were identified, tagged and GPS marked within the boundaries of the proposed development area (Figure 5-55). The species diversity of the large tree assessment was relatively low (30 species), compared to the full complement of flora identified across the study site (128 species). The most abundant species recorded throughout the large tree survey was the Guango (*Samanea saman*), with 188 individuals recorded, followed by 43 African Tulip (*Spathodea campanulata*) individuals and then 39 Bastard Cedar (*Guazuma ulmifolia*) (Figure 5-53).

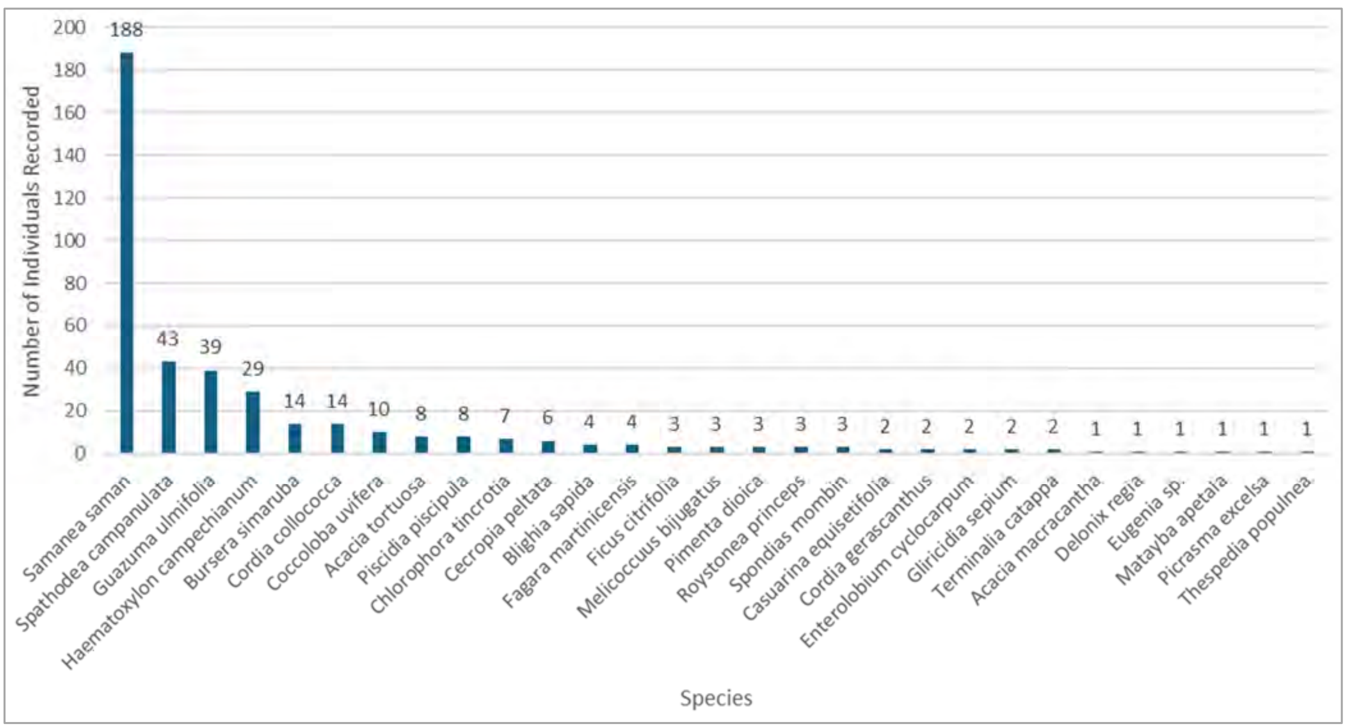


Figure 5-53 **Number of individuals recorded for each plant species for the large tree assessment**

The DBH of the trees measured were between 30.0 cm and 125.3 cm, however the most dominant DBH class recorded were between 30.0 cm - 39.9 cm, followed by 40.0 cm – 49.9 cm (Figure 5-54). The species that had the largest DBH recorded in the assessment was a Guango (*Samanea saman*) with a DBH of 125.3 cm.

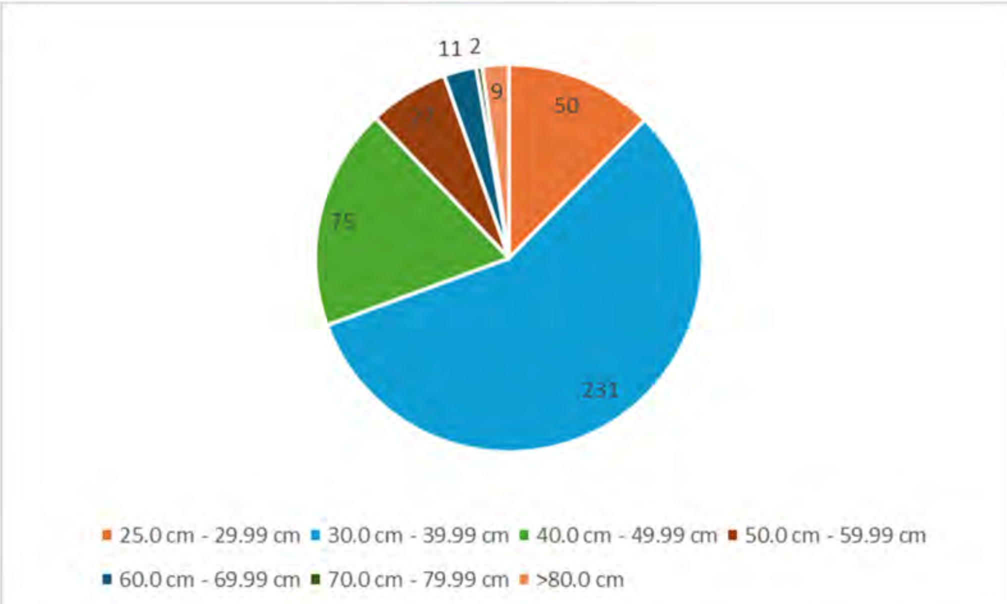


Figure 5-54 **Number of trees measured as per DBH class.**

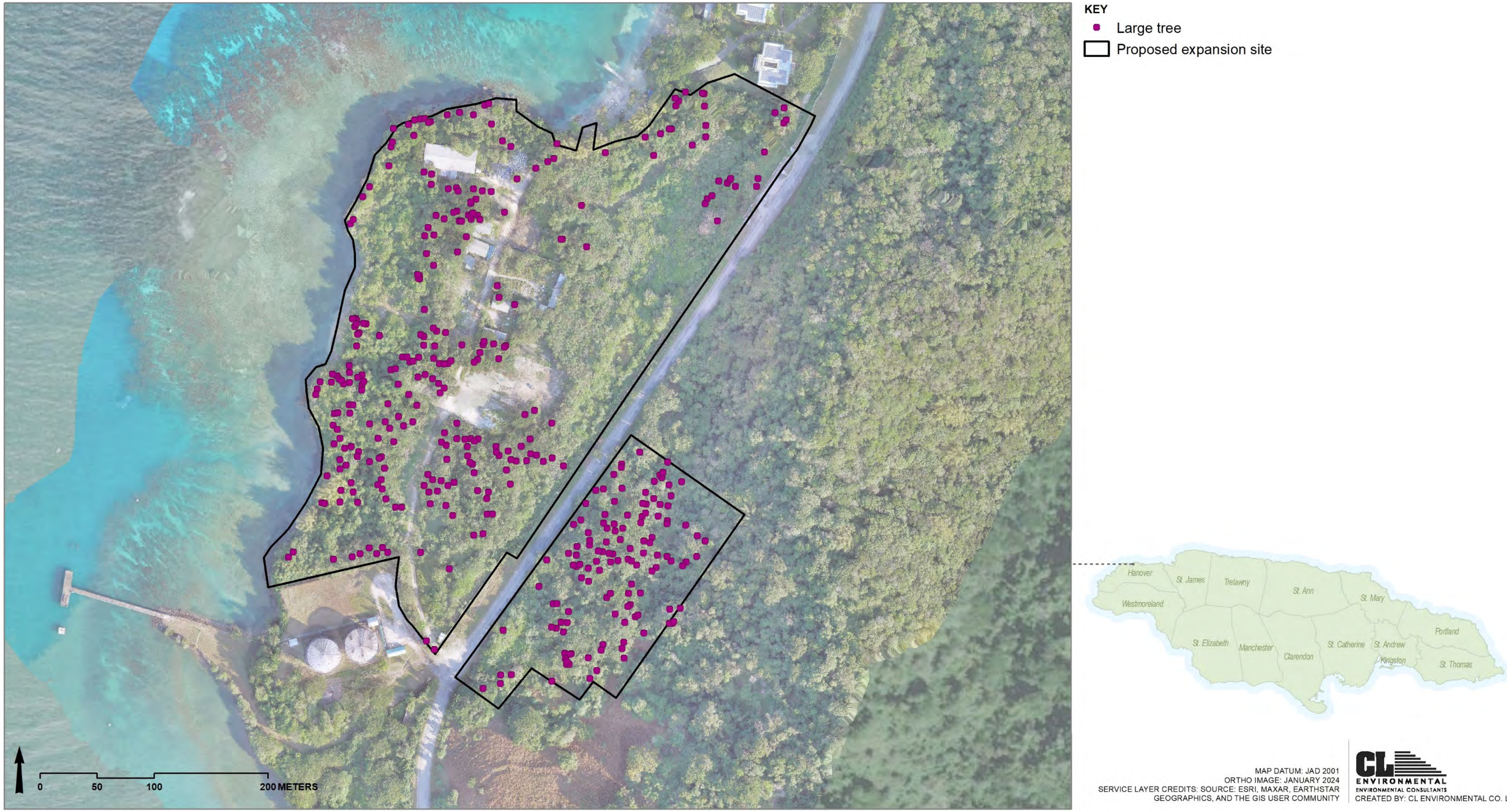


Figure 5-55 Large trees mapped at the project site

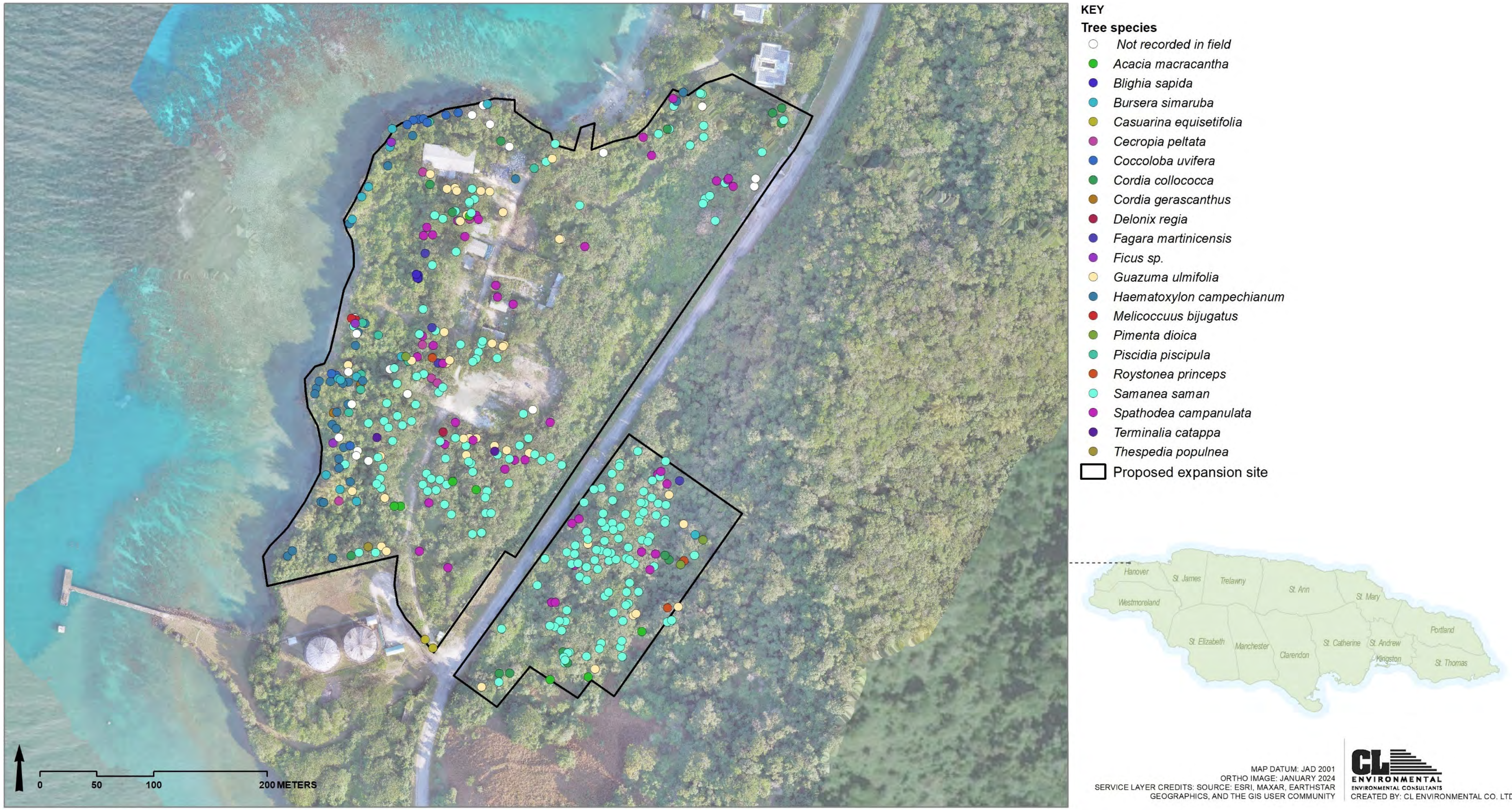


Figure 5-56 Large trees mapped during the field survey by species

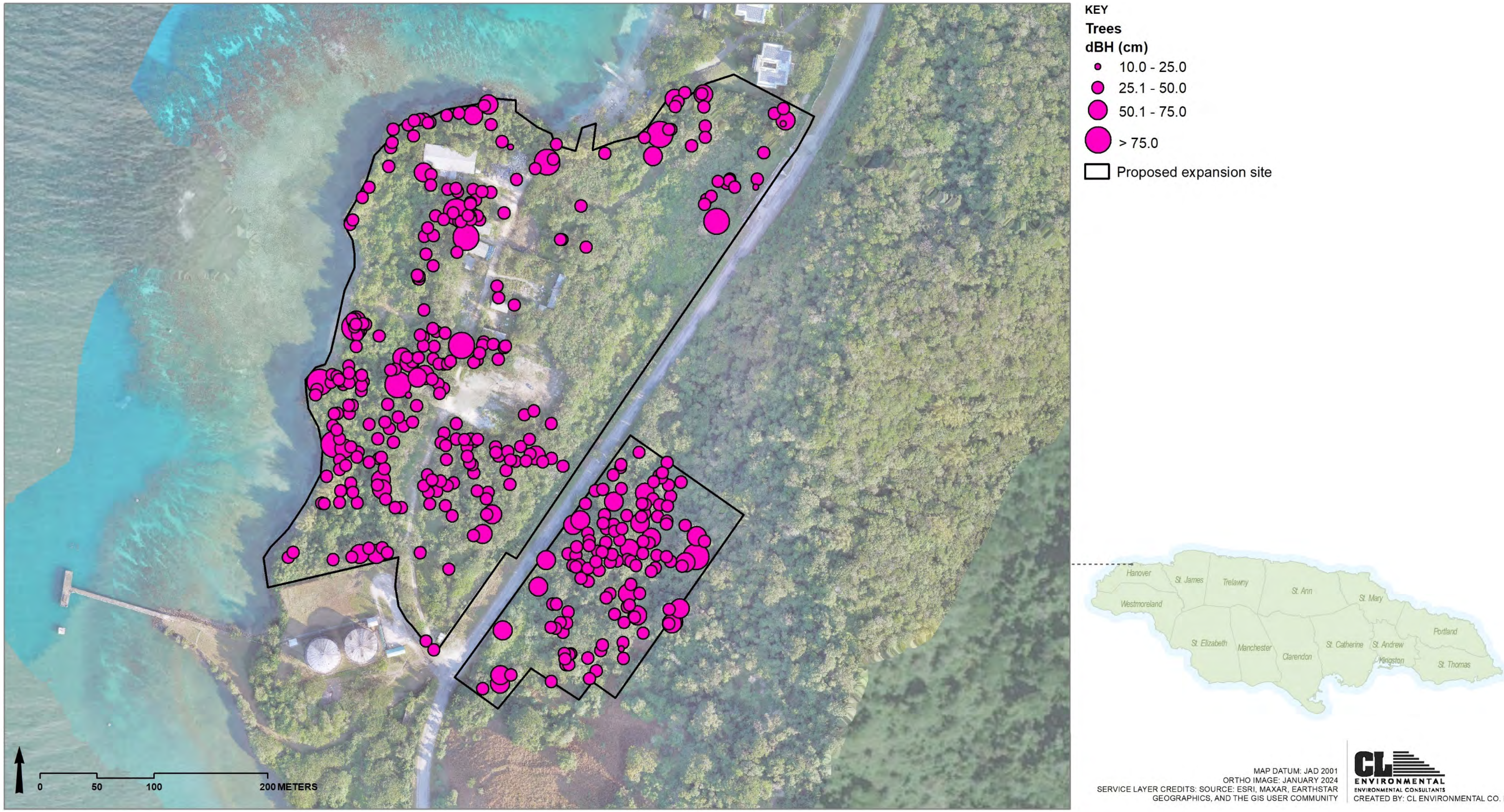


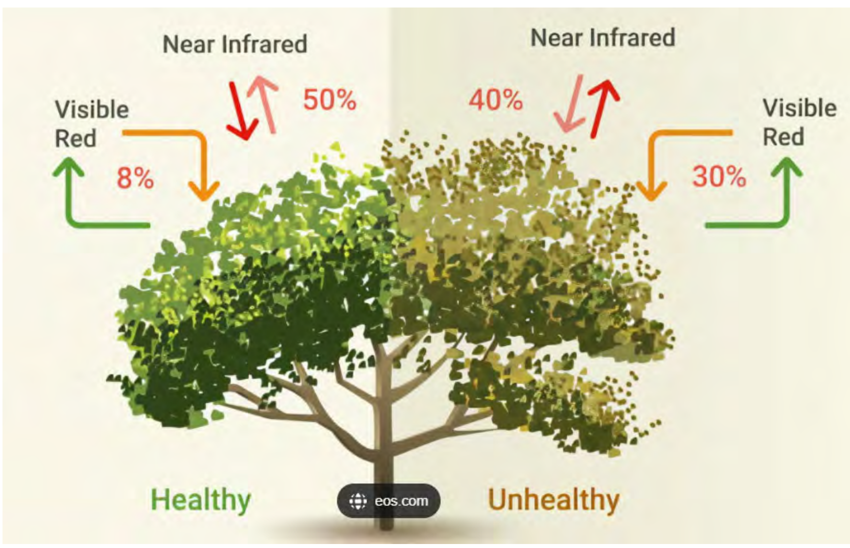
Figure 5-57 dBH of large tress mapped during the field survey

Vegetation Health

Normalized Difference Vegetation Index (NDVI) quantifies vegetation based on differences in near-infrared (NIR) and visible red-light reflectance (Equation 5-1), and provides an indication of vegetation density, health, and land cover. Chlorophyll reflects near-infrared (NIR) light (700 to 1100 nm), however absorbs visible light (400 to 700 nm) for use in photosynthesis. This means that high photosynthetic activity, commonly associated with dense healthy vegetation, will have less reflectance in the red band and higher reflectance in the near-infrared band (Figure 5-58).

Equation 5-1 Normalized Difference Vegetation Index (NDVI)

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$



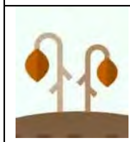
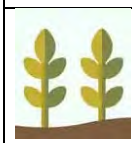
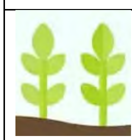
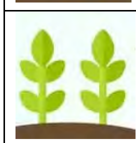
Source: NDVI FAQs: Top 23 Frequently Asked Questions About NDVI (eos.com)

Figure 5-58 Illustration of absorption and reflectance of visible red and NIR light by health and unhealthy plants.

Resulting NDVI values range between -1 and 1. If the result yields high NDVI values, this signifies more or healthier vegetation, and vice versa with low NDVI values, less or no vegetation. NDVI may also give indications for other types of land cover and Table 5-19 provides the classification utilised in this assessment.

Table 5-19 Interpretation of NDVI

Source of images: NDVI FAQs: Top 23 Frequently Asked Questions About NDVI (eos.com)

NDVI	Vegetation description	Other descriptors
 **-1 - 0**	• Dead plants • Absence of vegetation	• Inorganic objects such as stones and man-made built-up areas • Clouds • Snow fields • Water bodies (slightly negative NDVI)
 **0-0.33**	• Unhealthy/ diseased plants • Very sparse vegetation cover/ early stages of cultivation/ senescing • Minimal Chlorophyll levels • Bare soil	• Water bodies (very low positive NDVI values) • Some soil types (that exhibit a near-infrared spectral reflectance somewhat larger than the red)
 **0.33-0.66**	• Moderately healthy plant • Moderate vegetation cover • Moderate Chlorophyll levels	
 **0.66-1**	• Very healthy plant • Dense vegetation cover • High Chlorophyll levels	

A 10-band image mosaic was created using images captured by a RedEdge-MX Dual Camera Imaging System fitted to a Quantum Systems Trinity F90 plus drone on Janar 24 and 25, 2023. Using the NIR and red bands, the NDVI was calculated for the land portion of the proposed project. The vegetated portions of the project site can be considered moderately healthy to healthy, with dense cover (Figure 5-59). Roadways and trails, which lack vegetation, are easily identifiable as linear features with negative and very low positive NDVI values. Rectangular-shaped areas with similar NDVI values correspond to buildings, while irregularly shaped areas represent cleared land.

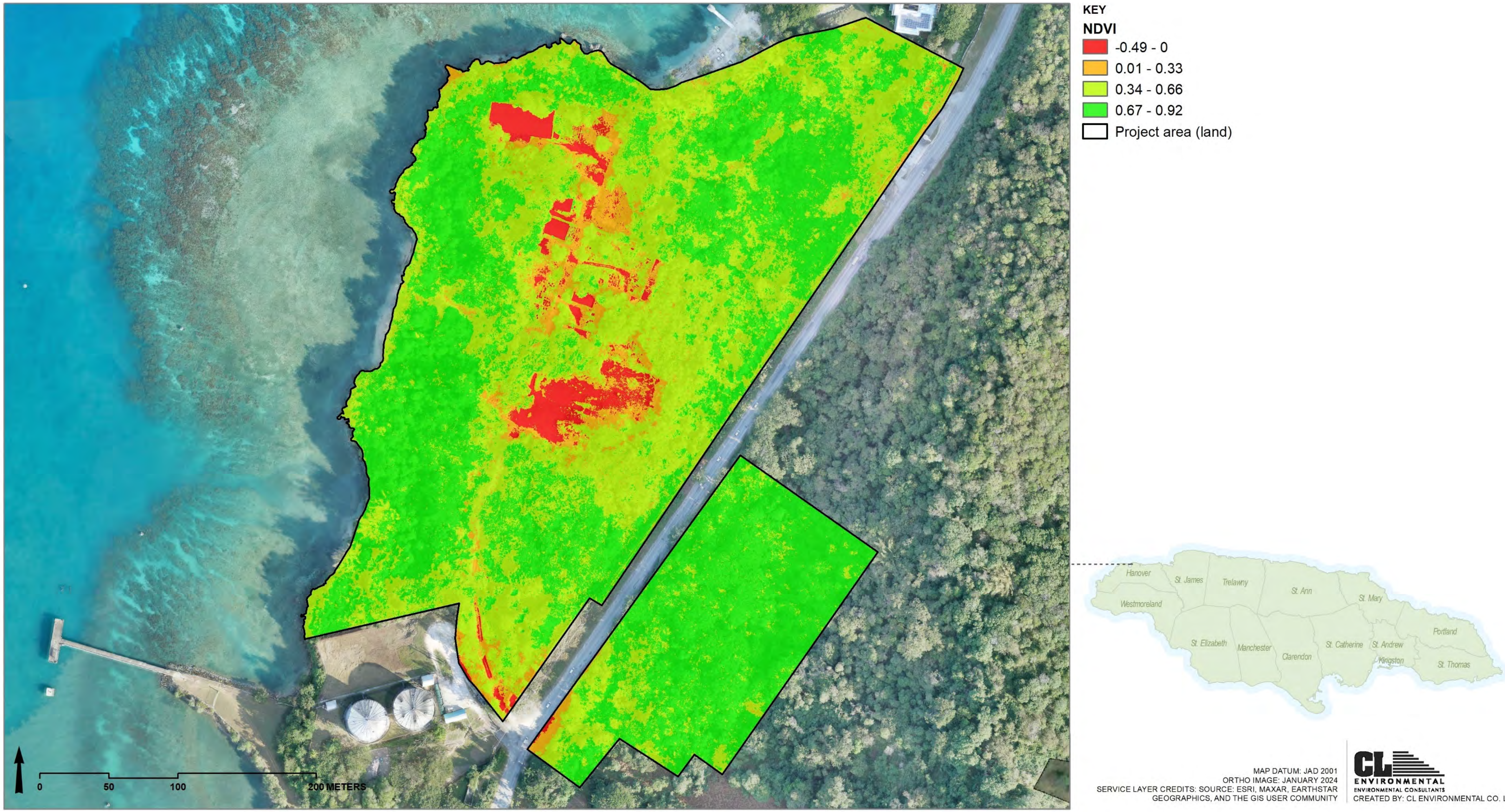


Figure 5-59 Normalized Difference Vegetation Index (NDVI) representing land vegetation cover at the project site

5.2.1.2 Fauna

The faunal survey was carried out throughout the project land boundaries using the various methodologies listed below for each faunal group. The assessments were conducted between January 19th and 21st, 2024.

Bird Surveys

METHODOLOGY

The bird survey used the line transect method, which involved slowly walking along both established and newly created trails within the project area, recording all birds detected by sight or sound (Bibby, Jones, and Marsden 2000). Additionally, any birds observed for the first time during other fauna surveys were added to the list. Residents encountered in the project area were questioned about bird species present, with a particular focus on nocturnal species. The Merlin App, which includes reference materials such as pictures and calls, was used for species identification.

RESULTS AND DISCUSSION

During the assessment, thirty-eight bird species were identified, comprising 8 resident endemics, 25 resident non-endemics, and 5 migrants (Table 5-20). Among the 8 endemic birds, none were classified as forest specialists. The study area included five migrants: four winter migrants and one egret. The winter migrants typically arrive in Jamaica as early as September and depart by April.

Two species with special conservation statuses were recorded in both Blocks A and B: the Jamaican Parakeet (*Eupsittula nana*) and the White-crowned Pigeon (*Patagioenas leucocephala*), both listed as Near Threatened by the IUCN.

Table 5-20 Birds observed during the assessment of the project area

Common Name	Scientific Name	Range	IUCN	Secondary Forest	Coastal Forest
American Kestrel	*Falco sparverius*	*Resident*	LC	R	R
American Redstart	*Setophaga ruticilla*	*Migrant*	LC	O	R
Bananaquit	*Coereba flaveola*	*Resident*	LC	F	
Black-and-white Warbler	*Mniotilta varia*	*Migrant*	LC	R	
Black-crowned Night-Heron	*Nycticorax nycticorax*	*Resident*	LC		R
Black-faced Grassquit	*Melanospiza bicolor*	*Resident*	LC	O	
Brown Pelican	*Pelecanus occidentalis*	*Resident*	LC		F
Cattle Egret	*Bubulcus ibis*	*Resident*	LC	F	R
Common Ground Dove	*Columbina passerina*	*Resident*	LC	A	
Common Yellowthroat	*Geothlypis trichas*	*Migrant*	LC	R	R
Glossy Ibis	*Plegadis falcinellus*	*Resident*	LC		R
Great Blue Heron	*Ardea herodias*	*Resident*	LC		R

Common Name	Scientific Name	Range	IUCN	Secondary Forest	Coastal Forest
Greater Antillean Bullfinch	*Melopyrrha violacea*	*Resident*	LC	R	
Greater Antillean Grackle	*Quiscalus niger*	*Resident*	LC	O	
Green Heron	*Butorides virescens*	*Resident*	LC		R
Jamaican Euphonia	*Euphonia jamaica*	*Endemic*	LC	R	
Jamaican Mango	*Anthracothorax mango*	*Endemic*	LC	O	
Jamaican Oriole	*Icterus leucopteryx*	*Resident*	LC		R
Jamaican Parakeet	*Eupsittula nana*	*Endemic*	NT	O	
Jamaican Vireo	*Vireo modestus*	*Endemic*	LC	O	
Jamaican Woodpecker	*Melanerpes radiolatus*	*Endemic*	LC	O	
Little Blue Heron	*Egretta caerulea*	*Resident*	LC		R
Loggerhead Kingbird	*Tyrannus caudifasciatus*	*Resident*	LC	O	
Magnificent Frigatebird	*Fregata magnificens*	*Resident*	LC		R
Prairie Warbler	*Setophaga discolor*	*Migrant*	LC	R	
Red-billed Streamertail	*Trochilus polytmus*	*Endemic*	LC	F	
Sad Flycatcher	*Myiarchus barbirostris*	*Endemic*	LC	R	
Smooth-billed Ani	*Crotophaga ani*	*Resident*	LC	R	
Tricolored Heron	*Egretta tricolor*	*Migrant*	LC		R
Turkey Vulture	Cathartes aura	*Resident*	LC	F	
Vervain Hummingbird	*Mellisuga minima*	*Resident*	LC	R	R
White-chinned Thrush	*Turdus aurantius*	*Endemic*	LC	R	
White-crowned Pigeon	*Patagioenas leucocephala*	*Resident*	NT	F	
White-winged Dove	*Zenaida asiatica*	*Resident*	LC	A	
Yellow Warbler	*Setophaga petechia*	*Resident*	LC	O	F
Yellow-crowned Night-Heron	*Nyctanassa violacea*	*Resident*	LC		R
Yellow-faced Grassquit	*Tiaris olivaceus*	*Resident*	LC	F	
Zenaida Dove	*Zenaida aurita*	*Resident*	LC	F	

It should be noted that a relatively large Brown Pelican (*Pelecanus occidentalis*) roosting/nesting area was observed on the property in Plate 5-9 and Figure 5-60. This species does not have any special conservation designation, however these birds are still protected under law, as all birds in Jamaica are protected.

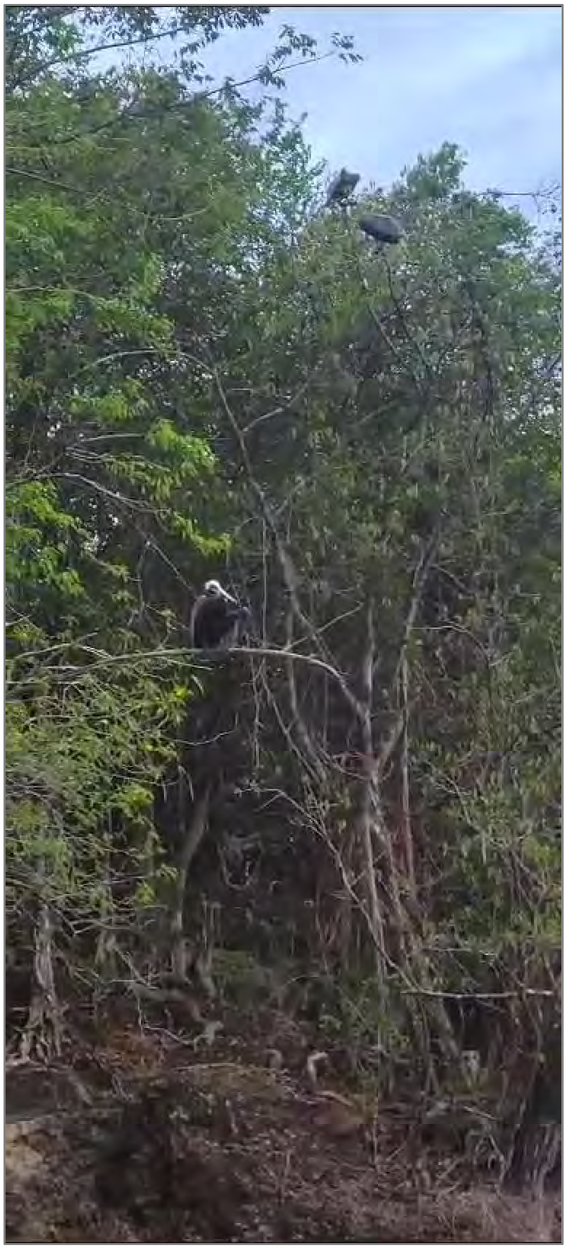


Plate 5-9 **Brown Pelican (*Pelecanus occidentalis*)**

Figure 5-60 Mapped pelican roost location

Bat Assessment

METHOD

Five AudioMoth® acoustic recorders were deployed at selected sites within different vegetation zones throughout the project area (Figure 5-61). The acoustic detectors were configured to record from 18:00 to 06:00 for at least 4 weeks, with a sample rate of 384 kHz and the gain set to medium. Each device recorded for 10 seconds with a 30-second sleep duration between recordings and was placed at least 1.5 meters above the ground.

Kaleidoscope Pro Software's auto bat ID features were used to analyse the acoustic data from the AudioMoths. The acoustic files, including auto-identified calls, unknown calls, and noise, were further reviewed, as the software can sometimes misidentify calls. Unknown calls were compared with sound libraries of known bat species in Jamaica for accurate identification.

RESULTS

Nine species of bats were identified using Kaleidoscope Pro Acoustic software. These species fall into two trophic guilds: Piscivore (n=1) and Insectivore (n=8).

The Jamaican Fruit Bat (*Artibeus jamaicensis*) was not detected in the study, although the presence of a few almond trees on the property suggests potential foraging in the area. The two species known to forage in open areas, *Tadarida brasiliensis* and *Molossus molossus*, were detected. The fish-eating bat was expected to be found near the ponds and the large open tank, but none were detected. This absence may be attributed to the low water levels in the two ponds observed during the study, likely due to drought conditions. No endemic bats, nor any bats with special protection or endangered status, were detected.

Table 5-21 Bats observed during the assessment of the project area

Scientific name	Common name	IUCN	Diet	D1_GP	D2_GP	D4_GP	D8_GP	PA1_GP
Eumops glaucinus	Wagner's Bonneted Bat	LC	Insectivore	1	1	1	1	1
Molossus milleri	Pallas' Mastiff Bat	LC	Insectivore	1	1	1	1	1
Moormops blainvillei	Antillean Ghost-faced Bat	LC	Insectivore	1		1	1	
Noctilio leporinus	Fishing Bat	LC	Piscivore	1				
Nyctinomops macrotus	Big Free-tailed Bat	LC	Insectivore	1		1	1	1
Pteronotus macleayii	MacLeay's Mustached Bat	LC	Insectivore	1		1	1	1
Pteronotus parnellii	Parnell's Mustached Bat	LC	Insectivore	1	1	1	1	1
Pteronotus quadridens	Sooty Mustached Bat	LC	Insectivore	1			1	
Tadarida brasiliensis	Free-tailed Bat	LC	Insectivore	1	1	1	1	1

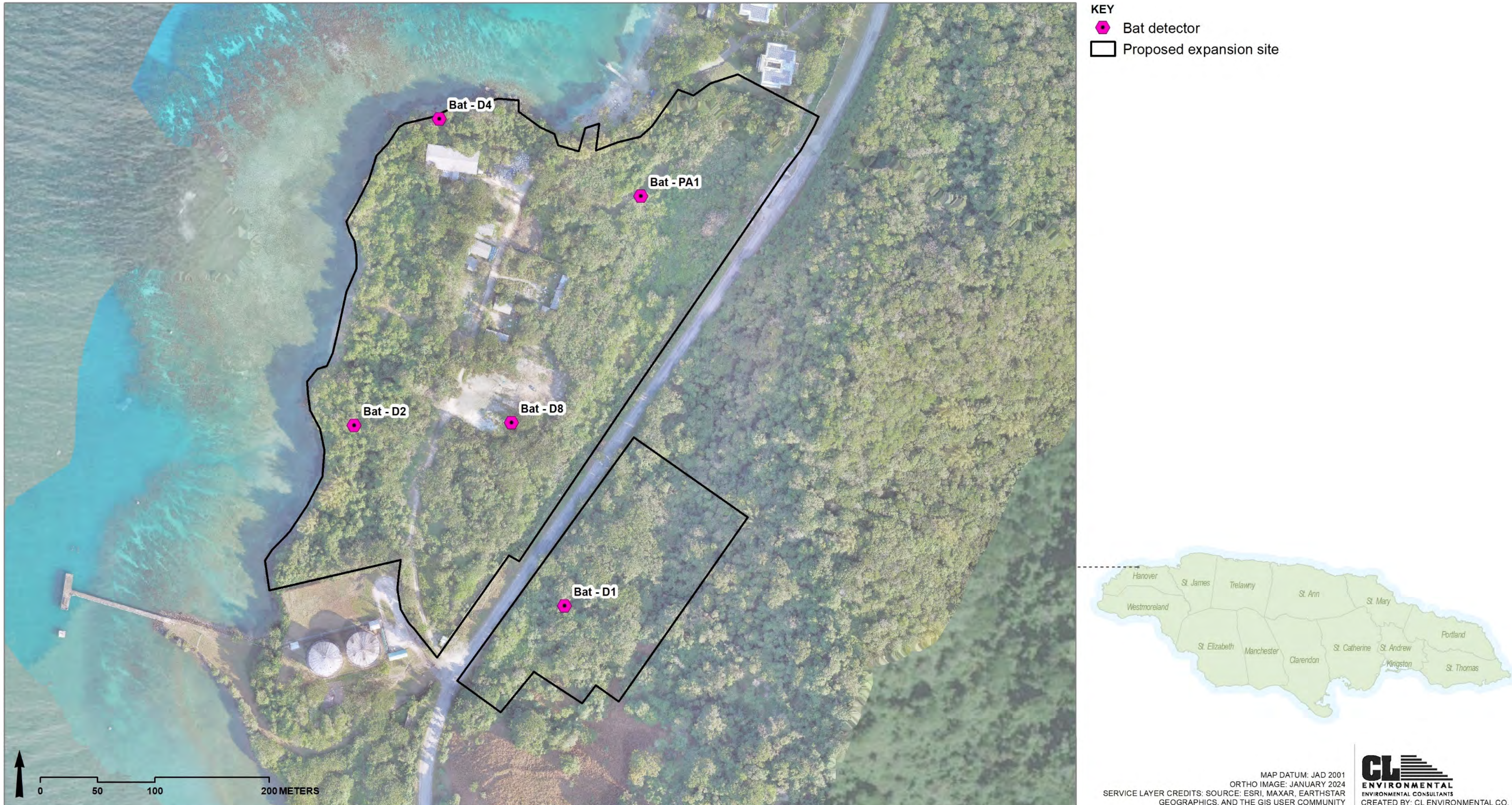


Figure 5-61 Locations of AudioMoths deployed throughout the property

5.2.2 Benthic Communities

5.2.2.1 Overview

Benthic Habitats and Services

The marine component of the 1 km study area covers approximately 1.6 km², with seagrass (both dense and sparse) being the dominant habitat, accounting for 60% of the area, according to The Nature Conservancy (TNC) habitat map (Schill, et al., 2021) [3] (Table 5-22, Figure 5-62). Coral/algae is the second most dominant class, covering 0.4 km² or 26% of the study area. It is also important to highlight the boundaries of the Lucea fish sanctuary within the 1km study area (Figure 5-62), which includes a complex array of coastal ecosystems, developments, and uses.

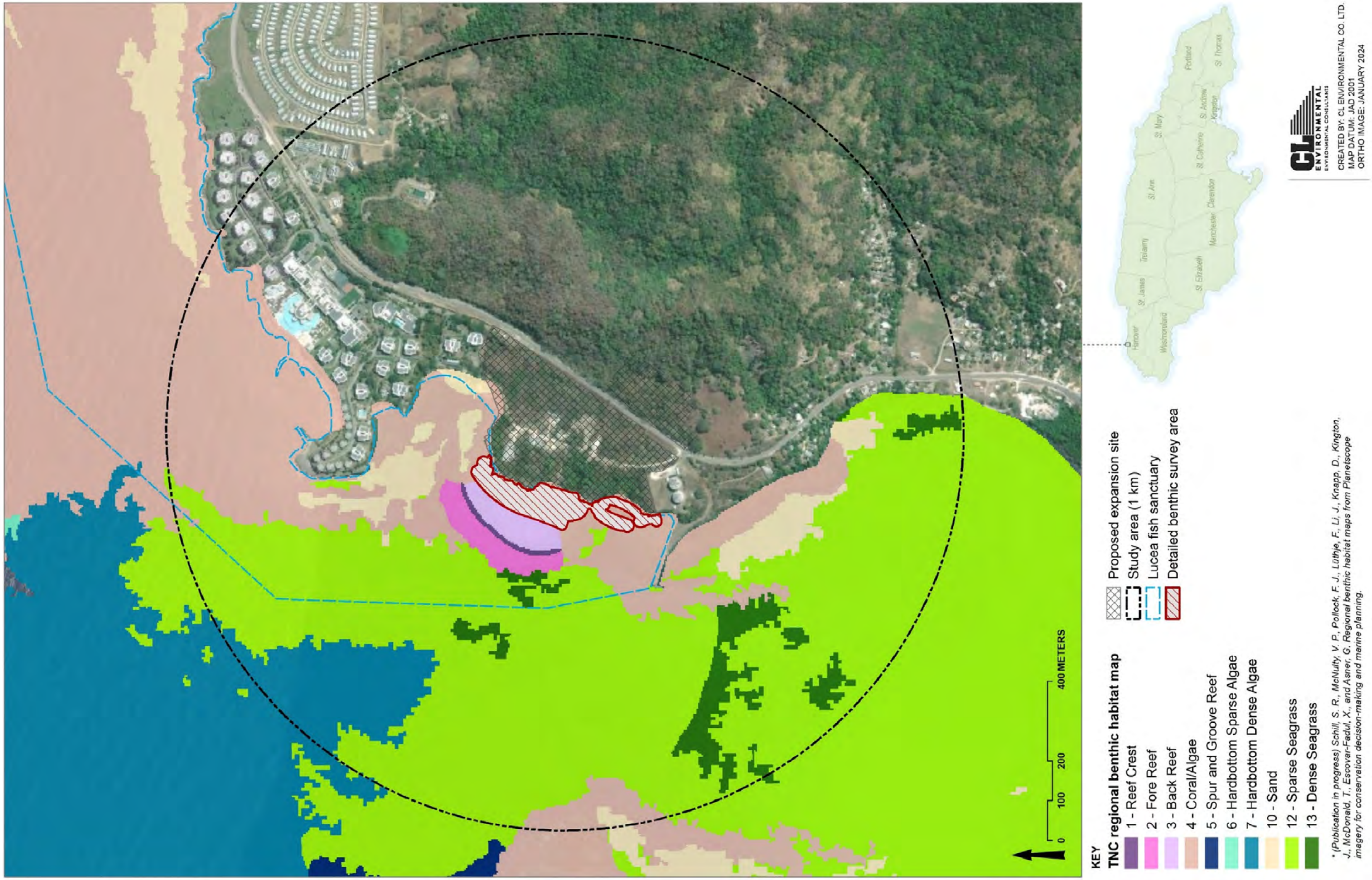
Table 5-22 Benthic classes within the 1km study area

Benthic Class		Area (sqm)	Percentage of 1km Study Area
1	Reef Crest	3,856	0%
2	Fore Reef	21,504	1%
3	Back Reef	22,096	1%
4	Coral/ Algae	421,872	26%
7	Hardbottom Dense Algae	93,584	6%
10	Sand	83,168	5%
12	Sparse Seagrass	898,080	56%
13	Dense Seagrass	69,808	4%
Total		**1,613,968**	**100%**

Source: Schill, et al. (2021)

Within the detailed survey area, totalling 29,917.5 m² in area (Figure 5-62), a diverse array of benthic habitats, including seagrass beds, coral/reef communities, pavement/hard bottom areas and rocky shores/intertidal communities exist, each playing a critical role in supporting marine life and ecosystem processes. Benthic habitats serve as essential nurseries, foraging areas, and refuges for a multitude of marine species, contributing significantly to the resilience and functionality of coastal ecosystems. Surrounding these habitats are coastal communities, reliant on its resources for sustenance, economic livelihoods, and cultural heritage.

[3] Using 4m resolution imagery derived from the PlanetScope (PS) Dove Classic SmallSat constellation, Schill et al. (2021) employed a comprehensive object-oriented ruleset utilizing Dove-derived bathymetry and surface/bottom reflectance data to generate an automated thirteen-class benthic habitat classification extending to 30 m water depth, which yielded a confidence interval of 78%–82% . The TNC atlas is intended to map coral reef distributions and characteristics on a regional (e.g., 100 km) to ocean-basin scale (e.g., 1000 km).



Data source: (Schill, et al., 2021)

Figure 5-62 Benthic habitats within the 1 km study area, and in relation to Lucea fish sanctuary

Four documented species of seagrass inhabit Jamaica: *Thalassia testudinum* (Turtle grass), *Syringodium filiforme* (Manatee grass), *Halodule wrightii* (Shoal Grass), and *Ruppia maritima* (Widgeon grass) (Thorhaug, et al., 1985). Among these, *Thalassia testudinum*, *Syringodium filiforme*, and *Halodule wrightii* are the primary species studied within Jamaica. Additionally, *Halophila decipiens* has been observed around the island based on information from the National Environment and Planning Agency (NEPA), bringing the total number of seagrass species to five. *Thalassia testudinum* predominates and exhibits the largest growth form. These species are widespread in marine areas throughout the island (De Kluijver, Gijswijt, De Leon, & Da Cunda, 2016; McKenzie & Hq, 2008). Seagrass meadows also dissipate wave energy and stabilize sediment, therefore reducing coastal erosion and turbidity.

A highly variable seagrass bed dominates the nearshore detailed study area, along with other backreef habitats. Substrate here varies, as does the seagrass in terms of density and distribution. Three species of seagrass were identified in the detailed survey area, *Thalassia testudinum* (the dominate species), Syringodium and Halodule were also seen. These benthic communities provide several ecosystem goods and services for marine species and essential component of food security. Seagrass meadows are noted for being nursery grounds, with many juveniles and small fish living among seagrass blades before migrating to adjacent reefs. Similarly, the many variations in habitats such as hard bottoms, patch reefs and rocky shores, also provide spaces for juveniles and a productive food source for many species of fish, molluscs, crustaceans and birds.

Though small in proportional coverage, coral reefs offer a wide array of benefits. In a report by Ruitenbeek et al, reefs in Montego Bay, Jamaica accounted for $400 million in 1999 (Ruitenbeek et al. 1999). The many growth forms of corals, soft corals and other reef organisms provide interstitial spaces for many individuals to occupy (Idjadi and Edmunds 2006). Ideally, the more three-dimensional the framework, the more redundant and resilient the system is, increasing its ability to withstand stressors and threats to biodiversity. Like seagrass meadows, reefs also assist in coastline protection, with reefs reducing wave energy by as much as 86% (Ferrario et al. 2014). This service is important during high-energy events such as storms and hurricanes, where many of the nation's population and industries are found within close proximity to the sea.

Marine ecosystems face several threats to biodiversity, including climate change, coastal development, pollution, and invasive species. Nearby reefs (Hopewell) were ranked "poor" by NEPA when last surveyed as a part of the national assessment exercise in 2020. This was characterized by a coral cover of 17%, macroalgal cover of 51% and low biomasses of commercially important and herbivorous fishes.

As part of the establishment of the fish sanctuary a rapid assessment of the reefs within the proposed fish sanctuary was conducted, measuring a selection of key indicators to provide baseline information on the state of fish stocks and the health of the reefs within the area (The Oracabessa Marine Trust, 2020).

The findings indicate that coral cover at Barble Ridge and Dry Hill was relatively high, with 23% and 27%, compared to other areas in Jamaica. However, nutrient-indicating algae were prevalent near the mouth of Lucea Harbour, indicating water quality impacts from the harbour. Diadema were most abundant at the westernmost site, Barble Hill, leading to lower algae coverage there compared to Dry Ridge.

Fish assessments found juvenile fish abundant at some sites, indicating good recovery potential. Parrotfish were the most abundant group across all sites. Figure 5-63 shows areas assessed as part of the management plan.

Figure 5-63 Reef survey locations within the Lucea Fish Sanctuary

Phase 1 of the hotel construction included coral and seagrass relocation exercises; these areas were surveyed during this assessment. While relocated seagrass beds were intact, it was not possible to identify corals that had been relocated several years ago. These colonies are either indistinguishable from natural colonies or they have died.

Recent Large-Scale Events

Recent large-scale events have significantly impacted marine ecosystems in the Caribbean and beyond:

1. 2023 Mass Coral Bleaching Event
   - High sea temperatures in 2023, driven by climate change and El Niño, caused widespread coral bleaching across the Caribbean, leading to significant coral mortality and habitat

degradation. Forecasts indicate elevated sea temperatures may continue into 2024, threatening further bleaching events. (NEPA, 2024). As of April 2024, the forecast for 2024 indicates another year of elevated sea temperatures, raising concerns for a recurring coral bleaching event. With consecutive years of warmer-than-average ocean temperatures, coral reefs across the Caribbean and other regions are at heightened risk of experiencing widespread bleaching once again.

2. 2022 Diadema Die-Off
    - A mass mortality event in 2022 affected *Diadema antillarum* sea urchins, crucial for controlling algae on coral reefs. Their loss led to increased algal growth and reduced coral recruitment, weakening reef resilience.
3. SCTLD Outbreak
    - Stony Coral Tissue Loss Disease (SCTLD) has caused extensive coral mortality, particularly affecting pillar corals in the Caribbean, reducing habitat complexity and threatening reef ecosystems.
4. Invasive Species
    - Invasive species like lionfish and green mussels are disrupting Jamaica's marine ecosystems by outcompeting native species and altering habitats. Potential invasive species, such as *Unomia stolonifera* and *Halophila stipulacea*, pose additional risks by outcompeting native species and changing ecosystem dynamics.

MARINE HEATWAVE

According to the European Earth observation agency Copernicus, February 2023 to January 2024 were the hottest on record. The global average temperature for this period was 0.64°C above the 1991-2020 average and 1.52°C above the 1850-1900 pre-industrial average. The survey was conducted during a period of elevated global temperatures, which resulted in a Marine Heat Wave (MHW).

From (Mohamed, et al., 2023) 'Global mean sea surface temperature (SST) has increased in recent decades due to anthropogenic-induced climate change (IPCC, 2021). One of the most certain consequences of this global warming is extremely warm ocean temperatures, known as marine heatwaves (MHWs) (Hobday et al., 2016). MHW have destructive impacts on marine ecosystems, biodiversity, and fisheries.

MHW pose a significant threat to benthic communities, disrupting the delicate balance of these ecosystems. Elevated sea temperatures, exacerbated by climate change, can lead to coral bleaching events, where corals expel their symbiotic algae, resulting in loss of colour and potential mortality. Heat stress also affects other benthic organisms such as seagrasses, which may experience reduced growth rates and increased vulnerability to disease. As temperatures rise, the metabolic rates of benthic organisms can increase, leading to higher energy demands and potential stress. These changes can have cascading effects throughout the ecosystem, impacting biodiversity, trophic interactions, and ecosystem services.

Heat stress is a primary driver of coral bleaching, a phenomenon where corals expel their symbiotic algae in response to prolonged exposure to elevated temperatures. Without their algae, corals lose their colour and primary source of nutrition, becoming more susceptible to disease and mortality. While some corals may recover from bleaching events if conditions return to normal quickly, prolonged or repeated heat stress can lead to widespread coral mortality and degradation of reef ecosystems. Additionally, heat stress can impact coral reproduction, with elevated temperatures disrupting spawning events and reducing the success of larval settlement. Overall, the increasing frequency and severity of heat stress events pose a grave threat to coral communities, highlighting the urgent need for conservation efforts and climate change mitigation measures to safeguard these invaluable marine habitats.

As outlined in (Lillian R. Aoki, 2021), increasing ocean temperatures, and increasing frequency and severity of heat waves, threaten seagrass meadows and their sediment blue C. To date, no study has directly measured the impact of seagrass declines from high temperatures on sediment C stocks. Long-term record of sediment C stocks from a 7-km2, restored eelgrass (Zostera marina) meadow showed that seagrass dieback following a single marine heat wave (MHW) led to significant losses of sediment C. Patterns of sediment C loss and re-accumulation lagged patterns of seagrass recovery. Sediment C losses were concentrated within the central area of the meadow, where sites experienced extreme shoot density declines of 90% during the MHW and net losses of 20% of sediment Cover the following three years. However, this effect was not uniformed.

Effects of MHW on seagrasses may include the following: -

- Increased Stress and Mortality: Elevated temperatures can cause thermal stress to seagrasses, leading to physiological changes and potentially resulting in mortality. Seagrasses have specific temperature tolerance ranges, and when these are exceeded, they may experience heat-induced damage.
- Reduced Photosynthesis: High temperatures can negatively impact the process of photosynthesis in seagrasses. Excessive heat can reduce the efficiency of photosynthetic reactions, limiting the production of carbohydrates essential for seagrass growth and maintenance.
- Altered Growth Rates: Prolonged exposure to elevated temperatures can lead to changes in the growth rates of seagrasses. This can manifest as reduced shoot density, slower vertical growth, and alterations in the overall structure of the seagrass bed.
- Increased Vulnerability to Diseases: Elevated temperatures can weaken seagrasses, making them more susceptible to diseases and pathogens. Stress-induced by high temperatures may compromise the defence mechanisms of seagrasses, leading to increased vulnerability to infections.

- Changes in Reproductive Patterns: Seagrasses often rely on specific temperature cues for reproductive processes. Elevated temperatures can disrupt reproductive patterns, affecting seed germination, seedling establishment, and the overall reproductive success of seagrasses.
- Altered Biotic Interactions: High temperatures can disrupt the balance of biotic interactions within seagrass ecosystems. For example, temperature-induced changes in the abundance or behaviour of herbivores and grazers can affect seagrass consumption rates and lead to altered community dynamics.
- Shifts in Species Composition: Seagrass communities may experience shifts in species composition as some species prove more resilient to elevated temperatures than others. This can lead to changes in the overall biodiversity and ecological structure of the seagrass bed.
- Impact on Associated Fauna: Elevated temperatures in seagrass beds can affect the abundance and distribution of associated fauna, including fish, invertebrates, and epiphytic organisms. Changes in temperature can influence the availability of food resources and shelter, impacting the entire ecosystem.

5.2.2.2 Benthic Habitat Mapping

The extent of the seagrass beds, coral assemblages and other distinct benthic features within the detailed survey area were mapped as points, lines and polygons using a Trimble Geo 7x Global Positioning System (GPS). Additionally, multiple survey methods were employed to evaluate various characteristics of the benthic community in detail, including transect lines, quadrats, and roving surveys within the larger survey area. The specific methods employed for each community and measured characteristic are detailed in subsequent sections.

Aerial imagery was also used to provide a contextual perspective of the benthic characteristics in the detailed survey area. Specifically, orthorectified imagery from a Quantum Trinity F90+ fixed-wing drone was visually assessed to determine the spatial configuration of benthic features within the survey area. This spatial understanding assisted in planning the field survey approach and was later augmented with detailed in-situ mapped data to create a comprehensive habitat map of the survey area. The combination of high-resolution aerial imagery and precise GPS mapping significantly enhanced the overall habitat map's precision and utility, providing a comprehensive and reliable depiction of the benthic environment.

The detailed survey area can be described as a backreef or lagoon area; seagrass dominated (77%), with areas of pavement, rock and rubble (13%) and bare sand/silt substrate primarily located adjacent the coastline (Table 5-23 and Figure 5-64). Pavement is a prominent feature in the southern section of the survey area within the nearshore areas, as well further away from the coastline; however, towards north, there is a notable presence of fore reef and patch reef, totally 955 m^2 (3% of the total survey area).

Table 5-23 Predominant habitats within the detailed study area

Benthic Habitat	Area (m^2)	Percentage of Study Area
Forereef	737.2	2.46%
Patch reef	217.8	0.73%
Pavement/rock/rubble	4,021.7	13.44%
Sand/silt	1,755.2	5.87%
Intertidal rock	62.1	0.21%
Seagrass (patchy distribution)	23,185.7	77.49%
Total	**29,917.6**	

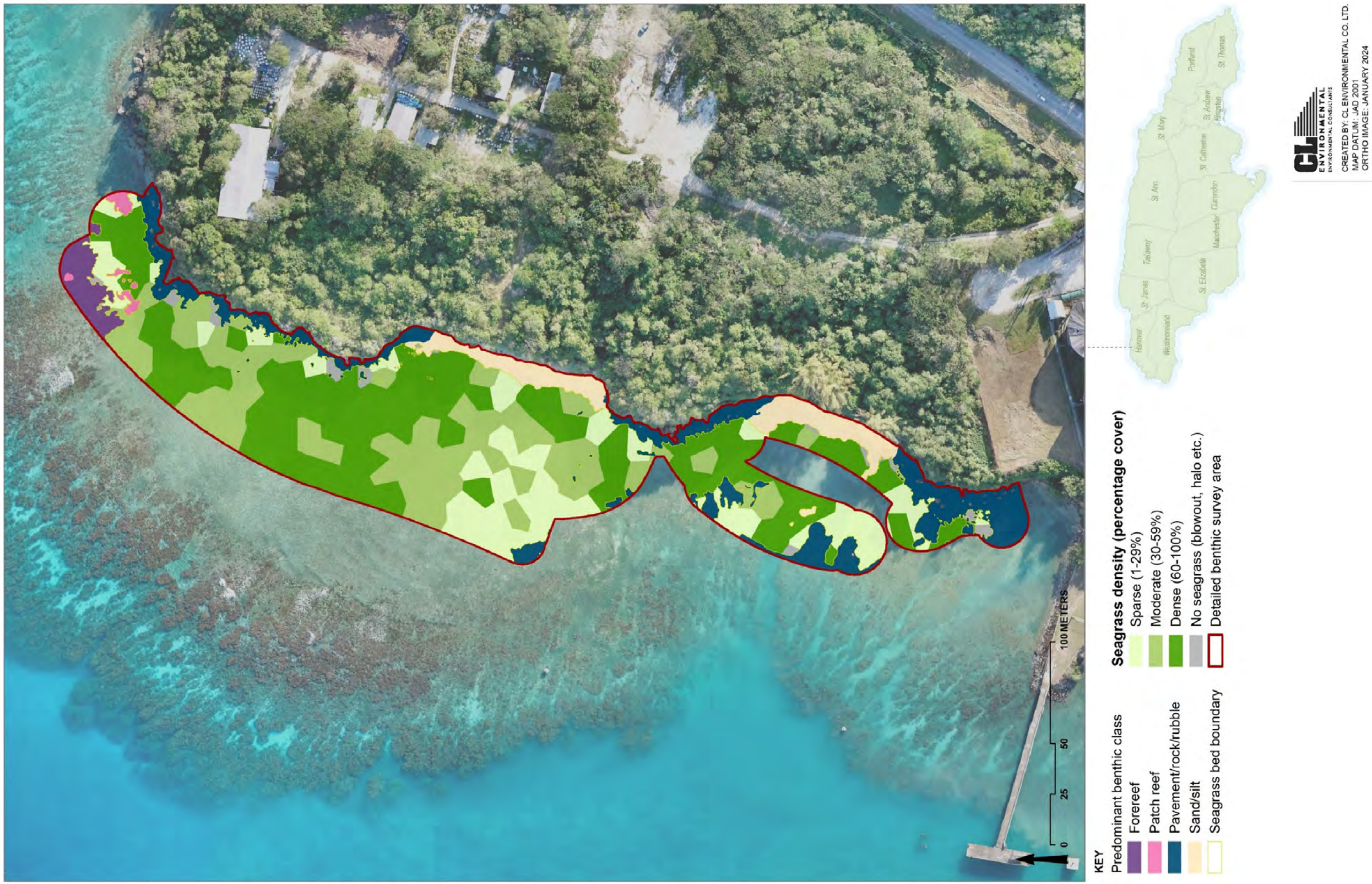


Figure 5-64 **Predominant benthic classification within the detailed survey area**

5.2.2.3 Seagrass

The seagrass bed within Lucea Harbour is primarily dominated by the species *Thalassia testudinum*. The aforementioned diverse range of substrate types present here contribute to varying densities and species compositions across the habitat. This variability in substrate composition significantly influences the health and characteristics of the seagrass bed. Parameters such as blade length, shoot density, and productivity exhibit notable variations throughout the bed, indicative of the dynamic nature of this ecosystem.

Water Quality and its Relationship with Seagrass

The presence of seagrass can have a significant impact on water quality parameters, and conversely, water quality influences the health and vitality of seagrass ecosystems.

- Filtration and Nutrient Uptake:
  - Seagrasses act as natural filters, trapping suspended particles and helping to clarify the water. They can absorb and assimilate nutrients, such as nitrogen and phosphorus, which are essential for their growth. This nutrient uptake reduces nutrient levels in the water, potentially mitigating issues like nutrient pollution, nitrate and phosphate levels were all non-compliant at all locations during sampling event for the project location, negative impacts of these high level will be slightly mitigated due to the extensive seagrass beds. The high nutrient concentrations in the water are often caused by runoff or pollution and can stimulate excessive algal growth, leading to reduced light availability for seagrasses which negatively impact seagrass health and coverage.
- Oxygen Production and Consumption:
  - Seagrasses contribute to oxygen production through photosynthesis, releasing oxygen into the surrounding water. This process can enhance oxygen levels and support aerobic conditions for marine life.
  - Low dissolved oxygen levels in the water, often associated with eutrophication or excessive organic matter decomposition, can negatively affect seagrasses. Seagrasses may suffer from hypoxic conditions, leading to decline or die-off.
- pH
  - Seagrasses influence pH levels in their surroundings through various mechanisms. Primarily, the process of photosynthesis in seagrasses involves the absorption of carbon dioxide from the water, contributing to an increase in pH by reducing the concentration of carbon dioxide and releasing oxygen. Additionally, seagrasses enhance alkalinity by increasing the concentration of carbonate ions through photosynthesis and organic carbon production, promoting a more stable pH environment. The shading effect and temperature regulation provided by seagrasses also play a role, influencing the solubility of carbon dioxide in water. Furthermore, microbial activity associated with seagrass roots and sediment decomposition can impact pH levels through the release of byproducts. Overall, the intricate interactions of

seagrasses with their environment contribute to pH regulation, emphasizing their importance in maintaining the health and equilibrium of coastal ecosystems.

- Although changes in dissolved oxygen appeared to affect changes in pH and vice -versa, it is in fact the result of changes in photosynthesis and respiration that results in changes to both parameters. Photosynthesis increases the amount of dissolved oxygen in the water column, while respiration uses the oxygen and also produces carbon dioxide which in solution produces carbonic acid which changes the pH (Cambell, 2000).
- Seagrasses are affected by changes in pH levels, which can have various implications for their growth and health. These effects include alterations in photosynthesis and respiration processes, as seagrasses may experience reduced carbon dioxide uptake and respiration efficiency under acidic conditions. The availability of carbonate ions, crucial for seagrass structure formation, can also be influenced by pH changes. Furthermore, increased acidity may favour algal growth, posing competition to seagrasses, while shifts in nutrient availability and sediment pH can affect seagrass ecosystems' overall health. Additionally, global concerns about ocean acidification exacerbate the challenges seagrasses face, particularly in regions where pH levels are naturally lower.

- Sediment Stabilization:
  - Seagrass beds stabilize sediments with their root systems, reducing sediment resuspension. This helps maintain water clarity by preventing excessive sedimentation.
  - Excessive sedimentation from factors like runoff or plumes from the construction site can bury seagrass blades, limiting light penetration and inhibiting photosynthesis.
- Biodiversity Support:
  - Seagrass beds provide habitat and shelter for various marine species. The complex structure of seagrass meadows offers refuge for juvenile fish and invertebrates.
  - Poor water quality, including pollutants and sedimentation, can harm the diverse community of organisms that depend on seagrass habitats, disrupting the balance within the ecosystem.
- Carbon Sequestration:
  - Seagrasses play a role in carbon sequestration by trapping and storing carbon in their biomass and sediments, contributing to climate change mitigation.
  - Changes in water quality, such as alterations in pH or carbonate chemistry, can influence the ability of seagrasses to effectively sequester carbon.
  - In summary water quality, particularly in terms of nutrient levels, sedimentation, and dissolved oxygen, significantly impacts the health and persistence of seagrass ecosystems. Conversely, the presence of seagrass positively influences various water quality parameters by acting as a natural filter, stabilizing sediments, contributing to oxygen production, and supporting biodiversity.

Methods

TRANSECT LINES

Seven belt transects were conducted in the detailed survey area (Figure 5-65).

TARGET POINTS INCLUDING PROBES

Survey target points were identified using satellite imagery for both general ground truthing as well as detailed data collection (Figure 5-65). Seagrass data collected include the following:

- Species
- Percentage cover
- Sediment composition and sediment depth

ROVING SURVEY

Roving surveys were conducted within the detailed project survey area as well outside (Figure 5-66), including areas of interest such as previous seagrass relocation areas, coral relocation areas as well as potential areas for relocation and restoration.

GPS MAPPING AND SPATIAL ANALYSIS

The extent of the seagrass beds within the detailed survey area was mapped by physically walking along the boundaries where possible, using a Trimble Geo 7x Global Positioning System (GPS) for precise location data.

Target data points collected in the field were modelled into Thiessen polygons[4] to create a continuous representation of seagrass percentage cover and substrate type.

[4] Thiessen polygons, also known as Voronoi polygons, are a spatial analysis technique used in geographic information systems (GIS) to partition a plane into regions based on proximity to a specific set of points. Each region, or polygon, contains a single generating point and encompasses all locations nearer to that point than to any other. Thiessen polygons are a powerful tool for spatial analysis, offering clear and practical delineation of areas based on proximity to specified points, thereby enhancing the accuracy and utility of ecological studies.

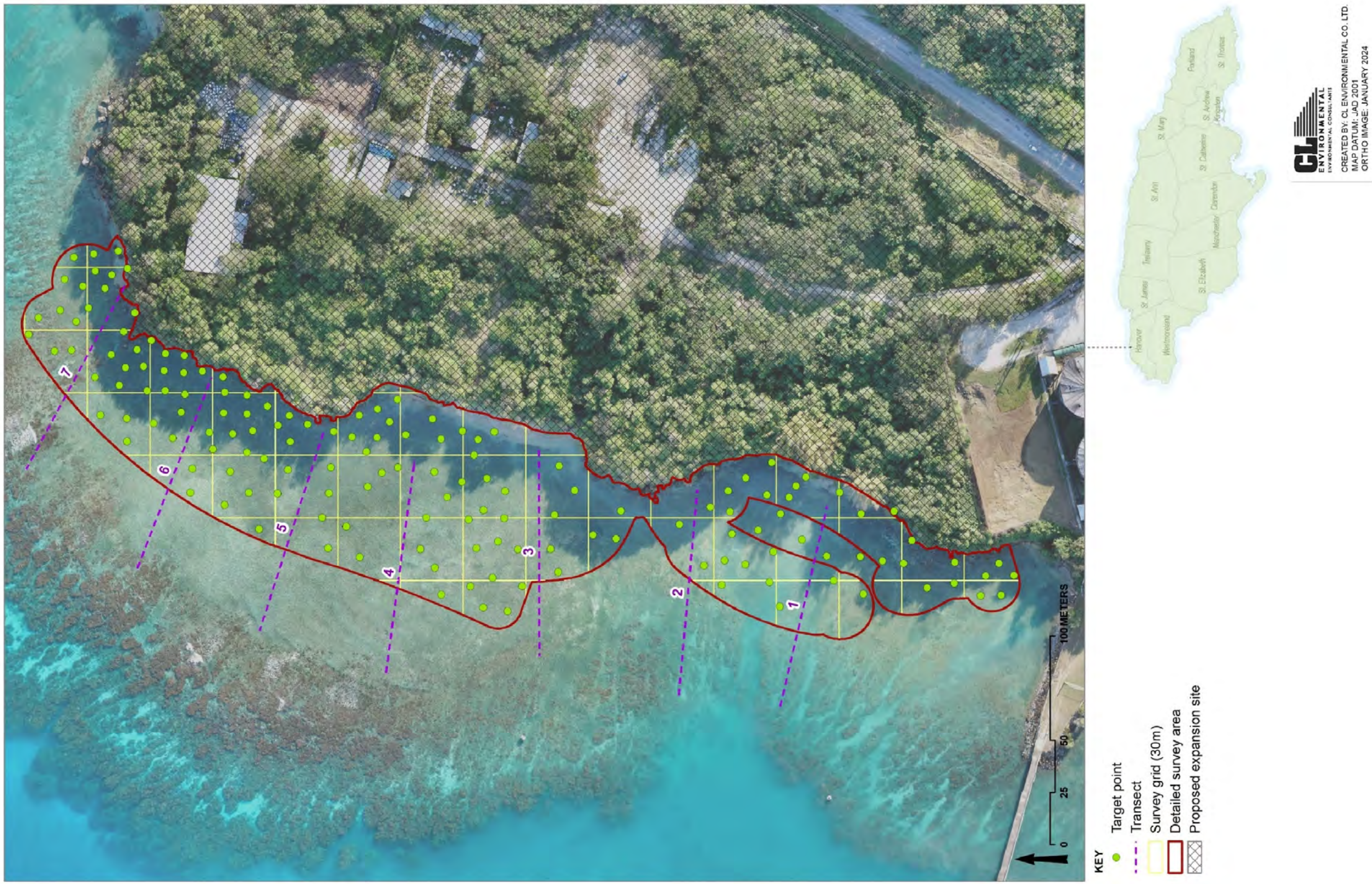


Figure 5-65 **Survey grids, transects and target points within the detailed benthic survey area**

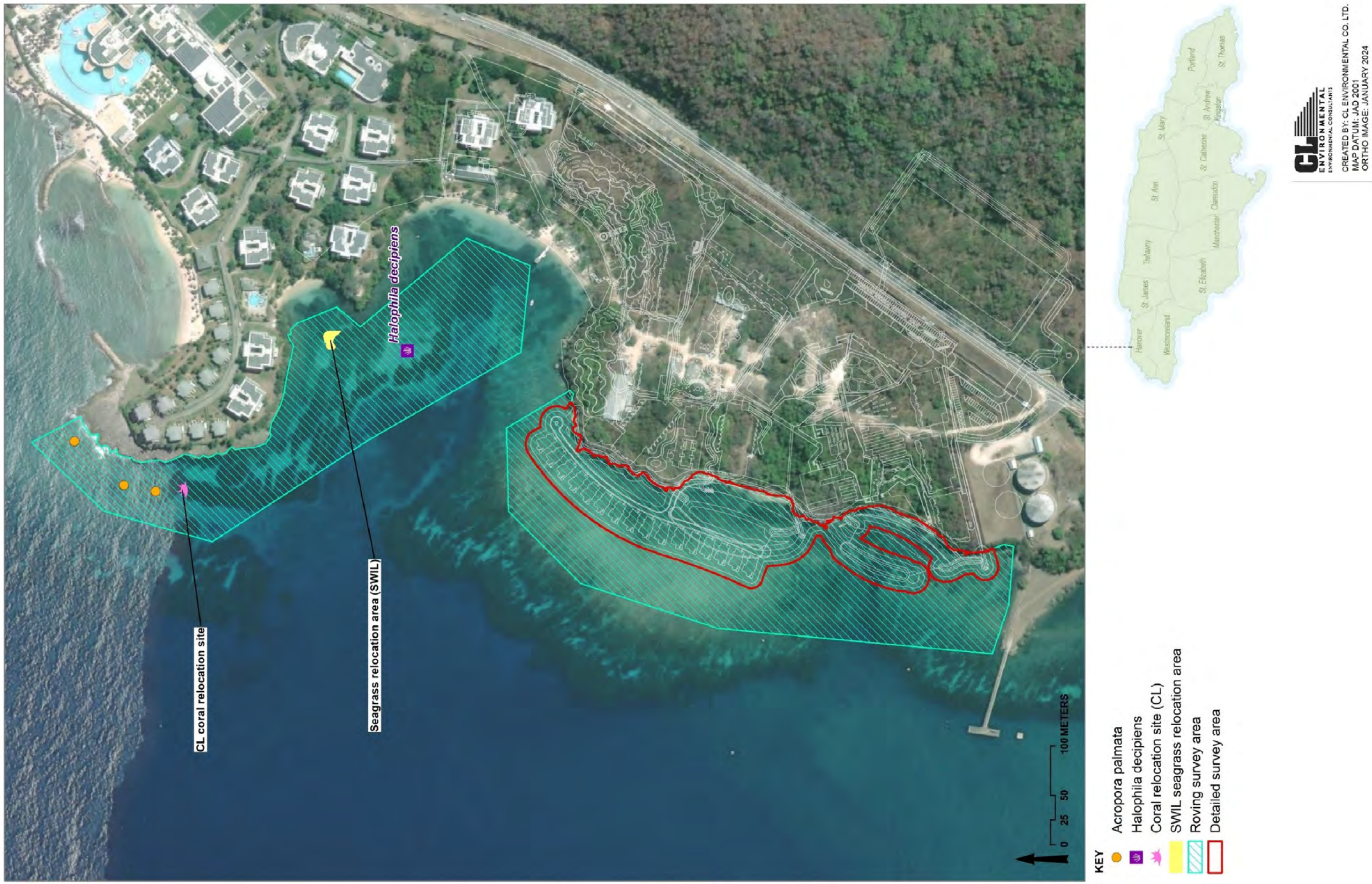


Figure 5-66 Roving surveys and relocation sites

SEAGRASS CARBON SEQUESTRATION

Within the project area a total of seven (7) seagrass cores were extracted (Table 5-24 and Figure 5-67). At each site, diving was utilized to extract core data using a PVC corer and sledgehammer. The core was then capped and removed, and the removed core and contents (vegetative and soil plug) were then carried to the surface and stored for later processing. This process was repeated for each sample taken.

Table 5-24 Coordinates of core extraction points taken at Grand Palladium

Core ID	Eastings	Northings
GPC 1	627785.2262	700311.0547
GPC 2	627845.7799	700365.8659
GPC 3	627867.7998	700438.3065
GPC 4	627827.8597	700515.9125
GPC 5	627871.3447	700550.5262
GPC 6	627890.7478	700604.6124
GPC 7	627930.9198	700652.809

In the laboratory, each seagrass blade from the sample was individually measured for length and width, and the wet weight was recorded along with attached epiphytes. Notable epiphytes were identified and removed using a 10% hydrochloric acid solution. After epiphyte removal, the blades were wiped clean, reweighed, and the weight of the epiphytes was noted. The entire root biomass was then extracted, weighed, and recorded. Samples were packaged, dried for 72 hours at 60 degrees Celsius, and dry weights for both roots and seagrass were recorded.

The collected soil was divided into two replicates, placed in labelled aluminium containers, and weighed for wet weight. After drying for 72 hours at 60 degrees Celsius, the soil samples were allowed to cool, weighed for dry weight, and then subjected to a muffle furnace at 450 degrees Celsius for five hours. The samples were removed, ash-free dry weights were recorded, and the resulting data were analysed.

SEAGRASS PRODUCTIVITY

At each location, four (4) 0.027m^2 quadrats fitted with flagging tape were randomly anchored within the seagrass meadow (Table 5-24 and Figure 5-67). The seagrass blades enclosed within each quadrat were properly fixed to ensure that none of the blades were folded underneath the quadrat boundary. A hole punch was then used to make a hole as close to the base of the blade as possible. This was done for at least 10 blades in each quadrat, samples were then left for two weeks after which they were reaped by removing the entire shoot from the quadrats and stored for later processing.

Table 5-25 Coordinates of productivity quadrats taken at Grand Palladium

Productivity Quadrat ID	Eastings	Northings
GPP1	627784.892	700310.5338
GPP2	627843.2662	700365.4822
GPP3	627868.6106	700439.0993
GPP4	627829.0582	700516.6213

In the lab, samples were carefully examined to identify holes made in seagrass blades. Blades were then cut along the cross section of each hole, and the upper section discarded. The remaining blade was then placed in 10% hydrochloric acid solution for twenty (20) minutes. After epiphyte removal, blades were wiped clean, reweighed, and the weight of the epiphytes noted. Samples were packaged, dried for 72 hours at 60 degrees Celsius, and dry weights recorded. Productivity data was obtained by transposing the weighted results into the formula:

Dry weight(g) x 0.027258 x 1/14

Across the dataset, total carbon storage within the vegetative component (roots and shoots) derived from core analysis of the seagrasses present was **2.180 MgC** within the sampled area with an estimated value of **5.055MgC** within the project area. Total soil carbon values within the sampled area amounted to **136.338 MgC** with an estimated value of **316.109 MgC** within the project area**.**

Figure 5-67 Location of seagrass cores and productivity quadrats

Results

A total of 23,185.7 m^2 of seagrass was mapped in the detailed survey area, which was previously not classified by TNC mapping initiative. Seagrass beds are dominated by Thalassia of varying densities and other characteristics.

The wider survey area had additional Thalassia dominated seagrass beds, also of varying characteristics. A total four species of seagrass were identified in the 1 km survey area (Table 5-26).

Seagrass bed health and distribution within the surveyed area are likely influenced by several factors, including environmental conditions such as substrate type, water quality parameters, and anthropogenic impacts. Variations in seagrass bed health across the detailed survey area are moderated and also like fluctuate based on seasonal changes and other environmental factors.

Furthermore, the survey area exhibited relatively low diversity and abundance of coral and invertebrate species. This observation suggests potential ecological stressors affecting these marine communities, possibly linked to broader environmental changes as well as localized disturbances within the marine ecosystem.

Table 5-26 Seagrass species found within the 1km survey area

Scientific Name	Common Name
Thalassia testudinum	Turtle Grass
Syringodium filiforme	Manatee Grass
Halodule wrightii	Shoal Grass
Halophila decipiens	Paddle Grass

Plate 5-10 *Halophila decipiens* found in the wider survey area (near the original seagrass relocation bed)

Plate 5-11 ***Halophila decipiens***

SEAGRASS DENSITY AND DISTRIBUTION

The density and distribution of seagrass within the study area are highly variable, influenced by a range of environmental factors. One primary determinant is the type of sediment present; sandy and muddy substrates generally support denser seagrass beds due to easier root penetration and better nutrient availability, while rocky or rubble substrates can limit seagrass establishment and growth. Additionally, variations in light availability, water quality, and hydrodynamic conditions such as currents and wave action can also affect seagrass density. Seasonal changes and biotic interactions, including grazing by herbivores and competition with other marine flora, further contribute to the spatial variability observed in seagrass coverage throughout the study area.

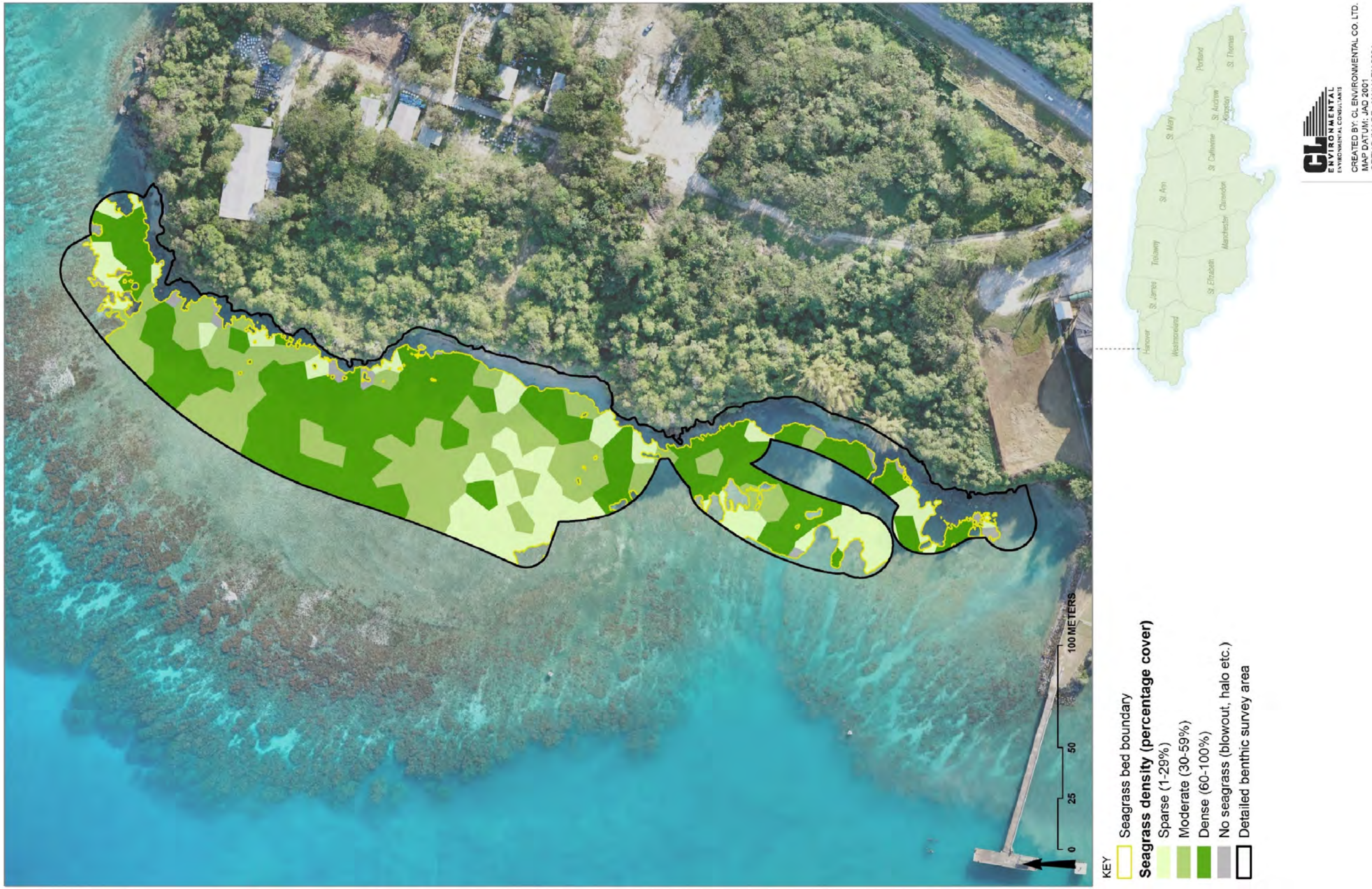


Figure 5-68 **Seagrass density in detailed survey area**

SEAGRASS BED HEALTH

Seagrass bed health can be affected by both natural and human-induced factors. Natural factors include temperature fluctuations, variations in light availability, changes in salinity, and interactions with other organisms like herbivore grazing. Events such as marine heatwaves, storms, and sedimentation from runoff can cause significant fluctuations in seagrass health.

Human influences include pollution in various forms, dredging activities, and nutrient loading from agricultural runoff, which contribute to habitat degradation, increased turbidity, eutrophication, and overfishing. Physical disturbances from boating, anchoring, and fishing practices also pose threats to seagrass meadows.

Seagrass health is significantly influenced by substrate type and temporal factors. Sandy and muddy substrates generally support denser seagrass beds due to easier root penetration and nutrient availability, while rocky or rubble substrates can limit seagrass establishment and growth.

Temporal factors such as seasonal changes and long-term climate patterns also play a crucial role in seagrass health. Seasonal variations in temperature, light, and water quality can lead to fluctuations in seagrass density and biomass. Events like marine heatwaves can cause prolonged stress, resulting in reduced seagrass cover and overall health over time.

Seagrass shoot density, leaf blade length and percentage cover are important factors in seagrass bed health and ecosystem quality. Seagrass shoot density refers to the number of individual shoots which are present within an area while seagrass percentage cover is a measure of how much of the seabed is covered with grass. These measurements along with the length of the seagrass leaves are important in monitoring the current status of seagrass beds and the impact of human or environmental factors.

Shoot Density

The average shoot density for the survey area was 450 shoots/m^2 (Figure 5-69), with a high 606 at station 1 and low of 283 at station 7. Shoot density varied across the survey area as a result of microhabitat differences. Small-scale changes in substrate type, such as patches of sand versus areas with more silt or rubble, can influence root establishment and shoot density. *Thalassia* generally prefers sandy substrates, which allow for better root penetration and stability. Variations in the organic content of the sediment can affect nutrient availability, influencing seagrass growth and density. Hydrodynamics, grazing and human activities may all influence shoot density variations in the study area.

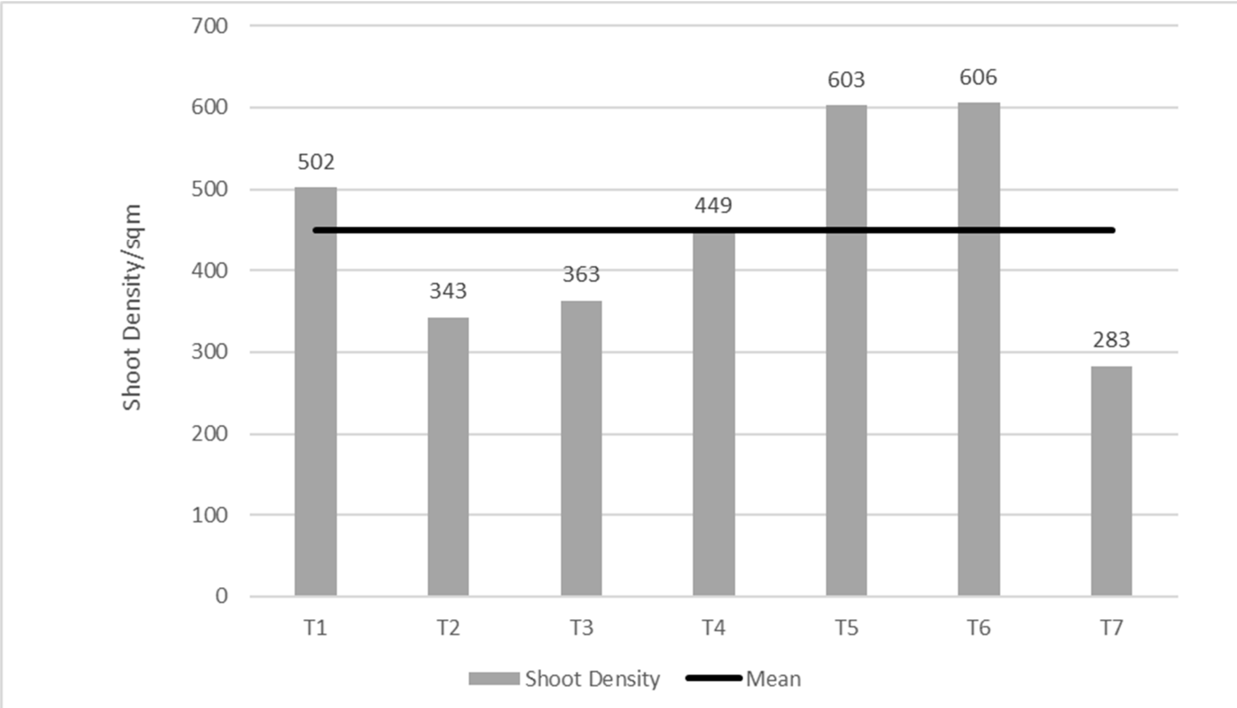


Figure 5-69 Seagrass bed shoot density

Leaf Blade Length

The average leaf blade length in the study area was 14.6cm(Figure 5-70), with a high of 21.8 at station 1 and a low of 8.7 at station 6. General blade length ranges from 10 to 40 centimetres. In optimal conditions with good light availability, nutrient-rich sediments, and stable hydrodynamic conditions, blades can reach lengths up to 50 centimetres or more. Conversely, in suboptimal conditions, blade lengths can be shorter, often less than 10 centimetres. Variations in blade length in the study area were minimal in most areas and likely due to differences in microhabitats. Blade length in T6 and T7 were low when compared to other transects. These areas are more likely influenced proximity to reef areas which may result in increased grazing and wave action. These areas are also more likely to be influenced by maritime activities associated with the hotel.

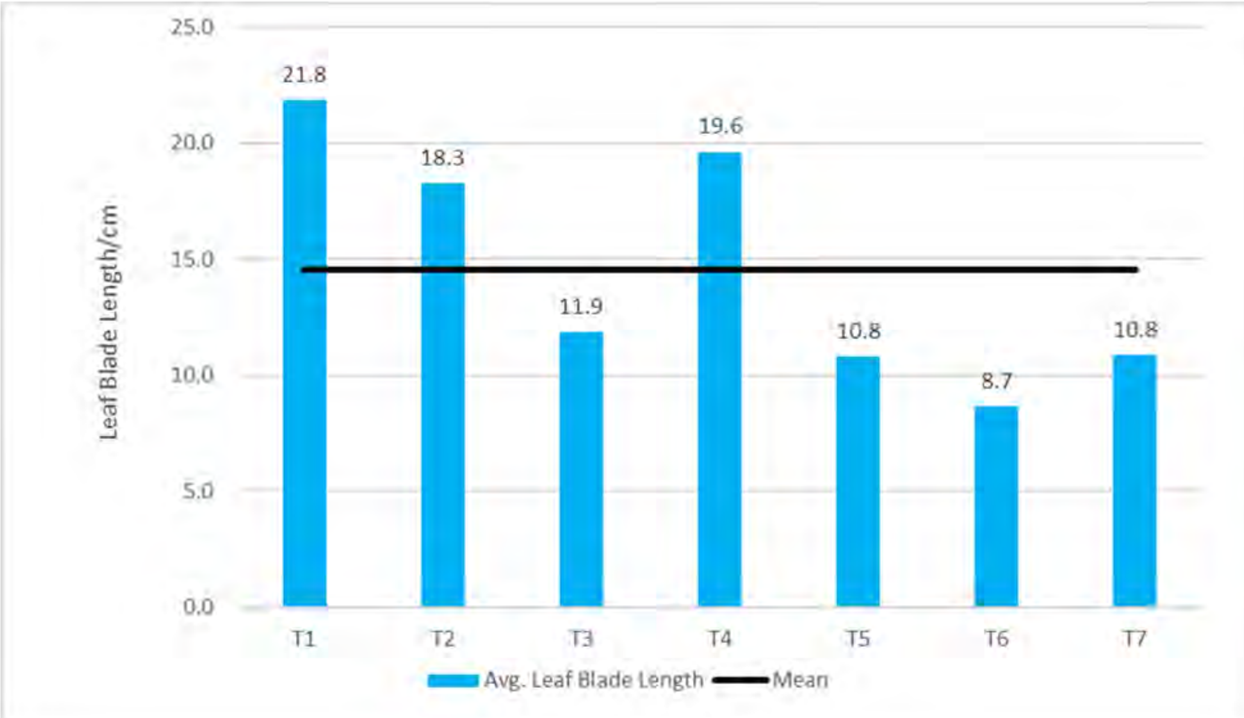


Figure 5-70 **Seagrass bed average leaf blade length**

Percentage Cover

The average percentage cover in the study area was 59% (Figure 5-71), with a high of 71%b at station1 and a low of 41% at station 7. Percentage cover was similar for most of the sample area. Similar to other bed health parameters, variations in microhabitat can result in variations observed through the bed.

The seagrass bed health in the study area demonstrates spatial variability, influenced by a range of environmental factors and human activities. Station 1 generally showing the higher values and Station 7 the lowest. Station 1, located in a more sheltered area within the harbour, benefiting from reduced wave action and potentially higher nutrients, leading to higher shoot density, leaf blade lengths, and percentage cover. Conversely, Station 7, being more exposed and closer to the hotel, experiences harsher conditions, resulting in lower seagrass health metrics. These differences highlight the impact of environmental factors such as shelter, runoff, substrate and exposure on creating microhabitats which affect seagrass bed health.

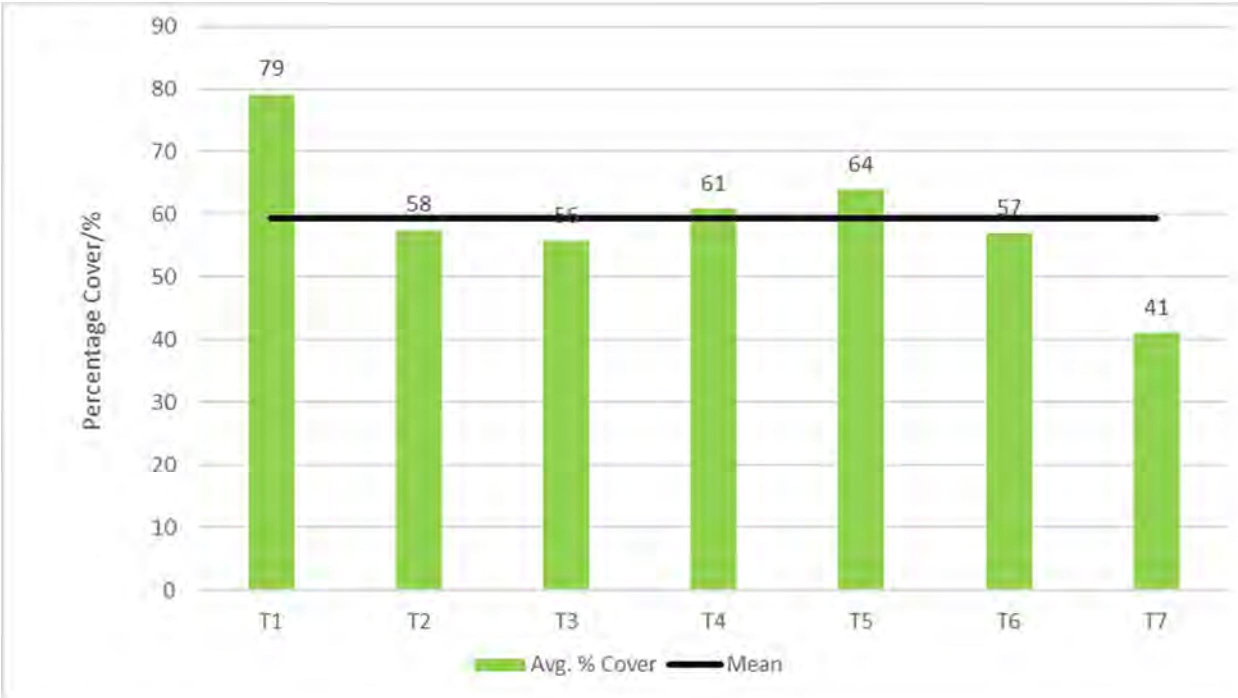


Figure 5-71 Seagrass bed average percentage cover

CORE ANALYSIS

Vegetative Component

Within the sampled area, a total of 131 blades were retrieved within sediment cores. Of these, the highest blade retrieval occurred at GPC6 with a total of 32 blades while the lowest was located at GPC1 yielding 6 blades within the corer (Figure 5-72). Values for the parameter mean blade lengths within the sampled areas ranged between 18.4centimetres (GPC2) and 7.2 centimetres (GPC7) (Figure 5-73).

Figure 5-72 Blade density (numbers) of seagrasses collected in core samples per site at Grand Palladium

Figure 5-73 Mean blade length (cm) of seagrasses collected in core samples per site at Grand Palladium

As seen in Figure 5-74, epiphyte colonization among the samples were characterized by both filamentous as well as calcareous communities. Of the samples collected, GPC5 and GPC6 had the highest epiphytic colonization of 2.3g and 1.5g respectively while lowest colonization was seen at GPC1 (0.1g) and GPC7 (0.2g).

Figure 5-74 **Epiphyte weights (g) of seagrasses collected in core samples per site at Grand Palladium**

The total biomass of both vegetative components (roots and shoots) was highest at GPC3 while GPC2 had the lowest of both components (Figure 5-75). In relation to the biomass, total carbon values within the root and shoot components of the samples yielded similar results with the highest carbon storage values in GPC3 (0.455MgC) and lowest at GPC2 (0.174MgC) (Figure 5-76).

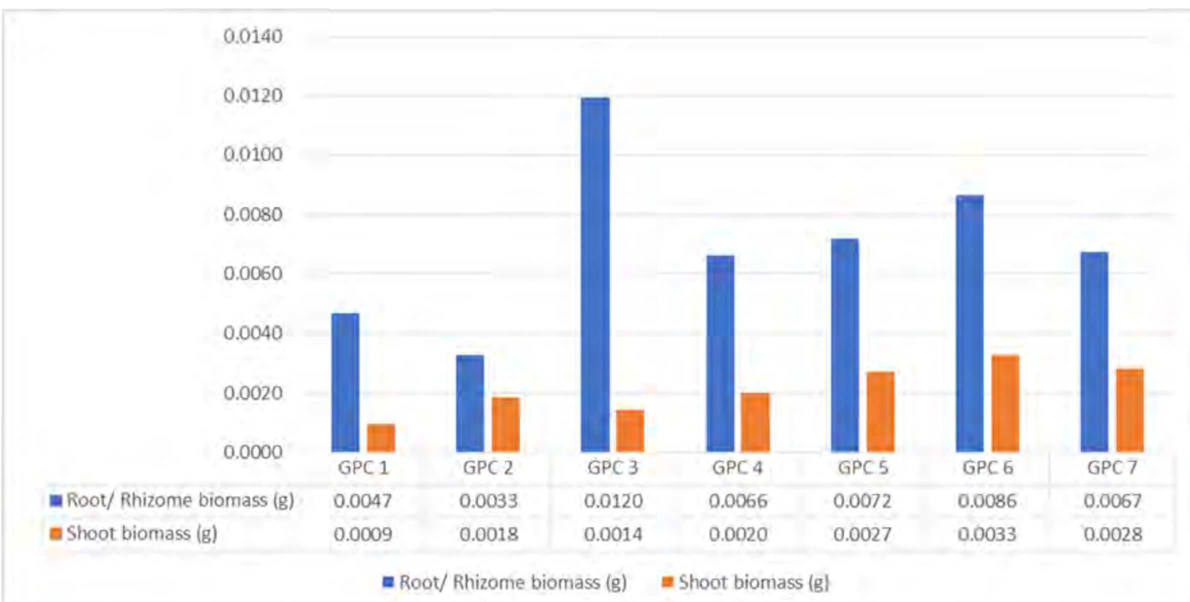


Figure 5-75 **Biomass of vegetative components (g) of seagrasses collected in core samples per site at Grand Palladium**

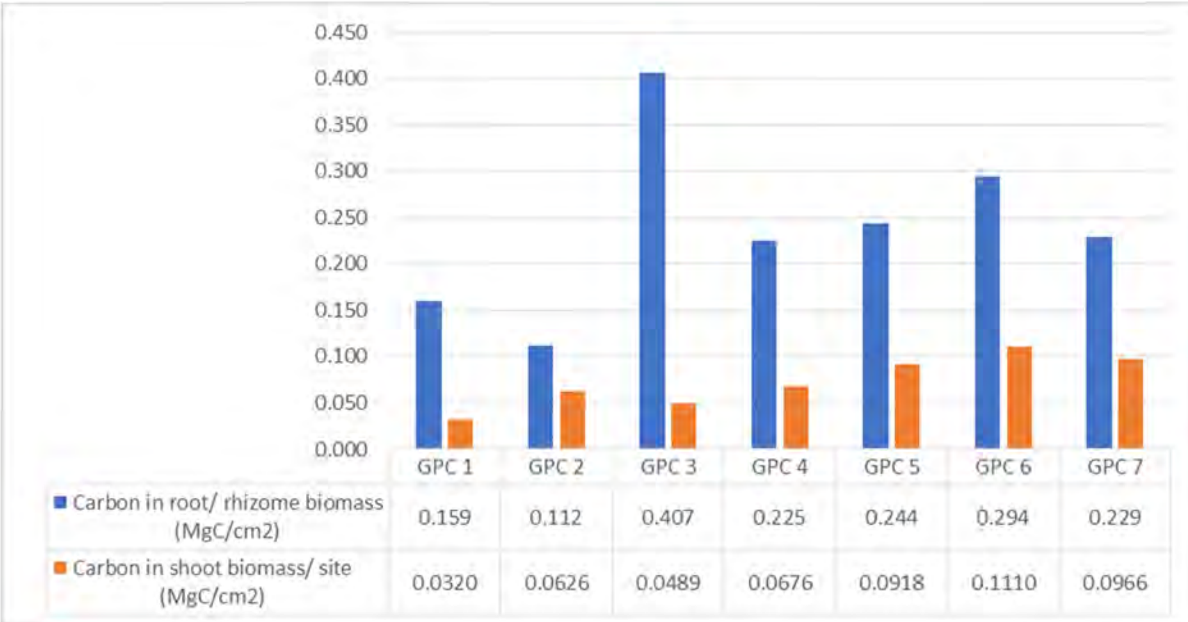


Figure 5-76 **Carbon stored within both sampled vegetative components (MgC) of seagrasses collected in core samples per site at Grand Palladium**

Total vegetative carbon in both root and shoot components obtained from core samples indicated a high of 0.455MgC at GPC3 and low of 0.175 MgC at GPC2 (Figure 5-77).

Figure 5-77 **Total vegetative carbon (MgC) of seagrasses collected in core samples per site at Grand Palladium**

Soil Component

Across the dataset, a total soil carbon content of 136.338 MgC was found among the sampled sites with the largest amount of carbon storage being found at GPC2 (56.43MgC) and the lowest at GPC6(5.17MgC) (Figure 5-78).

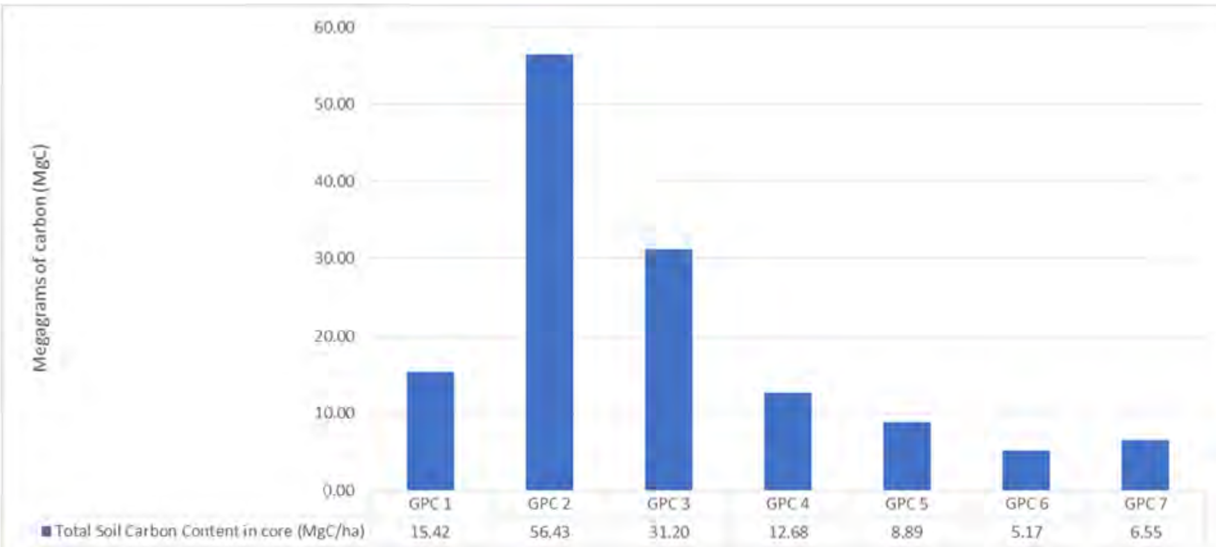


Figure 5-78 Total carbon stored within soil component (MgC) of seagrass bed collected in core samples per site at Grand Palladium

Seagrass Productivity

Seagrass productivity over a two week period indicated highest rates at GP2 while the lowest rate of productivity was found at GP4. Values were seen to fluctuate between 0.02 and 0.04g/m^2 over the period (Figure 5-79).

Figure 5-79 Productivity (g/m²) of seagrass bed after a two week period per site at Grand Palladium

SUMMARY OF RESULTS

Seagrass carbon analysis within the vegetative component among all sites indicated a total of 2.18MgC within the sampled area while soil carbon amounted to 136.34MgC. Soil carbon is seen to have a decreasing trend after GPC2, while vegetative carbon is seen to fluctuate among sites. Of the sites sampled, the highest sediment carbon was located at GPC2 (56.43MgC). This area was characterized by large deposits of silt and mud as well as large amounts of organic matter. The site with the least amount of soil carbon (GPC6), was characterised by large deposits of rocks, shells and coral rubble in sand. In comparison to the dataset, this site had very thick rhizomes entangled around coral rubble and shells. Blades collected from GPC6 were characterized by high colonization by calcareous epiphytes and also possessed the largest amount of carbon among the sites sampled.

Table 5-27 Seagrass core ID and associated sediment type found at Grand Palladium.

Seagrass Core ID	Sediment Type
GPC1	Mud
GPC2	Silt
GPC3	Sand and Rubble
GPC4	Sand
GPC5	Mud
GPC6	Sand and Rock
GPC7	Sand

Shoot Analysis

Within each core sample collected within the project area, associated sediment types were noted (Table 5-27). Among the data, highest shoot carbon values were found at GPC6 (0.11MgC) and GPC7 (0.10MgC).

This may be due to various factors such as water quality and sediment composition. Water quality parameters associated with these sites can be seen among data presented for the site WQ2. This area is characterized by the highest nitrate and phosphate values among the datasets. These nutrients are key in the growth and addition of biomass within seagrass beds, particularly its shoot component. Notably, this area also possesses relatively low values relating to total suspended solids, light extinction coefficient and turbidity. This allows seagrass beds to receive an adequate amount of sunlight required for their continued growth. Though mean blade lengths are the lowest within these sites, this parameter cannot entirely describe the health of the seagrasses present; but also, the rate and efficiency of which new biomass is being created and its sustainability. Sites with the lowest shoot carbon values, GPC1 (0.03) and GPC3 (0.05) are located in locations of high turbidity and wave action. These conditions limit the health and productivity of seagrass shoots as high turbidity throughout the water column blocks incoming photosynthetically active radiation, limiting the rate of photosynthesis. High wave activity also increases the vulnerability of seagrass beds to breakage and so a constant loss of stored carbon.

Table 5-28 Total shoot carbon stored (MgC/ha) in seagrass component of the project area

Project area (ha)	Total carbon in shoot biomass (MgC/ha) in project area
2.318571	1.1841

Root Analysis

Root analysis indicated a total biomass of 0.0070g and a root carbon value of 1.6695MgC. Of the sites which were sampled, the highest root carbon values were found at GPC3 (0.41MgC) and GPC6 (0.29MgC). Root carbon was seen to be associated with sandy and rock/rubble substrates. This may be due to the need for an exaggerated effort needed for the grasses here to remain anchored to the sea floor. Seagrasses often reallocate resources to suit the conditions in which they exist. In this case, efforts may be placed towards below ground components rather than vertical growth reflected in blade lengths to ensure survivability and resilience. In contrast, the lowest root carbon values were associated with the sites GPC2 (0.11MgC) and GPC1 (0.16MgC). These areas are characterised by muddy and silty substrate as well deeper waters. As a result of these factors, there is reduced pressure upon these beds to remain rooted within this substrate. Here, roots are able to easily penetrate through the underlying soil. Consequently, the fine nature of silt and mud may result in a limited ability to uptake essential nutrients for growth. This coupled with the turbid nature of this area may cause hindrances to photosynthesis as discussed in the previous section and thus a lack in the function of the seagrass bed which will be reflected in all components.

Table 5-29 Total root carbon stored (MgC/ha) in seagrass component of the project area

Project area (ha)	Total carbon in root biomass (MgC/ha) in project area
2.318571	3.8708

Soil Analysis

Dry bulk density, which is determined by the mass of a fully dried sample and its original volume, often indicates prominent soil components, including differences between organic and inorganic components. Texture, colour, weight, and the contents of these dried samples are frequently used to determine this. Of the sites which were sampled, GPC1 and GPC2 had the darkest coloration with mixtures of mud and silt present at each site respectively. Eastern sites which were sampled were seen to gradually increase in sand, rubble and rocky substrate compositions. Carbon storage in sediments is determined by several factors, including sediment stability, associated root components of seagrasses present in the area, proximity to rivers and manmade outflows and the nature and level of disturbances present. Soil carbon calculations from cores taken within the project area indicated highest values at GPC2 (56.43MgC) and GPC3 (31.20MgC). Soil carbon values seen within the project area are due a number of factors including the nature of the sediment present, the efficiency of photosynthetic and respiratory properties of the beds present, the rate at which seagrass blades are capable of trapping sediment suspended within the water column and the effects of wave activity on the resuspension of sediments. High carbon values seen among these sites are most likely due to mixture and transition between these two sites from mud and silt to sand and rubble. Seagrass bed complexity often has varying results on the ability to store carbon. In an areas such as these, characterised by cliff face, the presence of seagrasses as well as sediment composition and benthic complexities such as rubble will assist sediment stability and settlement. As a result, this may be a likely factor in the carbon values seen within these areas. Root biomass being highest at GPC3 may also be a contributing factor to carbon values observed.

The lowest carbon values were observed at GPC6 (5.17MgC) and GPC7 (6.55MgC). Characterised by exposed and shallow waters, coarse sand and rocky substrate and shorter blade lengths, these sites are more vulnerable to sediment loss from wave activity and the inability of the seagrasses here to trap sediments. Mean blade lengths among these two sites are the lowest among the dataset at 8.3cm and 7.2cm respectively. The inability to trap sediments efficiently as well as constant wave activity will reduce the amount of soil carbon which can be stored here.

Table 5-30 Total soil carbon stored (MgC/ha) in seagrass component of the project area

Project area (ha)	Total soil carbon (MgC/ha) in project area
2.318571	316.1089

5.2.2.4 Coral

During the study period, a severe Marine Heatwave (MHW) significantly impacted much of the benthic community, especially hard and soft corals. By January 2024, all *Millipora* colonies and several other coral species had died, while some hard corals showed signs of recovery. Subsequently there was the passage of severe storms including hurricane Beryl.

Previous studies in the general area were conducted in deeper reef environments, beyond the bounds of the detailed survey area. Similar to those findings, the fringing reef and patch reefs within the survey area were predominantly covered by dense turf and macroalgae. Coral cover was generally very low in the detailed survey area. Most of the study area habitats were seagrass and pavement areas which featured very small, encrusting colonies, with *Siderastrea* emerging as the dominant species.

A photo inventory and species list (Table 5-31) were compiled from roving surveys. Colonies were marked using Trimble Geo 7x Global Positioning System (GPS) within the detailed survey area. Data collected included; colony counts, size classifications, and species identifications. Additional surveys included belt transects, with 1x1 meter quadrats positioned every 10 meters on alternating sides of the line, counting all small coral colonies within each quadrat.

Examples of corals seen in the survey are given in Plate 5- - Plate 5-.

Table 5-31 Coral species list

CORAL Common Name	*Scientific Name*
SOFT CORAL	
Common Sea Fan	*Gorgonia ventalina*
HARD CORAL	
	Agaricia spp.
Finger Coral	*Porites porites*
Grooved Brain coral	*Diploria labyrinthiformis*
Golfball Coral	*Favia fragum*
Great Star Coral	*Montastraea cavernosa*
Knobby Brain Coral	*Pseudo diploria clivosa*
Lobed Star Coral	*Orbicella annularis*
Massive Starlet Coral	*Siderastrea siderea*
	Siderastrea radians
Mustard Hill Coral	*Porites astreoides*
Smooth Brain Coral	*Pseudo diploria strigosa*
Thin Finger Coral	*Porites divaricata*
	Stephanocoenia
	Oculina sp
HYDROCORAL	
Common Name	
Branching Fire Coral	*Millepora alcicornis*
Blade Fire Coral	*Millepora complanata*

Plate 5-12 Example of a patch reef in the general study area

Plate 5-13 Bleached *Millipora* colony (died during survey)

Plate 5-14 Porites divaricata colony

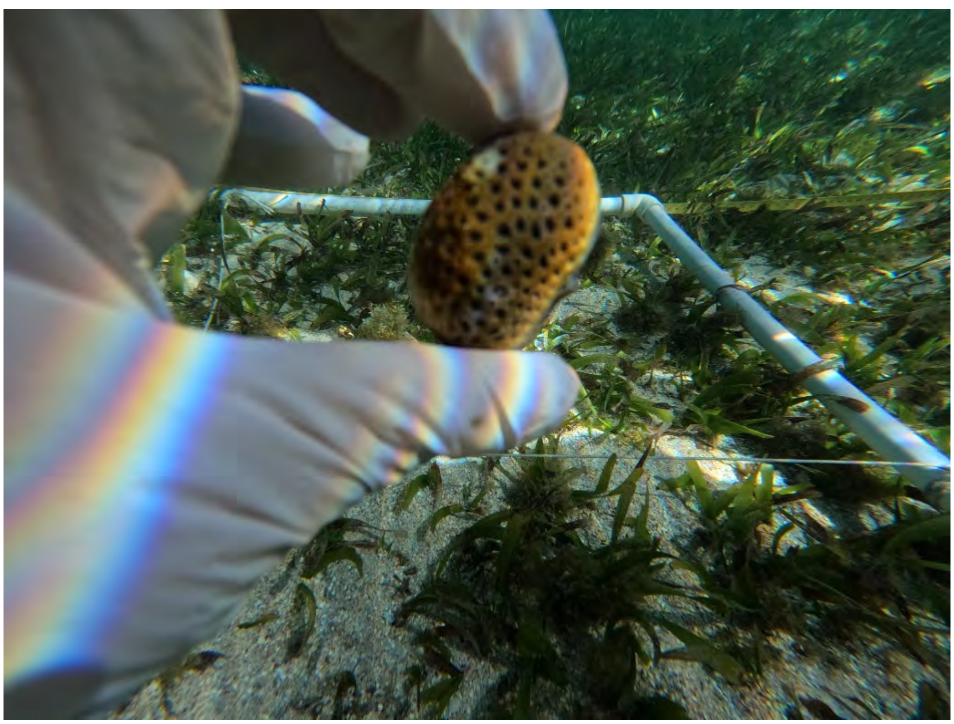


Plate 5-15 Siderastrea colony

Plate 5-16 Oculina sp.

Plate 5-17 Small encrusting coral colonies

Plate 5-18 **Bleached fire coral and finger coral**

Plate 5-19 **Patch reef covered in sediment with turf and macroalgae**

Plate 5-s20 Nearshore encrusting coral colonies

A total of 678 coral colonies were mapped by size class in the detailed survey (Table 5-32 and Figure 5-80).The average number of small corals (<5cm) was estimated at 2.57 individuals per square meter within the seagrass bed.

Most of the corals seen in the survey area were relatively small and encrusting, particularly in the pavement and seagrass habitats. These colonies, although small, play a role in the marine ecosystem by contributing to the structural complexity of the benthic environment. In pavement areas, the encrusting corals were found interspersed among patches of turf and macroalgae and other sessile organisms. Within the seagrass beds, these corals were less frequent. Small massive and branching species of coral were also seen in seagrass areas. Siderastrea was the dominant species in both seagrass and pavement habitats.

Table 5-32 Mapped coral colonies and by size class

Coral Size Class	Number of Colonies
>20cm	53
10-20cm	551
5 - 9cm	74
Grand Total	678

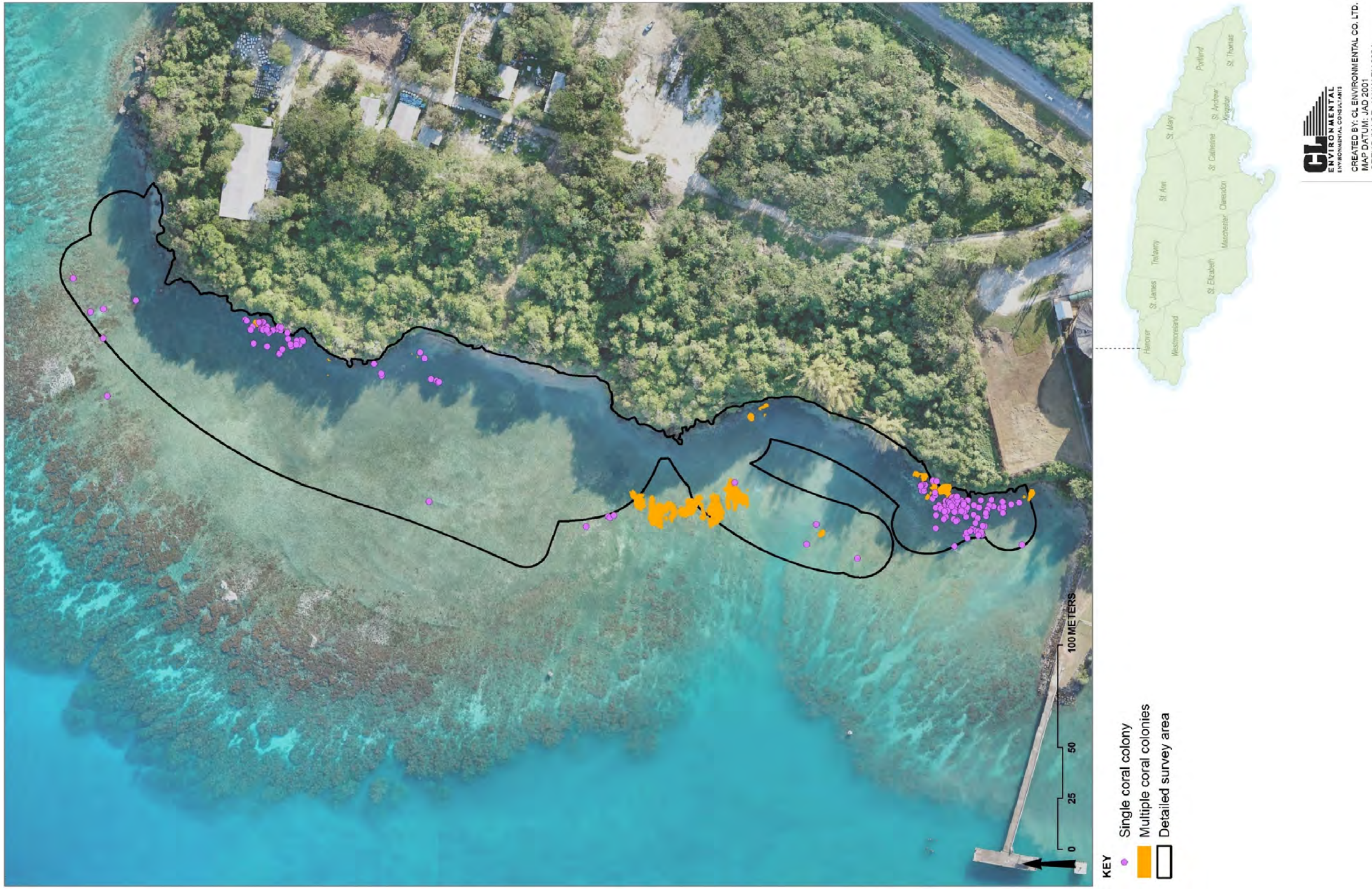


Figure 5-80 Mapped coral colonies

5.2.2.5 Invertebrates

Nearshore Communities

Nearshore communities have a diverse array of invertebrates, including gastropods, crustaceans, and echinoderms, which contribute to nutrient cycling, sediment stabilization, and the overall productivity of the habitat. These invertebrates provide essential food resources for fish and other marine species, enhancing the biodiversity and ecological balance of seagrass meadows. For example, bivalves and gastropods aid in filtering water and recycling nutrients, while crustaceans like crabs and shrimps aerate the sediment and facilitate nutrient exchange. Additionally, the presence of sea urchins such can influence seagrass health by grazing on epiphytes that compete with seagrass for light and nutrients. These species also experienced thermal stress from prolonged elevated temperatures. Examples of invertebrates in the study area are given in Table 5-33, Plate 5- and Plate 5-.

Table 5-33 Species seen in study area

Common Name	Scientific Name
Collector Urchin	*Tripneustes ventricosus*
Rock Boring Urchin	*Echinometra sp.*
Green Urchin	*Lytechinus variegatus*
Black/long Spined Urchin	*Diadema antillarum*
Cushion starfish	*Oreaster reticulatus*
Carpet/sun Anemone	*Stichodactyla helianthus*
Giant Anemone	*Condylactis gigantea*
Magnificent Feather Duster Worm	*Sabellastarte magnifica*

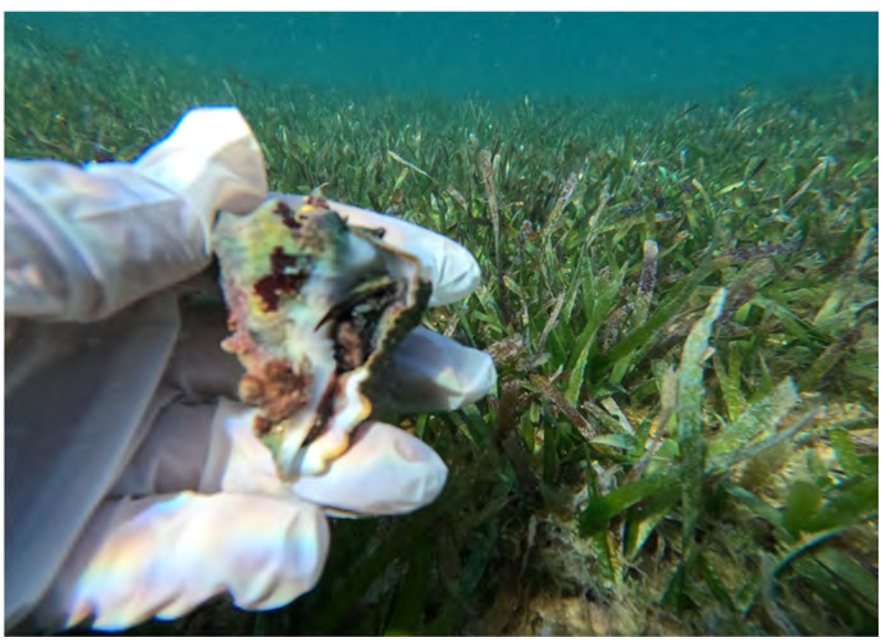


Plate 5-21 Molluscs in seagrass bed

Plate 5-22 **Bleach sun anemone in survey area (thermal stress)**

Intertidal Communities

Intertidal communities in the survey area, are situated on cliff faces and limestone rocks at the boundary between terrestrial and marine ecosystems. Intertidal communities have an assortment of organisms specialized to endure the challenging conditions inherent to this transitional habitat. Organisms here have remarkable adaptability and resilience as the experience pronounced shifts in environmental conditions, influencing the spatial distribution and population dynamics of intertidal species and facilitating complex ecological interactions and zonation.

Zonation along the intertidal zone refers to the distinct patterns of species distribution and community composition observed along the shoreline in response to gradients of environmental. These patterns result in the formation of distinct zones or bands, each characterized by unique assemblages of organisms adapted to specific environmental conditions. From the high intertidal zone, where organisms are exposed to air during low tide, to the low intertidal zone, which remains submerged for longer periods, zonation reflects the adaptations of organisms to survive in dynamic and often harsh intertidal environments.

Examples of species seen in intertidal areas in the study area are given in Plate 5-23to Plate 5-26.

Plate 5-23 **Example of intertidal snails *Tectarius muricatus***

Plate 5-24 **Chitons in the intertidal zone**

Plate 5-25 Nerites in the intertidal zone

Plate 5-26 Example of an intertidal rock in the study area

5.2.2.6 Fish Communities

Background

Most of the study site includes marine and coastal habitats, namely seagrass beds, coral reefs and rocky shores. Such habitats provide several ecosystem goods and services for thousands of marine dwelling species and human populations globally. Seagrass meadows are noted for being nursery grounds, with many juveniles and small fish living among seagrass blades before migrating to adjacent reefs. Similarly, the many depressions and platforms of rocky shores, provide spaces for juveniles and a productive food source for many species of fish, molluscs, crustaceans and birds. This proves important to the interconnectivity of ecosystems and assists in the sustenance of industries such as fisheries and tourism, both of which are main economic activities in the surrounding towns.

Though small in proportional coverage, coral reefs offer a wide array of benefits. In a report by Ruitenbeek et al, reefs in Montego Bay, Jamaica accounted for $400 million in 1999 (Ruitenbeek, n.d.). The many growth forms of corals, soft corals and other reef organisms provide interstitial spaces for many individuals to occupy (Idjadi, 2006). Ideally, the more three-dimensional the framework, the more redundant and resilient the system is, increasing its ability to withstand stressors and threats to biodiversity. Like seagrass meadows, reefs also assist in coastline protection, with reefs reducing wave energy by as much as 86% (Ferrario, 2014). This service is important during high-energy events such as storms and hurricanes, where many of the nation's population and industries are found within close proximity to the sea.

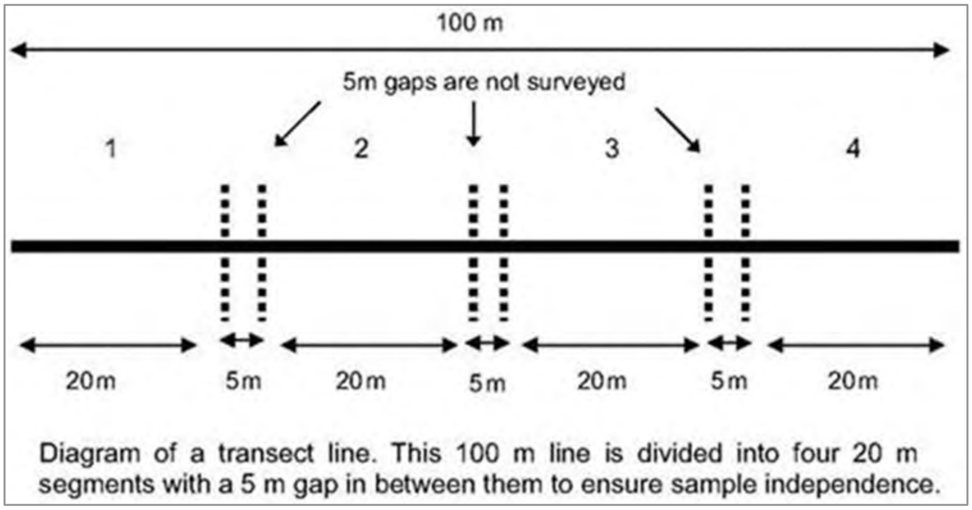
Marine ecosystems face several threats to biodiversity, including climate change, coastal development, pollution, and invasive species. Nearby reefs (Hopewell) were ranked "poor" by NEPA when last surveyed as a part of the national assessment exercise in 2020. This was characterized by a coral cover of 17%, macroalgal cover of 51% and low biomasses of commercially important and herbivorous fishes.

Survey Approach

FISH COMMUNITIES WITHIN SURVEY AREA

To assess the fish communities, a modified version of Reef Check's Fish Protocol was utilized (Figure 5-81). Throughout the area, seven (7) 100m long lines were laid perpendicular to the coastline. Along each 100m line, four 5m wide (centred on the transect line) by 20m long segments were sampled for fish, enumerating the number of individuals per species within each segment. The size of each individual was also noted and categorized using size classes (0 - <5cm; - 10 cm; 11 - 20 cm; 21 - 30 cm; 31 - 40 cm; more than 40 cm) with the aid of a T-bar graduated in 5cm intervals. Fish seen within the water column up to 5m above the transect line were also included. To reduce the risk of duplicating counts, there was a 5m gap in between each 20m segment. To minimize disturbance to the habitat, fish surveys were the first surveys to be performed.

FishBase was used to determine the diet of each species before assigning them to one of three broad categories – Herbivore, Carnivore, and Omnivore.



Source: FishBase (http://www.fishbase.org)

Figure 5-81 Reef Check Fish Protocol

CORAL REEF FISH ASSESSMENTS

To describe the fish composition on nearby back and fore-reefs, the Roving Diver Technique was utilized. Within the reef system, a thirty-minute timed roving survey was conducted. During this survey, every observed species was identified and recorded, assigning each species an abundance rank based on the number of individuals observed: Single (1), Few (2-10), Many (11-100), and Abundant (more than 100).

Seagrass Fisheries Habitat

DESCRIPTION OF SEAGRASS FISHERIES HABITAT

Nearshore habitats surveyed were mostly seagrass beds of 1-6m and dominated by Thalassia testudinum. Most areas were of a uniformed gradient with few patch reefs, rocks, and rubble within the area. The most observed activities within the study area were motorized and non-motorized water activities associated with the hotel (snorkelling, paddleboarding, boat tours) as well as fishing, with fishers and fish pots a few hundred metres from the coastline, these however were very limited.

FISH DIVERSITY

A total of 34 species within 18 families were identified across the seven transects (Table 5-34). GP-T1 had the highest species richness, with 20/34 species observed along the transect laid. The most frequent species across the four sites were Slippery Dick (*Halichoeres bivittatus*), Striped Parrotfish (*Scarus iseri*), and Cocoa Damselfish (*Stegastes variabilis*). Additional species observed within the beds while in transit between transect locations included Bottlenose Dolphin, Bermuda Chub, Yellow Jack and Night Sergeant.

Table 5-34 Species richness per transect

Species	IUCN Status	GP-T1	GP-T2	GP-T3	GP-T4	GP-T5	GP-T6	GP-T7
Ablennes hians	Least Concern				X	X		
Abudefduf saxatilis	Least Concern							X
Acanthurus chirurgus	Least Concern	X	X				X	X
Acanthurus coeruleus	Least Concern	X	X		X			
Caranx ruber	Least Concern	X						
Chaetodon capistratus	Least Concern	X						
Clupeidae	Least Concern							X
Diodon holocanthus	Least Concern							X
Gerres cinereus	Least Concern	X			X			
Haemulon flavolineatum	Least Concern	X	X		X			X
Halichoeres bivittatus	Least Concern	X	X	X	X	X	X	X
Halichoeres maculipinna	Least Concern					X		
Halichoeres poeyi	Least Concern		X	X	X	X	X	X
Holocentrus rufus	Least Concern							X
Hypoplectrus indigo	Least Concern		X					
Lutjanus apodus	Least Concern	X		X		X		X
Lutjanus synagris	Least Concern							X
Malacoctenus triangulatus	Least Concern					X		
Ocyurus chrysurus	Data Deficient	X	X	X		X		X
Scarus / Sparisoma (Juvenile)	Least Concern	X	X	X	X		X	
Scarus iseri	Least Concern	X	X	X	X	X	X	X
Scarus taeniopterus	Least Concern			X				
Scorpaena plumieri	Least Concern			X				
Serranus tigrinus	Least Concern	X	X				X	
Sparisoma aurofrenatum	Least Concern	X	X					
Sparisoma radians	Least Concern	X	X	X	X	X		X
Sparisoma rubripinne	Least Concern	X						
Sparisoma viride	Least Concern	X			X			X
Stegastes adustus	Least Concern	X					X	X
Stegastes diencaeus	Least Concern	X	X	X	X		X	X
Stegastes leucostictus	Least Concern							X
Stegastes partitus	Least Concern		X					
Stegastes variabilis	Least Concern	X	X	X	X	X	X	X
Synodus saurus	Least Concern							X
Thalassoma bifasciatum	Least Concern	X	X	X	X		X	X
Urobatis jamaicensis	Least Concern	X						
Species Richness (excluding Clupeidae + Scarus/ Sparisoma)		**20**	**15**	**11**	**12**	**10**	**9**	**19**

The most abundant family observed was *Labridae* (Wrasse), represented mostly by Slippery Dick (*Halichoeres bivittatus*) and Bluehead (*Thalassoma bifasciatum*). This family made up approximately 41% of all fish observed within the study area with 749 individuals. The second and third most abundant families were Scaridae (Parrotfish) and *Pomacentridae* (Damselfish), with 589 and 254 individuals respectively (Figure 5-82).

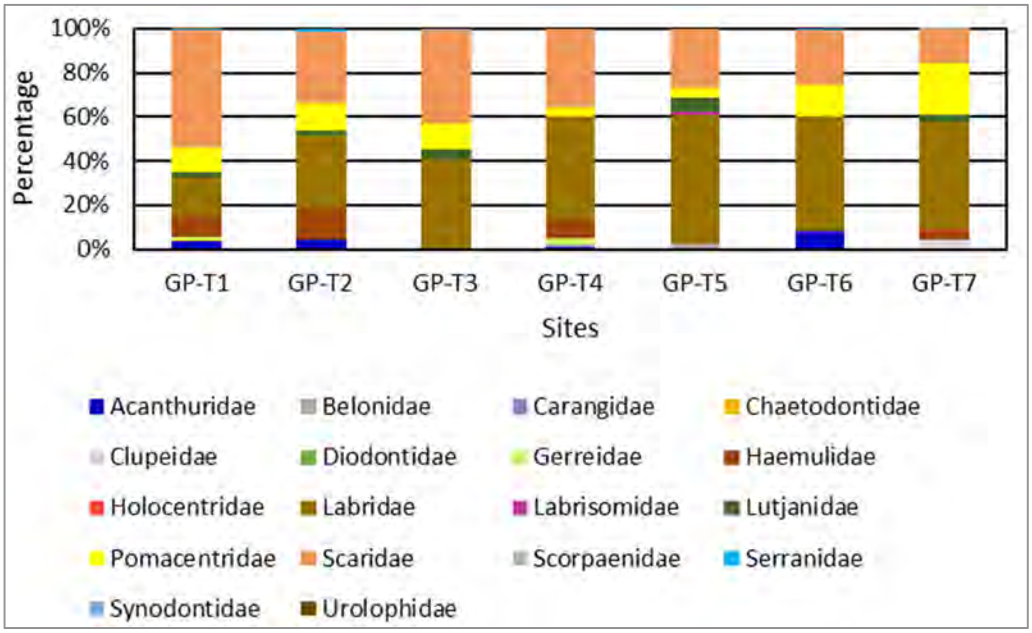


Figure 5-82 Representation of families across transects

FISH ABUNDANCE

GP-T7 had the highest number of fish recorded, while GP-T5 had the lowest (Figure 5-83). This high number of fish recorded along GP-T7 was as a result of rock outcroppings which were at the beginning of the transect area and thus providing more rugosity and areas for organisms to occupy. GP-T5 and GP-T6 were characterised as having a uniformed, flat slope with shorter seagrass blades and therefore not having many interstitial spaces for organisms to occupy. Many of the fish observed here were therefore roving through the water column, as opposed to staying amongst blades or rocks.

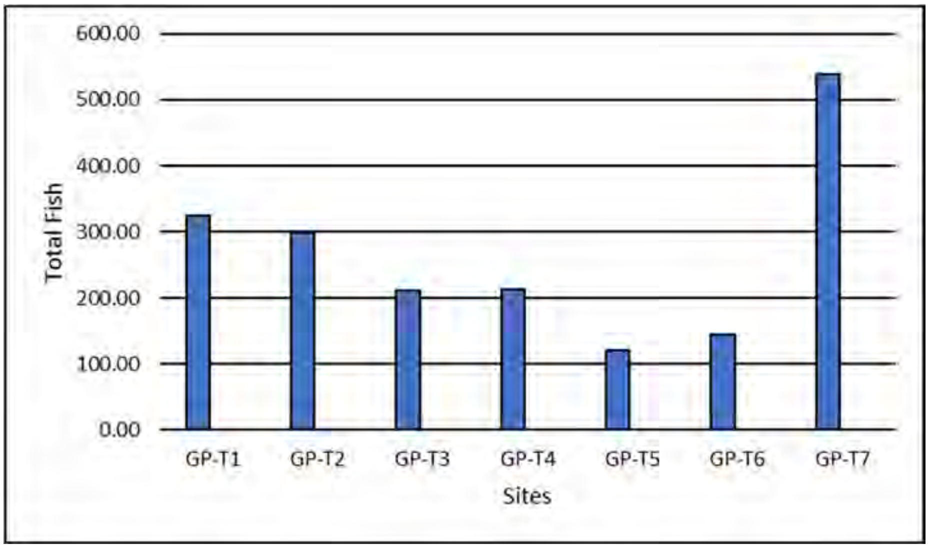


Figure 5-83 Abundance of fish per transect

FEEDING GROUPS

Most of the fishes observed during the surveys were carnivores, with herbivores being the feeding group having the second highest numbers (Figure 5-84). The most abundant carnivores were Wrasses (*Labridae)*, Grunts (*Haemulon flavolineatum*), and Snappers (*Lutjanidae)*. Herbivores observed mostly belonged to the Parrotfish Family (*Scaridae/Sparisoma*), with the most abundant fish being the Striped Parrotfish *(Scarus iseri*). The only observed omnivores observed along transects were Damselfishes (*Pomacentridae)*.

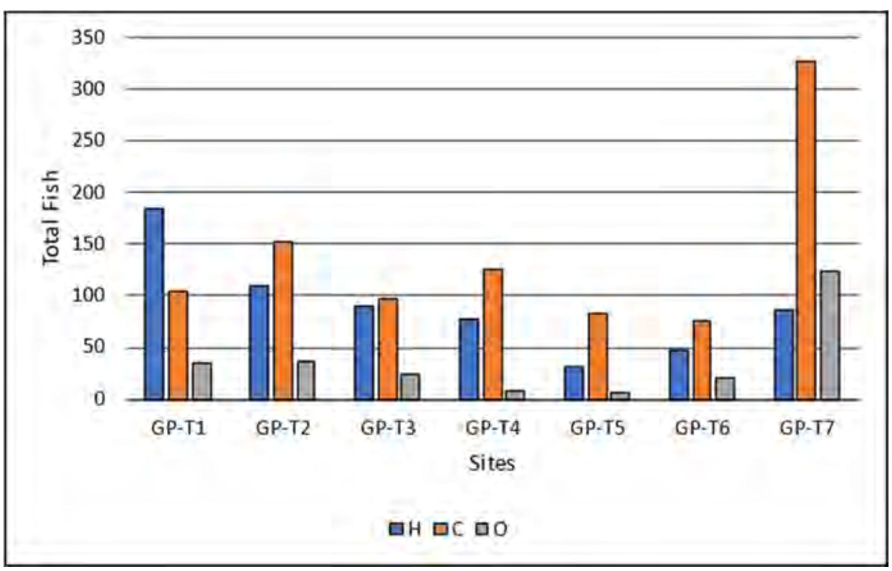


Figure 5-84 Mean abundance of fish per site based on feeding group

FISH DENSITY

The density across the seven transects ranged from 30.25 to 134.50 individuals /100m², with GP-T7 being the densest (Table 5-35). Areas that had rocks provided a greater surface area and were often occupied with more animals where fish could stay in crevices or underneath ledges

Table 5-35 Fish density per transect

	GP-T1	GP-T2	GP-T3	GP-T4	GP-T5	GP-T6	GP-T7
Density (#/100m²)	81.00	74.50	52.75	53.25	30.25	36.00	134.50

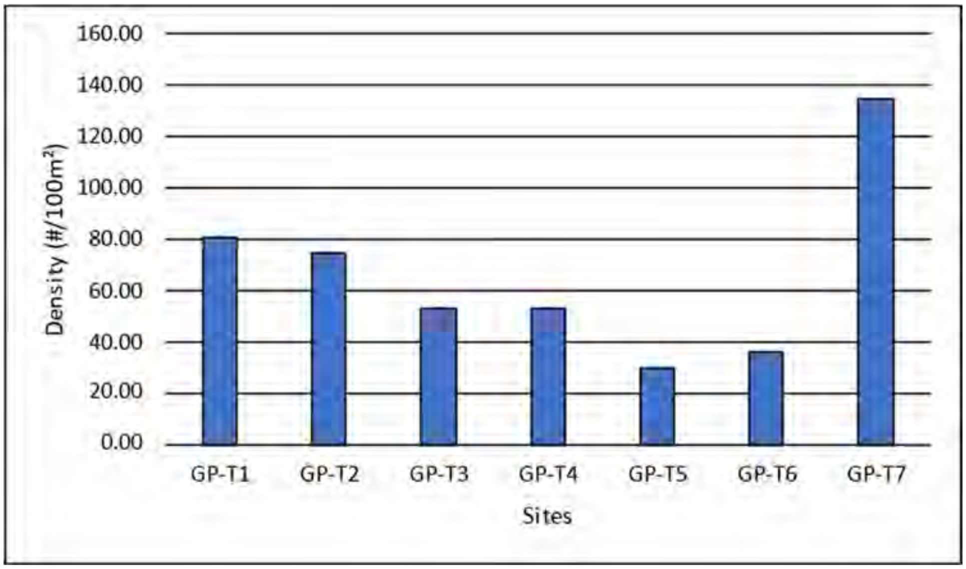


Figure 5-85 Density of individuals (#/100m²) per transect

FISH SIZE

Most fish were 20 cm and less in total length, with a significant portion being in the 0-5 and 6-10cm size classes (Figure 5-86). Based on the families observed, most of these fishes would be within the juvenile stage of their life cycle. The largest individuals were Flat Needlefish (*Ablenness hians*), Yellow Stingray (*Urobatis jamaicensis*), and Spotted Scorpionfish (*Scorpaena plumieri*).

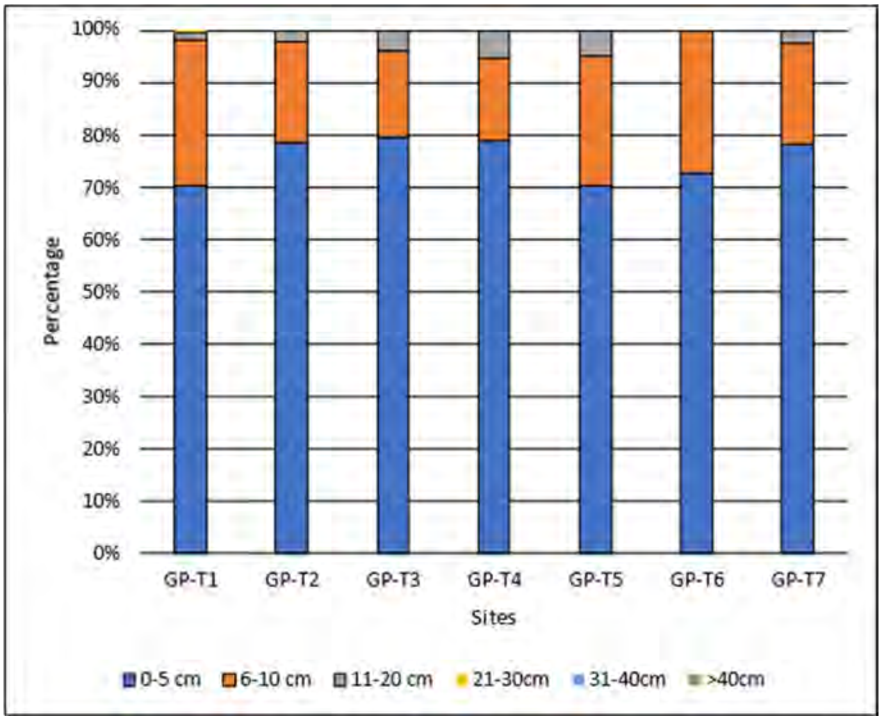


Figure 5-86 Percentage of fish per size class per transect

Coral Fisheries Habitat

DESCRIPTION OF CORAL FISHERIES HABITAT

Associated reefs were fringing reefs and patch reefs in 1 to 4m of water and, in some locations, as close as 60m to the shoreline. Several species of corals were observed, including *Millepora complanata*, *Orbicella annularis*, *Porites astreoides, Pseudodiploria strigosa*, and *Siderastrea spp.* The substratum providing growth areas for these colonies was mostly dead coral. The reefs had a significant coverage of turf algae and macroalgae, most notable being *Dictyota*. These various species and growth forms provide interstitial spaces for fish occupancy, with more fish observed in more rugose areas.

FISH DIVERSITY

A total of 18 species were observed during the roving surveys. The most observed individuals were members of the Damselfish family (*Pomacentridae*), namely dusky and longfin (Table 5-36). With regards to conservation status under IUCN, most species were categorized as of "Least Concern".

Table 5-36 Species list and abundance of reef fish

Common Name	Scientific Name	IUCN Status	Abundance
Doctorfish	*Acanthurus chirurgus*	Least Concern	S
Trumpetfish	*Aulostomus maculatus*	Least Concern	S
Graysby	*Cephalopholis cruentata*	Least Concern	F
Spotfin Butterfly	*Chaetodon ocellatus*	Least Concern	S
Banded Butterfly	*Chaetodon striatus*	Least Concern	F
Fairy Basslet	*Gramma loreto*	Least Concern	F
French Grunt	*Haemulon flavolineatum*	Least Concern	M
Slippery Dick	*Halichoeres bivittatus*	Least Concern	M
Blackear Wrasse	*Halichoeres poeyi*	Least Concern	F
Squirrelfish	*Holocentrus adscensionis*	Least Concern	S
Schoolmaster Snapper	*Lutjanus apodus*	Least Concern	F
Striped Parrotfish	*Scarus iseri*	Least Concern	M
Harlequin Bass	*Serranus tigrinus*	Least Concern	F
Redband Parrotfish	*Sparisoma aurofrenatum*	Least Concern	M
Dusky Damselfish	*Stegastes adustus*	Least Concern	A
Longfin Damselfish	*Stegastes diencaeus*	Least Concern	A
Cocoa Damselfish	*Stegastes variabilis*	Least Concern	F
Bluehead Wrasse	*Thalassoma bifasciatum*	Least Concern	A
No. of species = 18			

5.3 NATURAL HAZARDS

5.3.1 Earthquake and Seismicity

5.3.1.1 Historical Seismic Activity and Faults

Seismic occurrences pose considerable risks as natural hazards, ranging from minor tremors to catastrophic events with devastating consequences. The severity of such events varies based on their magnitude, potentially leading to infrastructure damage and loss of life. Despite advancements in monitoring technology, earthquakes remain inherently unpredictable.

Jamaica is situated at the convergence of the Caribbean tectonic plate and the Gonâve micro-plate. This geological setting is characterized by the Walton and Enriquillo Fault Zones, located to the west and east of Jamaica, respectively. These fault zones, along with the Jamaican Fault system, facilitate significant seismic activity in the region. The Duanvale Fault zone and the Montpelier-New-Market Fault zone, contribute to Jamaica's seismic landscape. These faults exhibit an east-west and north-northwest to south-southeast orientation, respectively (C. DeMets, 2007).

Jamaica has had a notable earthquake history with significant events such as the 1692 Port Royal earthquake, the 1907 Kingston earthquake, the 1957 March 1st earthquake, which impacted the western end of the island and the 1993 January 13th earthquake. These events were the cause of significant losses for Jamaican citizens but only represent a small portion of the seismic activity occurring on the island; more recently, between 2011 and 2020 there were over 1000 recorded earthquakes with local epicentres, of which approximately 94 were actually felt. Although none were catastrophic, it highlights the significant levels of seismic activity across Jamaica.

At the project site, a fault lies approximately 250 meters south of the expansion area, with the nearest epicentres situated 4.8 kilometres (February 1917) and 6.6 kilometres southwest of the site (July 1930) (Figure 5-87).

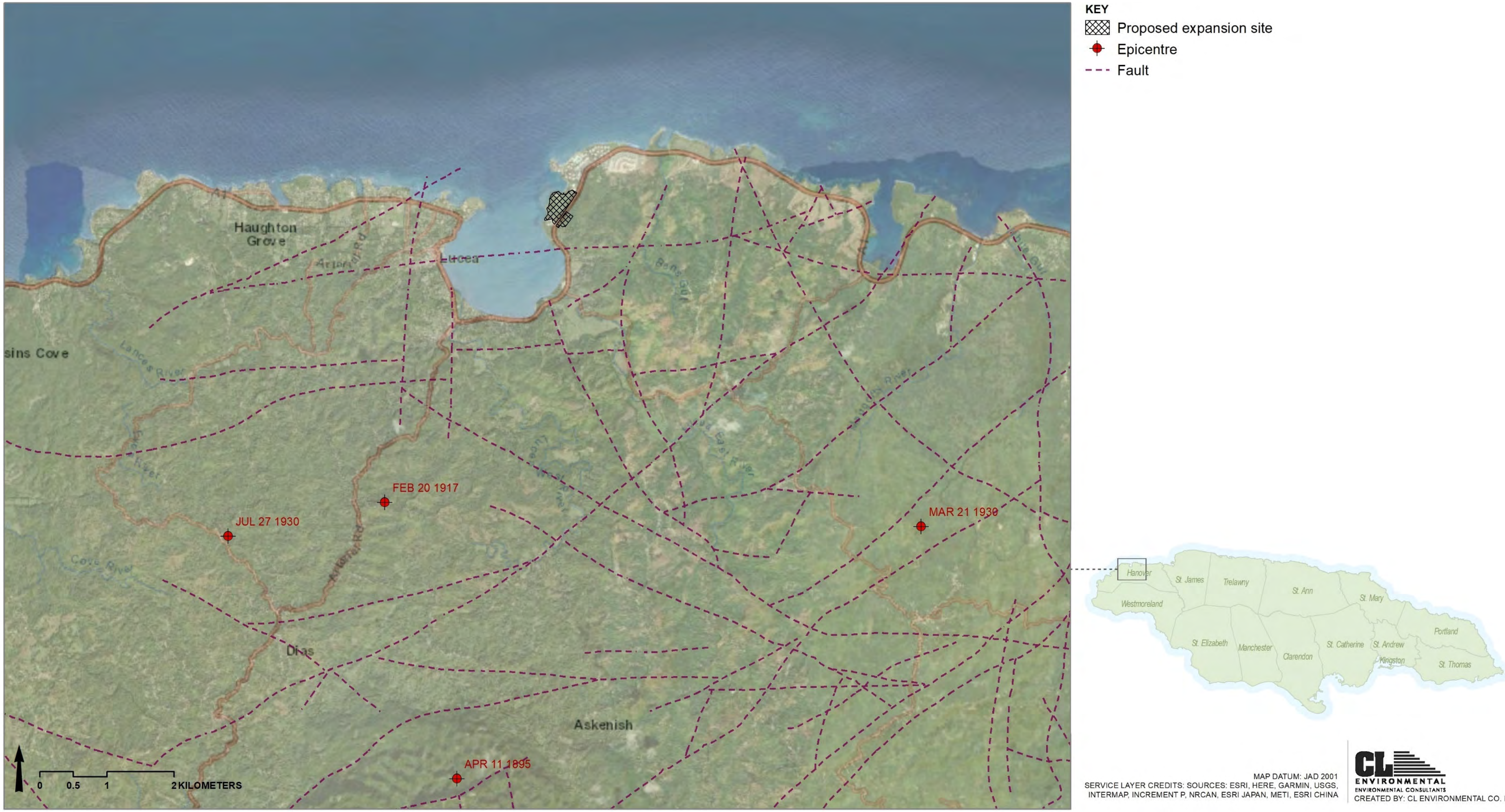


Figure 5-87 Earthquake epicentres and faults within the project area

5.3.1.2 Spectral Acceleration

The Spectral Acceleration (SA) is the primary seismic hazard intensity parameter employed in modern building codes. It represents the maximum acceleration experienced during sustained shaking caused by an earthquake, measured at a specific oscillatory period similar to that of a building's natural vibration. This acceleration measure varies depending on the location, indicating that the intensity of ground shaking also varies across different regions.

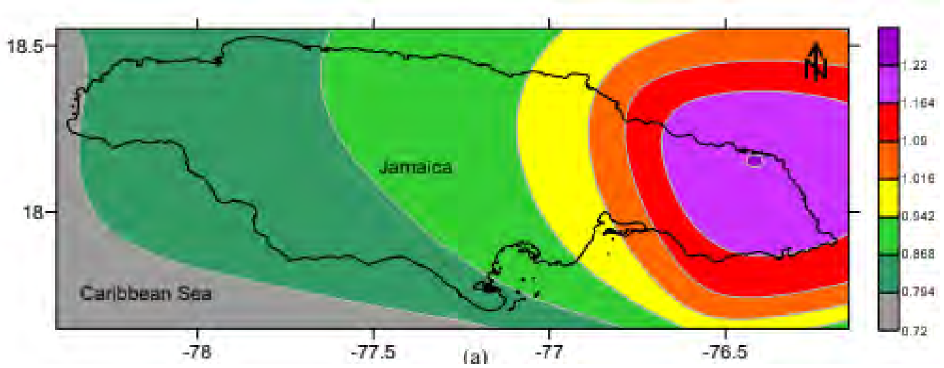
Evaluating short and long-period spectral accelerations across diverse regions provides valuable insight into the levels of seismic activity, revealing potential differences in ground motion severity among various areas. Short-period spectral accelerations, typically observed at 0.2 seconds, reflect seismic effects on low-rise structures (several floors tall). In contrast, long-period spectral accelerations, observed at 1.0 second, represent the oscillations experienced by taller structures (exceeding 7 floors).

To assess seismic hazard levels in the project area, spectral accelerations were derived from seismic hazard maps recommended in the International Building Code (IBC) adopted for Jamaica (Table 5-37).

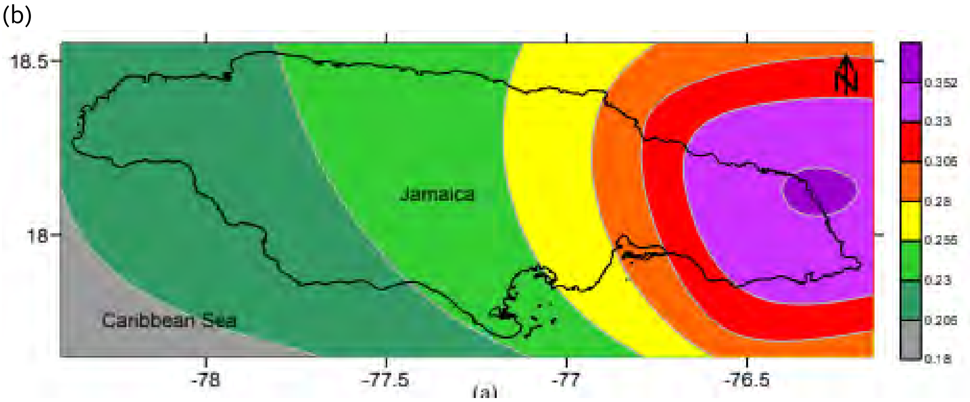
Table 5-37 Site Spectral Response map for 0.2s short period (a) and 1.0s long period (b)

Source: Probabilistic Seismic Hazard Assessment for Jamaica Sep. 2013

(a)



(b)



5.3.2 Storm Hazards

5.3.2.1 Historical Activity

Hurricanes present a significant threat, bringing heavy rainfall, powerful winds, and storm surges that can lead to damage and displacement. They can originate from various locations within the Tropical Atlantic Basin, spanning from the West Coast of Africa near the Cape Verde Islands to the Gulf of Mexico and the Caribbean Sea—a region known as the primary development area. Positioned directly within 'Hurricane Alley,' Jamaica is situated in the Atlantic Ocean zone where hurricanes tend to form, fuelled by warm sea surface temperatures (Figure 5-88).The north-east Trade Winds typically push those formed at lower latitudes on a westerly track, whereas those formed at higher latitudes track more to the north and north-west.

Jamaica is vulnerable to the threat of hurricanes, particularly during the Atlantic hurricane season, which typically runs from June 1st to November 30th. In the last two decades, the Caribbean region has experienced the impact of at least five major hurricanes (Figure 5-89).

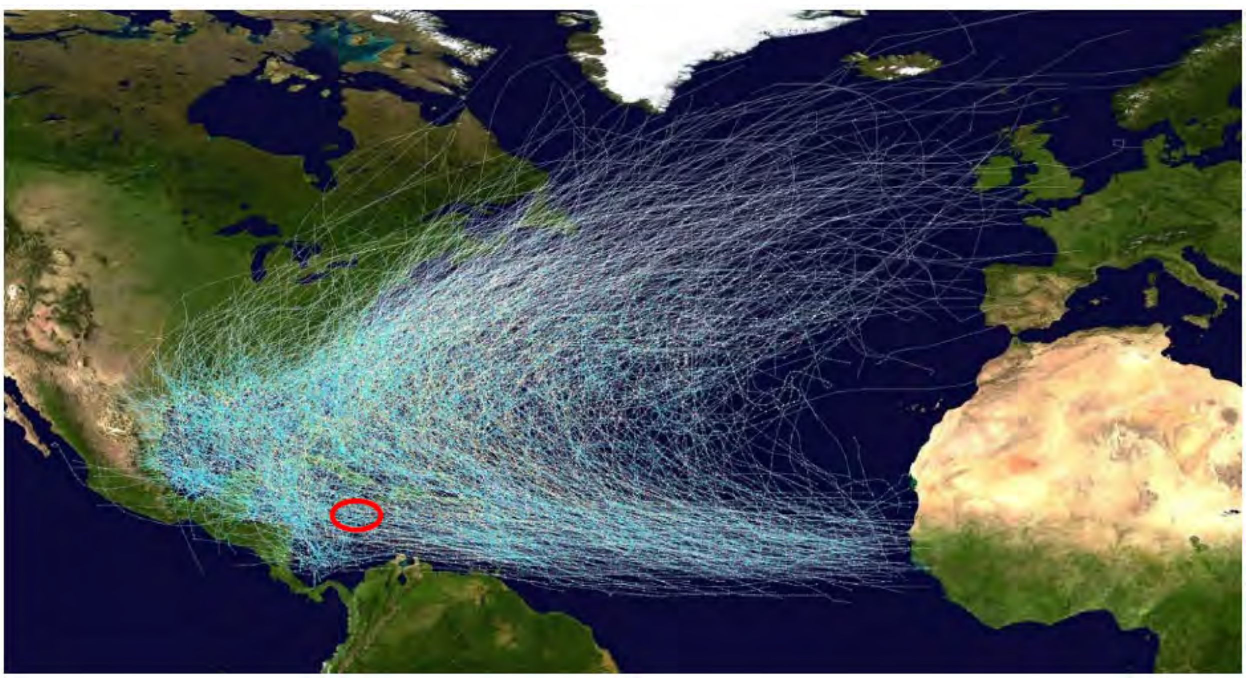


Figure 5-88 Atlantic hurricane tracks since 1851, the sweeping shape of which is commonly called 'Hurricane Alley'. The approximate location of Jamaica is highlighted by an orange circle.

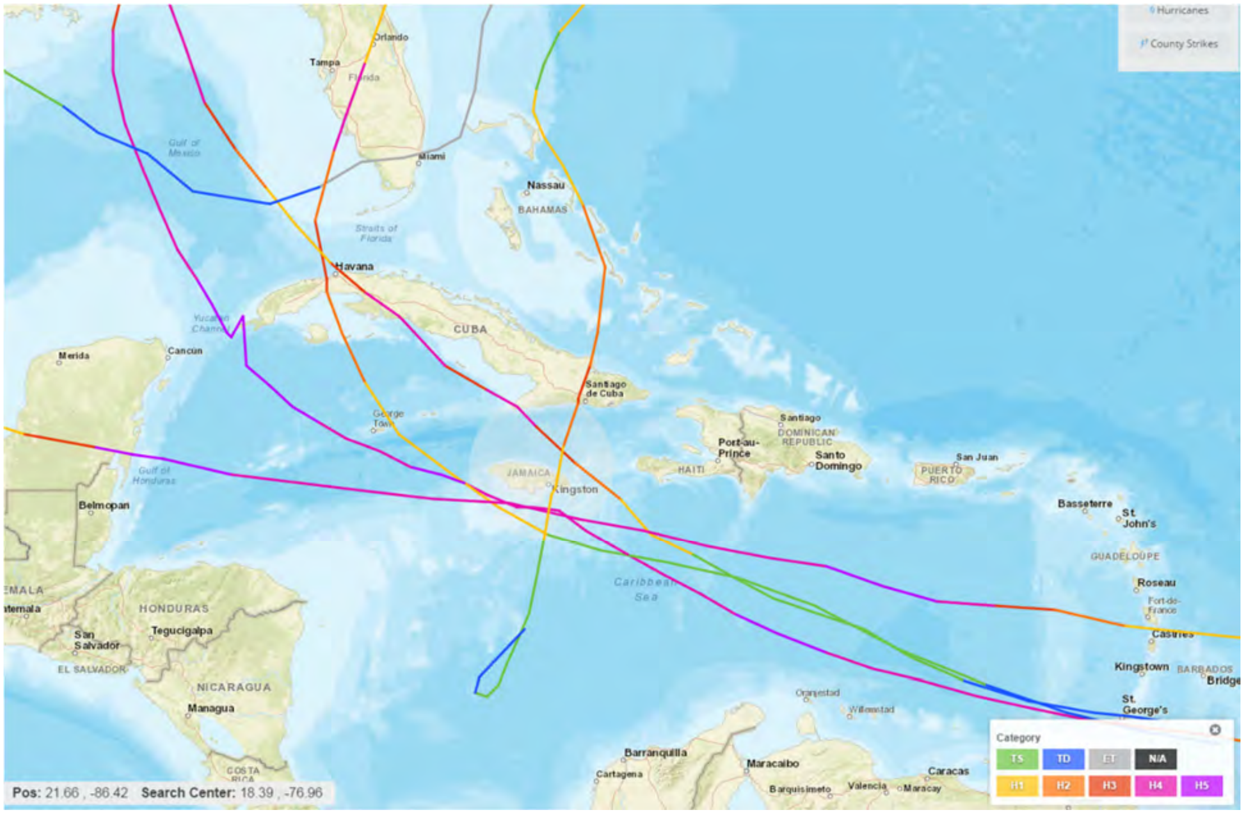


Figure 5-89 Tropical storms/Hurricanes passing through the Caribbean over the past fifteen (15) years

5.3.2.2 Climate Change Considerations

Recent global and regional climate change models have forecasted alterations in climate conditions that could amplify the effects of coastal hazards. The Intergovernmental Panel on Climate Change (IPCC) has provided projections derived from numerical models, suggesting that tropical storms are becoming more intense compared to previous years. The IPCC's 2007 report stated the following:

> *"There is evidence from modelling studies that future tropical cyclones could become more severe, with greater wind speeds and more intense precipitation. Studies suggest that such changes may already be underway; there are indications that the average number of Category 4 and 5 hurricanes per year has increased over the past 30 years."*

The predictions of the IPCC are consistent with the number of category 4 and 5 storms that have tracked within 400 kilometres Jamaica in the past 130 years (Figure 5-90); the number of category 4 and 5 storms has increased from 10 to 15 storms per twenty-year intervals up to 1950 to 30 to 35 storms per twenty years after 1950. This doubling of storm occurrences coupled with increased sea level rise can result in shoreline retreat as beach profiles adjust to a more intense wave climate.

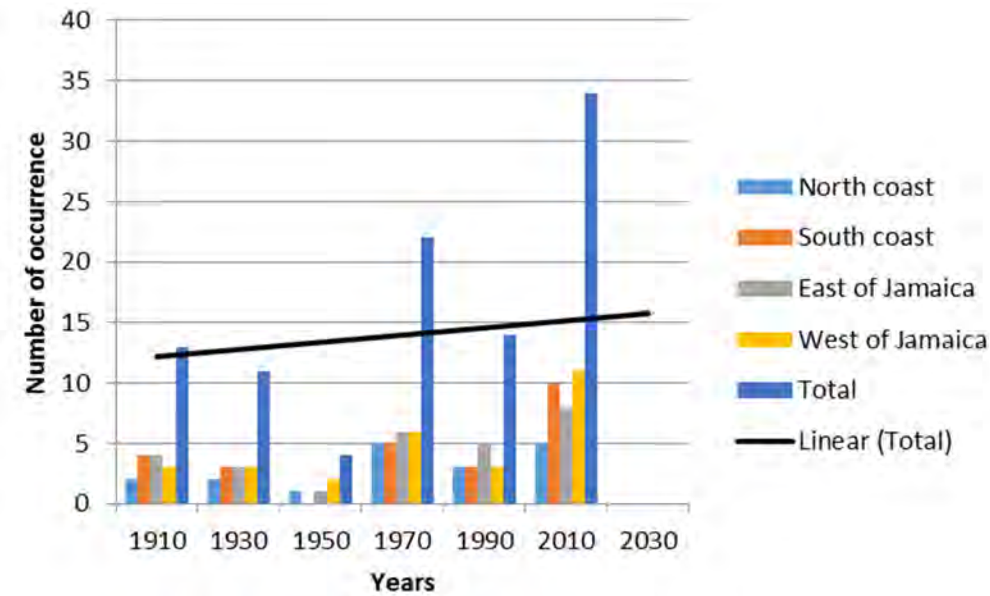


Figure 5-90 Occurrences of Category 4 and 5 hurricanes that have passed within 300 kilometres of Jamaica's shoreline since 1890 to 2014, in twenty years intervals

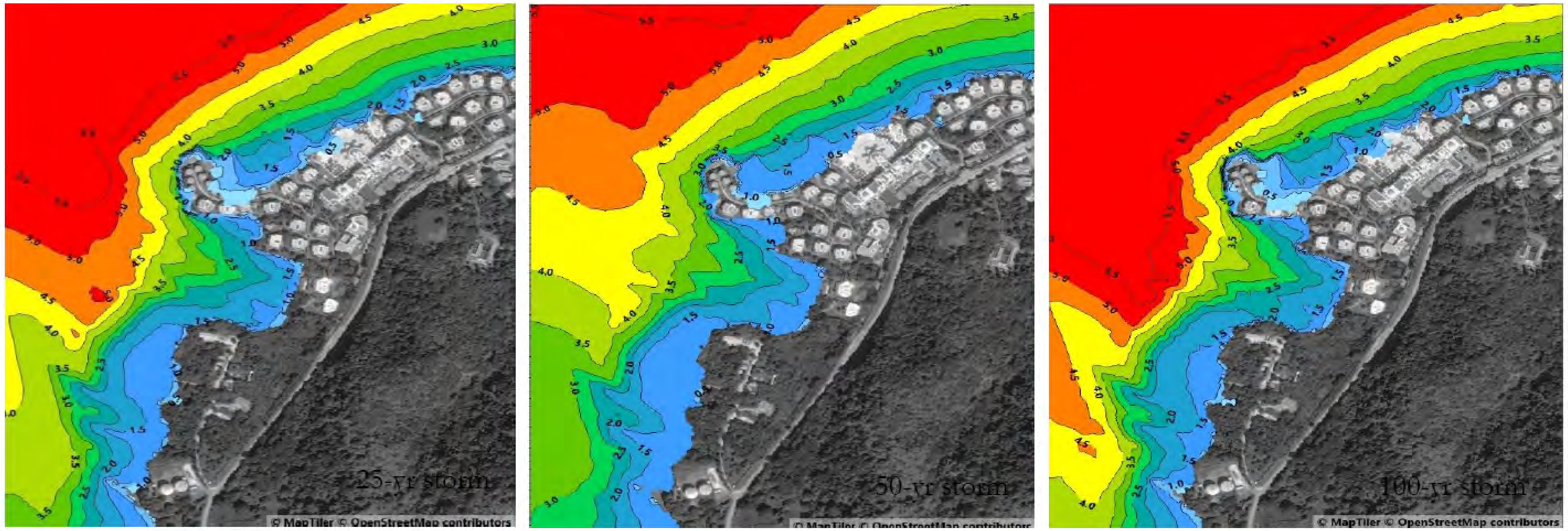
5.3.2.3 Hurricane Wave Simulation and Storm Surge

Hurricane parameters, including wave heights and static surge levels for various return periods, were extracted using HurWave. Subsequently, extreme wave values and deep-water surface levels originating from eight principal directional sectors—north-west, north, north-east, east, south-east, south-west, and west—were applied to the boundary of the MIKE 21 model. This application encompassed storm events with return periods of 1 in 25 years, 1 in 50 years, and 1 in 100 years (Smith Warner International Limited, 2023).

Representative Concentration Pathways (RCPs), utilized in climate modelling to forecast future greenhouse gas concentrations, offer a spectrum of potential future climates. Specifically, the 50-year horizon denotes specific timeframes within which these climate conditions are considered. All models incorporated a projected sea level rise for the next 50 years under both RCP 4.5 and 8.5 climate forecasts, ensuring a comprehensive assessment of the potential impacts of these climatic scenarios on coastal dynamics (Smith Warner International Limited, 2023).

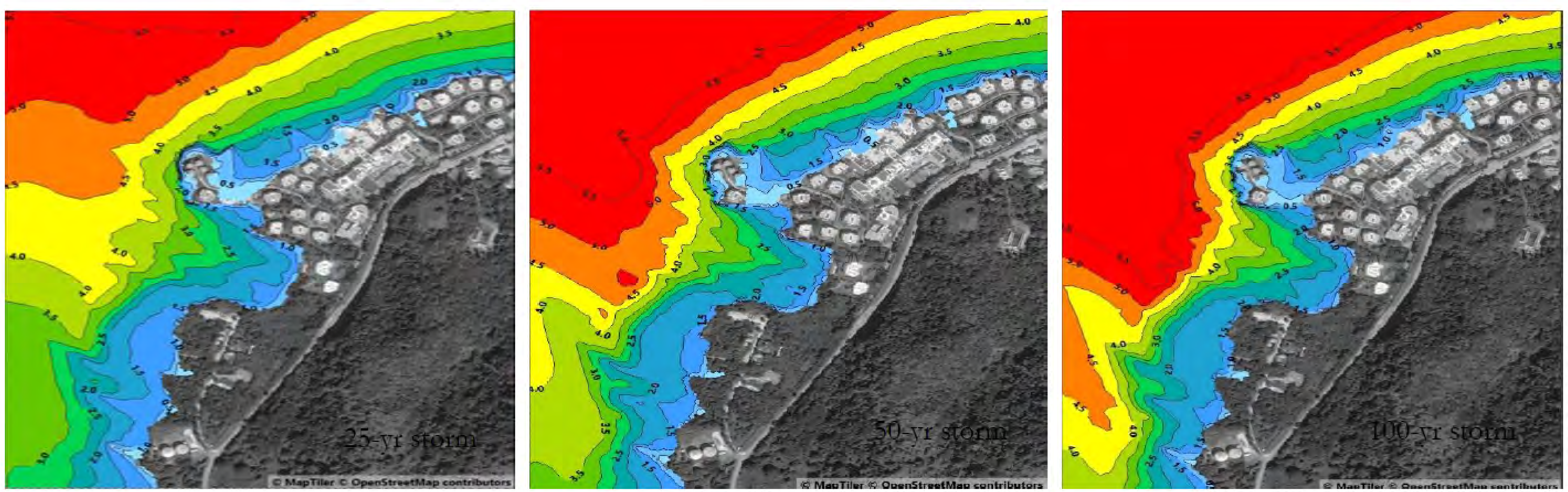
The integration of hydrodynamics and waves in the numerical model is pivotal for storm surge computations, particularly in regions like the Caribbean where wave set-up significantly contributes to total storm surge. As large waves approach shallow water or reefs and break, water levels increase, resulting in localized currents. These currents, coupled with changing water levels, influence wave behaviour, allowing them to propagate further inland. The coupling of waves and currents in MIKE 21 enables accurate simulation of these factors (Smith Warner International Limited, 2023).

In each scenario, the maximum nearshore conditions were associated with waves originating from the northwest (Figure 5-91 to Figure 5-94). For storm events under RCP 8.5 climatic forcing over the next 50 years, storm surge levels ranged from 1.79m to 2.19m MSL for various return periods. Consequently, critical infrastructure elevations along shorelines must exceed 2.2m above MSL (plus additional freeboard) to mitigate flooding risks. Although this phase of the hotel is situated along an 8m high cliff, alleviating concerns about flooding, waves impacting the shoreline range from 0.5m to 1.5m high at Phase 2. While the reef mitigates some wave energy, a 1.5m high wave could still potentially impact structures in this area.



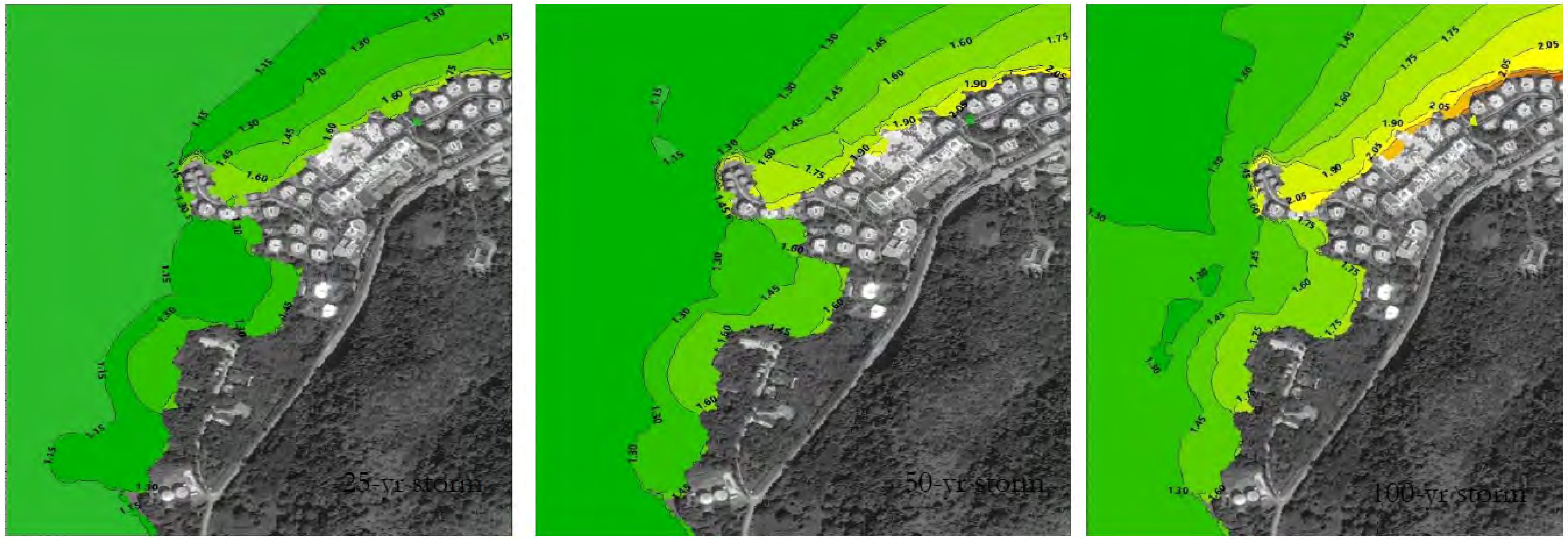
Source: (Smith Warner International Limited, 2023)

Figure 5-91 Wave heights for 1 in 25-year (left), 1 in 50-year (centre), and 1 in 100-year (right) storms [RCP 4.5, 50-year SLR]



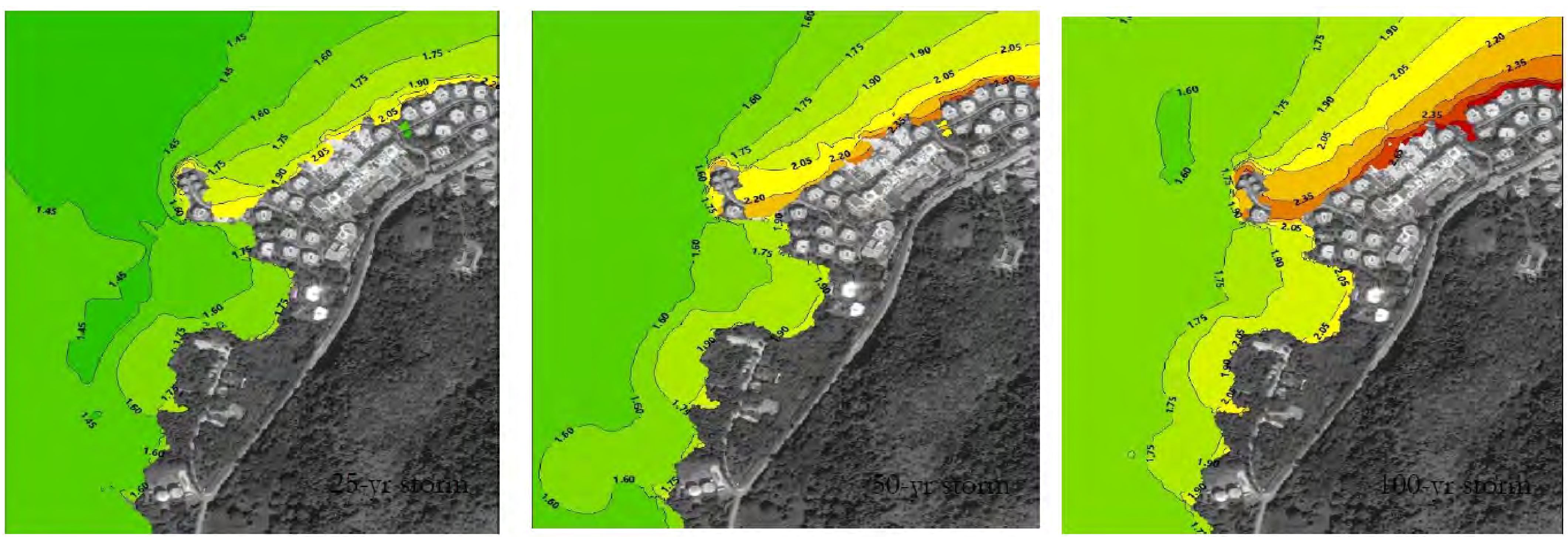
Source: (Smith Warner International Limited, 2023)

Figure 5-92 Wave heights for 1 in 25-year (left), 1 in 50-year (centre), and 1 in 100-year (right) storms [RCP 8.5, 50-year SLR]



Source: (Smith Warner International Limited, 2023)

Figure 5-93 Water Levels for 1 in 25-year (left), 1 in 50-year (centre), and 1 in 100-year (right) storms [RCP 4.5, 50-year SLR]



Source: (Smith Warner International Limited, 2023)

Figure 5-94 Water levels for 1 in 25-year (left), 1 in 50-year (centre), and 1 in 100-year (right) storms [RCP 8.5, 50-year SLR]

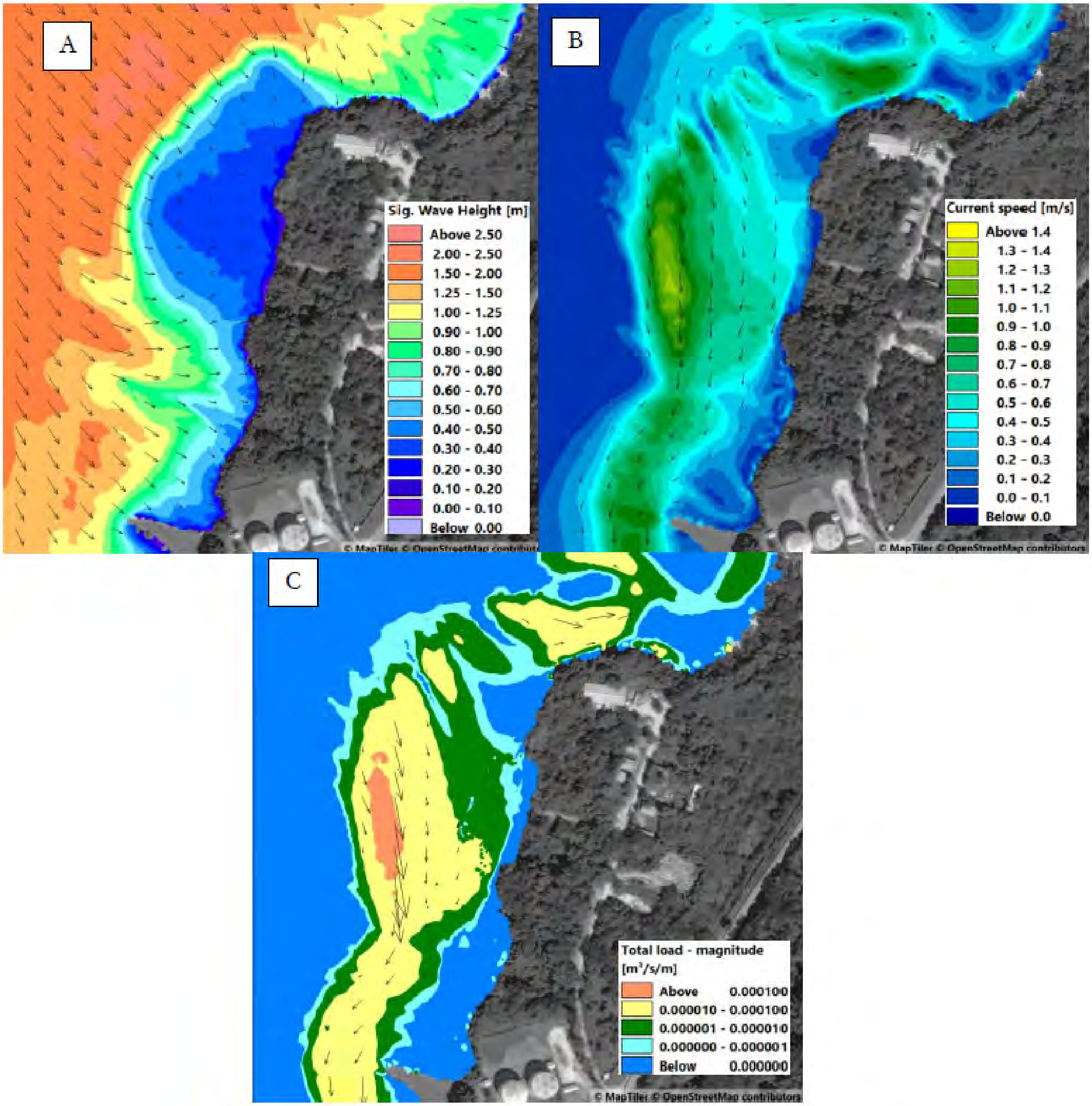
5.3.2.4 Wave and Current Conditions under a Typical Swell Event

The wave, hydrodynamic, and morphological modelling examined how the current shoreline would react during a swell event. Such an event signifies a period within the operational wave climate where the wave energy reaching the shoreline experiences a substantial increase, although it does not qualify as an extreme event like a hurricane. This heightened wave energy has the potential to result in significant overtopping and erosion driven by waves (Smith Warner International Limited, 2023).

The MIKE21 suite of numerical models was employed to simulate the intricate interactions among currents, waves, and sediment transport processes at the site. The Hydrodynamics (HD) module served as the foundation of our computations, delineating detailed current flow patterns. Coupled with this, the Spectral Waves (SW) module facilitated the integration of waves on currents to realistically represent wave conditions in the vicinity of the site. Finally, the Sand Transport (ST) module was utilized to forecast the movement of sand particles within the system. The model was driven by the conditions from the aforementioned swell event and assumed the presence of a 0.5m layer of sand in the area, overlaid with seagrass (Smith Warner International Limited, 2023).

The simulation yielded several observations (Figure 5-95) (Smith Warner International Limited, 2023):

- At the height of the swell event, waves originated from the northwest, with a wide band of relatively high waves (ranging from 1.5 to 2.0m) reaching the reef platform. This energy was dissipated by the reef.
- The reef effectively attenuated wave heights by 55% (from 1.5m to 0.6m). However, toward the south of Phase 2, larger waves approached the site due to the deeper water offshore.
- During the swell, consistent current patterns were observed, characterized by a predominant southerly flow that peaked over the reef area.
- These wave heights and currents have the potential to induce significant sediment movement at the shoreline, with sediment transport potential ranging from 10-100x10-6m3/s/m.
- The sediment transport potential aligns with the current directions, predominantly directing sediment movement toward the south.



Source: (Smith Warner International Limited, 2023)

Figure 5-95 **Model results of various parameters at the peak of the swell event: (a) wave heights, (b) current speeds, and (c) total load (sediment transport) at the peak of swell event**

5.3.3 Flooding

Resulting from the public perception survey undertaken for the project (section 6.0), the majority of respondents indicated that the hotel area was not affected by flooding, however some confirmed that the area did experience flooding. Among those who acknowledged flooding issues, most reported that it occurred only during heavy rains. Several areas were identified as being affected by flooding, including Grand Palladium, Kew Community, the Town of Lucea, Sea Wall/Lucea Main Road, Haughton Gardens Road (Millers Drive), the intersection of Dias Main Road and Seaview Drive, Brissette Road and Community, Malcolm Heights, Riley Bridge (near Keep Left), and the roadway near the Oceanpointe Gated Community. Some of these identified areas correspond with mapped flood prone areas (Figure 5-96).

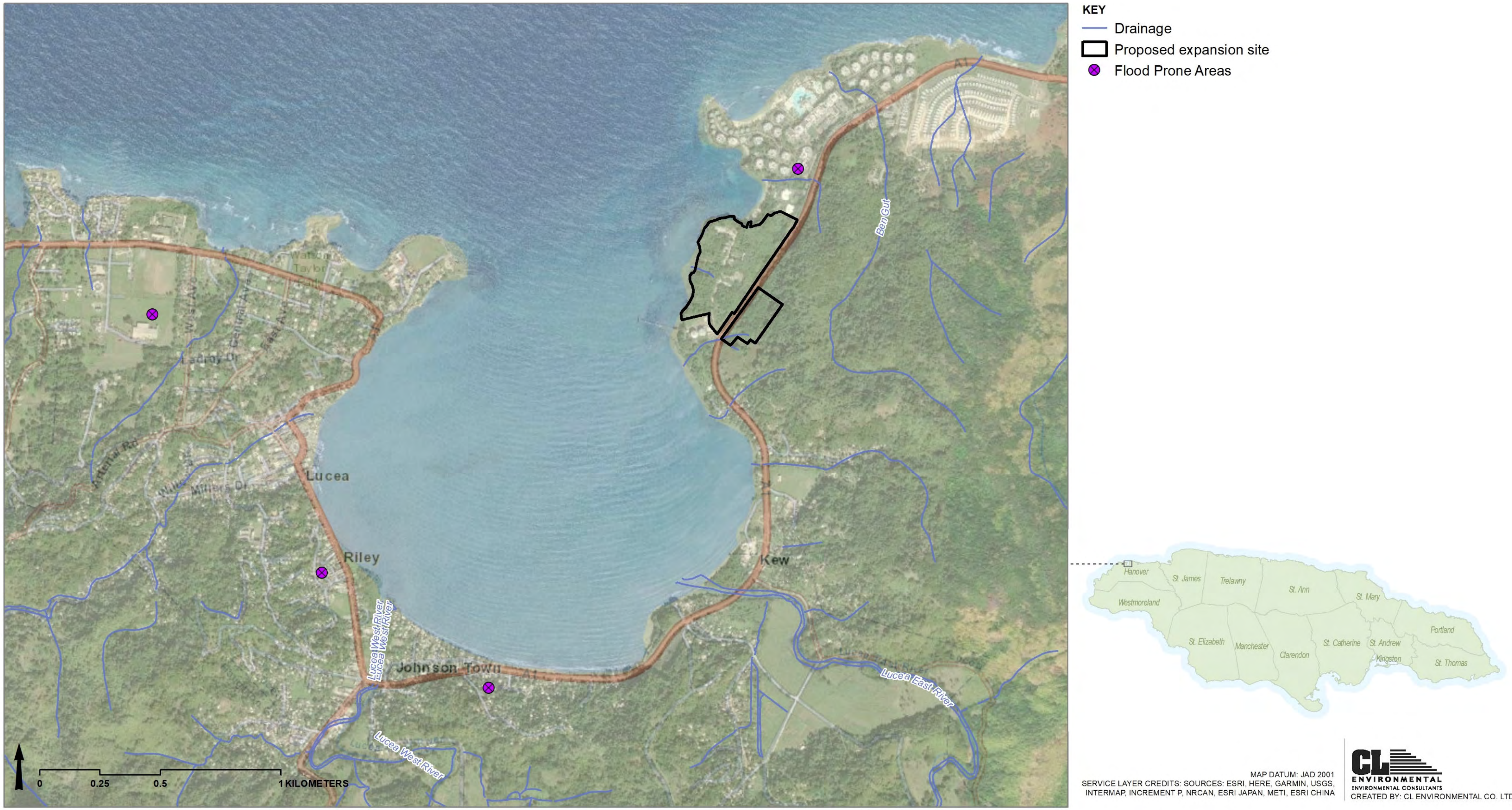


Figure 5-96 Flood prone areas within the study area

5.3.4 Beach Stability

5.3.4.1 Historical Analysis

Approach and Limitations

The historical movement of a shoreline is a valuable tool for understanding long-term changes. Shoreline morphology can be extracted from historical maps, surveys, aerial photos, and satellite imagery. The methodology used in this assessment was as follows (Smith Warner International Limited, 2024):

1. Procured available Google Earth satellite images of the shoreline.
2. Georeferenced satellite images using ArcGIS.
3. Traced the shoreline in each of the images.
4. Compared the traced shorelines using a fixed reference point.

There are limitations and uncertainties associated with this method, primarily due to the nature of the shoreline position at the time a satellite image is captured. Possible errors that could affect the accuracy of the analysis include:

- Seasonal error: Many beaches experience seasonal cycles of erosion and accretion. Due to the limited availability of high-resolution satellite images for the Caribbean islands, images cannot be selected based on seasonal time frames.
- Tidal fluctuation error: Satellite images were obtained without regard to tidal cycles, which can result in inaccuracies in the digitized shoreline.
- Digitizing error: Errors associated with digitizing the shoreline.
- Pixel error: The pixel size in orthorectified images is 0.5 meters, meaning anything within 0.5 meters cannot be resolved.
- Rectification error: Satellite images are corrected, or rectified, to reduce displacements.

Results

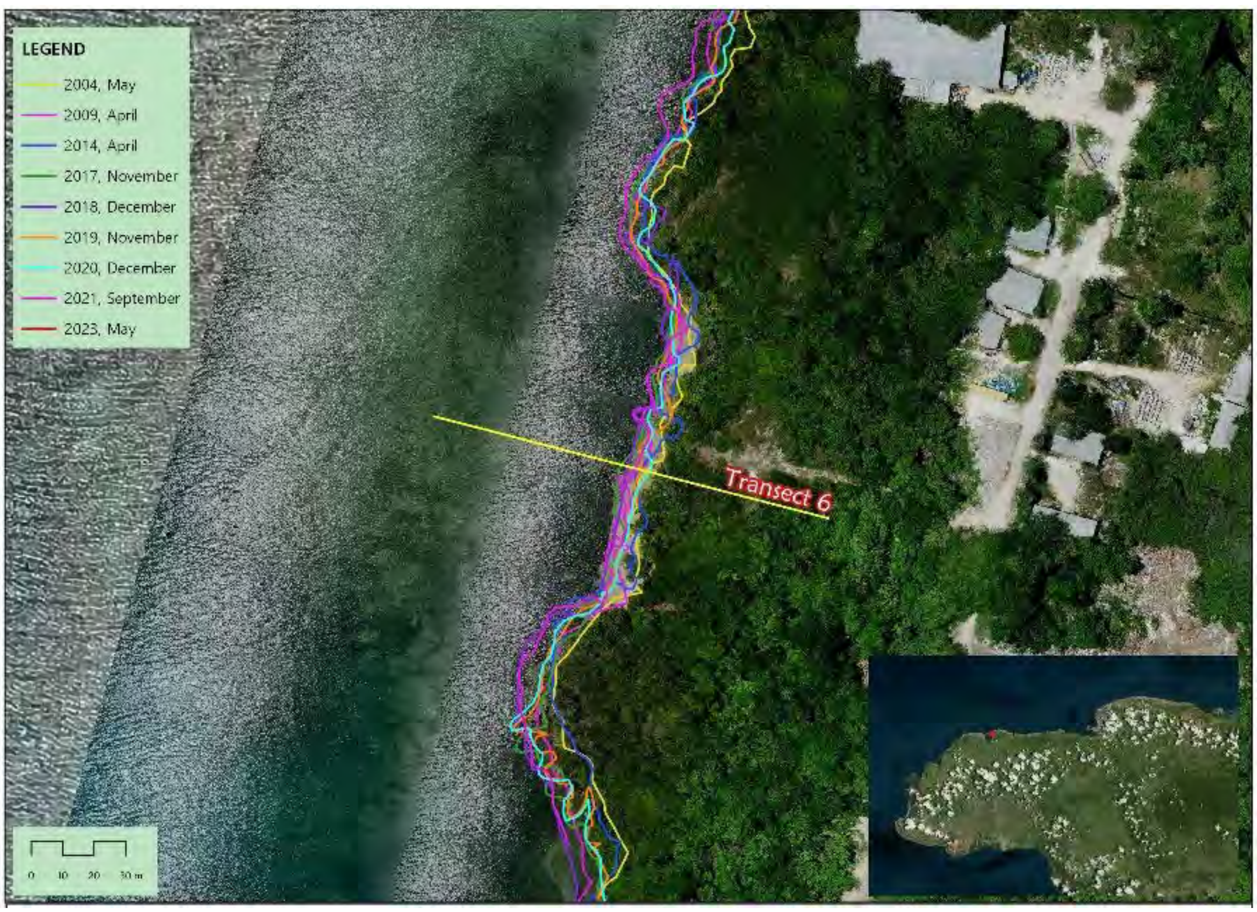
Analysis of beach stability from 2004 to 2023 revealed that the beach is highly dynamic, with significant fluctuations in its profile (Table 5-38 and Figure 5-97). Over this period, an overall erosive rate of 0.2 meters per year was observed. According to a recent report on the state of global beaches, this rate of erosion is classified as stable.

There are notable periods of high sediment deposition, as well as both accretion and erosion, particularly following major storms. This suggests that the beach receives sediments from offshore sources, but these sediments are not retained due to the lack of stabilizing structures. Historical aerial images corroborate these findings, indicating cyclical gains and losses of sediment.

Table 5-38 Calculated rate of change (m/yr) between 2004 and 2023

2014-2023 RATES (m/yr)		
Transect	Calculated Rate of Change (m/yr)	Trend
13-May-04		
16-Apr-09	0.6	Stable
28-Feb-14	-0.1	Stable
8-Jan-17	2.1	Accretion
4-Dec-18	-1.0	Erosion
13-Nov-19	-4.7	Erosion
17-Dec-20	-2.7	Erosion
6-Sep-21	6.8	Accretion
13-May-23	-4.2	Erosion
Transect 6 (Phase 2 Pocket Beach)	**-0.2**	**Stable**

Source: (Smith Warner International Limited, 2024)



Source: (Smith Warner International Limited, 2024)

Figure 5-97 Shoreline change along Phase 2 coastline between 2004 and 2023

5.3.4.2 Swell Event

During the modelled swell event (see section 5.3.2.4), consistent current patterns were observed, characterized by a predominant southerly flow that peaked over the reef area. These wave heights and currents have the potential to induce significant sediment movement at the shoreline, with sediment transport potential ranging from 10 to 100 x 10^-6 $m^3/s/m$. The sediment transport potential aligns with the current directions, predominantly directing sediment movement toward the south.

5.4 SOCIOECONOMIC AND CULTURAL

5.4.1 Approach

To evaluate the social aspects of the proposed project, a Social Impact Area (SIA) was defined. The SIA is characterized as the anticipated spatial range of the proposed project's impact on neighbouring communities. For the scope of this study, the delineation of the SIA is based on a five (5) kilometre buffer around the proposed project area. The SIA comprises approximately 46 km^2 of land in the parish of Hanover, encompassing a number of communities such as Lucea, Jericho, Mount Peace and Dias (Figure 5-98). The project is located in the district of Point, within the general Lucea community[5] (Social Development Commission, 2017).

Population data for the Social Impact Area (SIA) were retrieved from the Statistical Institute of Jamaica (STATIN) 2011 Population Census database. The data were organized by enumeration district (ED) and analysed in relation to the percentage coverage of each ED within the SIA, utilizing Geographic Information Systems (GIS) methodologies. The subsequent computations involved:

- ***Population growth***: **[$P_n = P_o (1 + r)^t$]**
  Where P_o is the population at the beginning of a period, t is the period of time in years, r is the annual rate of increase, and P_n is the population at the end of the period (United Nations, 1952).
- ***Dependency ratio***: **[child population + aged population /working population X 100]**
  Where the child population is between ages 0-14, the aged population is 65 & over, and the working population is between ages 15-64 years. This ratio is useful for understanding the economic burden being borne by the working population.
- ***Male sex ratio***: [**male population / female population X 100]**

[5] It's important to note that there are differences in community delineations between the Social Development Commission (SDC) and the Planning Institute of Jamaica (PIOJ) GIS datasets. The information provided here is based on the SDC community data (Social Development Commission, 2017), while the poverty community data in section 0 was created by the PIOJ.

This in effect denotes the number of males there are to every 100 females and is useful for determining the predominant gender in a particular area.

- ***Domestic water consumption***

  Based on the assumption that water usage is 227.12 litres/capita/day and sewage generation at 80% of water consumption. Water consumption for workers in Jamaica is calculated at 19 litres/capita/day and sewage generation at 100% water consumption.

- ***Domestic garbage generation***

  Calculated at 4.11 kg/household/day (National Solid Waste Management Authority).

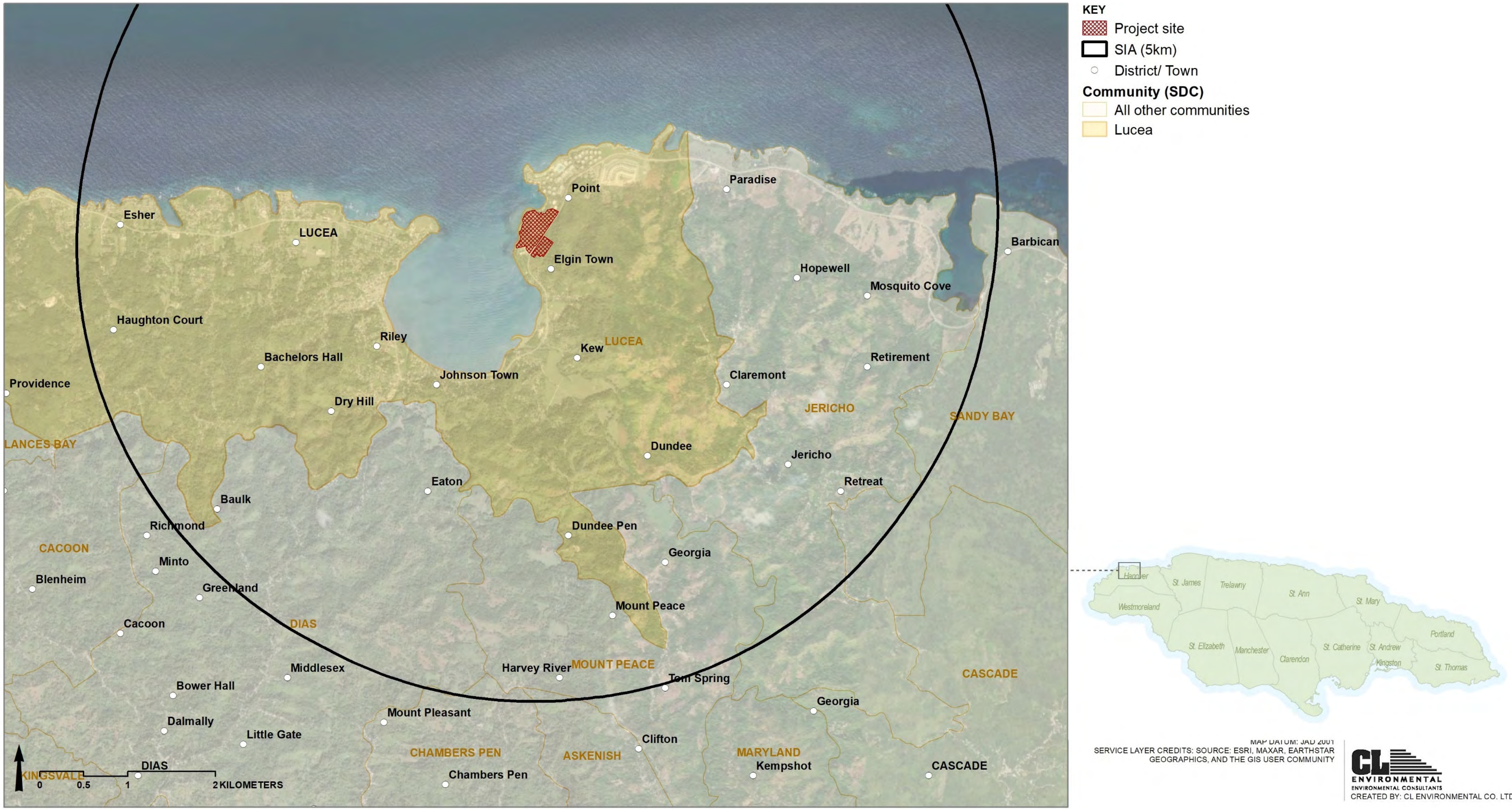


Figure 5-98 Communities within the Social Impact Area (SIA) for the proposed project

5.4.2 Population and Demographics

5.4.2.1 Population Density and Growth

The total population within the SIA in 2011 was calculated to be approximately 13,167 individuals. Given the land area within the SIA of approximately 46 km^2, the overall population density for the SIA was computed to be 286 persons per km^2. This population density surpasses that of Jamaica and the parish of Hanover (Table 5-39) and although the overall SIA may be characterized as a relatively densely populated area, this is not evenly distributed spatially (Figure 5-99).

Table 5-39 Comparison of ED population densities for the year 2011

Source: STATIN Population Census 2011

Category	Jamaica	Hanover	SIA
Total ED area (km2)	10,991.0	450.8	46.0
ED Population	2,697,983	69,533	13,167
ED Population density	245	154	286

In 2001, the population of the SIA was approximately 13,289 individuals. During the subsequent decade from 2001 to 2011, the overall growth within the SIA was approximated to be around -0.09% per annum, indicating a decline in population. This decrease in population was also observed within the ED where the project site is situated (Figure 5-99).

Based on the SIA growth rate, it is projected that at the time of this study (2024), the population within the SIA is approximately 13,009 persons, and it is anticipated to decrease further to 12,712 persons over the next twenty-five years, assuming the current population growth rate remains constant. In contrast, the annual growth rate between 2001 and 2011 for the parish of Hanover is reported as 0.38% (STATIN Population Census, 2011). Using this regional growth rate, the population within the parish in 2024 is estimated to be 13,832 persons, and by 2049, it is projected to increase to 15,208 persons.

In terms of community residency, 91.7% of household heads have lived in Lucea for over ten years, while 4.3% have resided for six to nine years. Only 4% of household heads have lived in the community for less than five years (Social Development Commission, 2018).

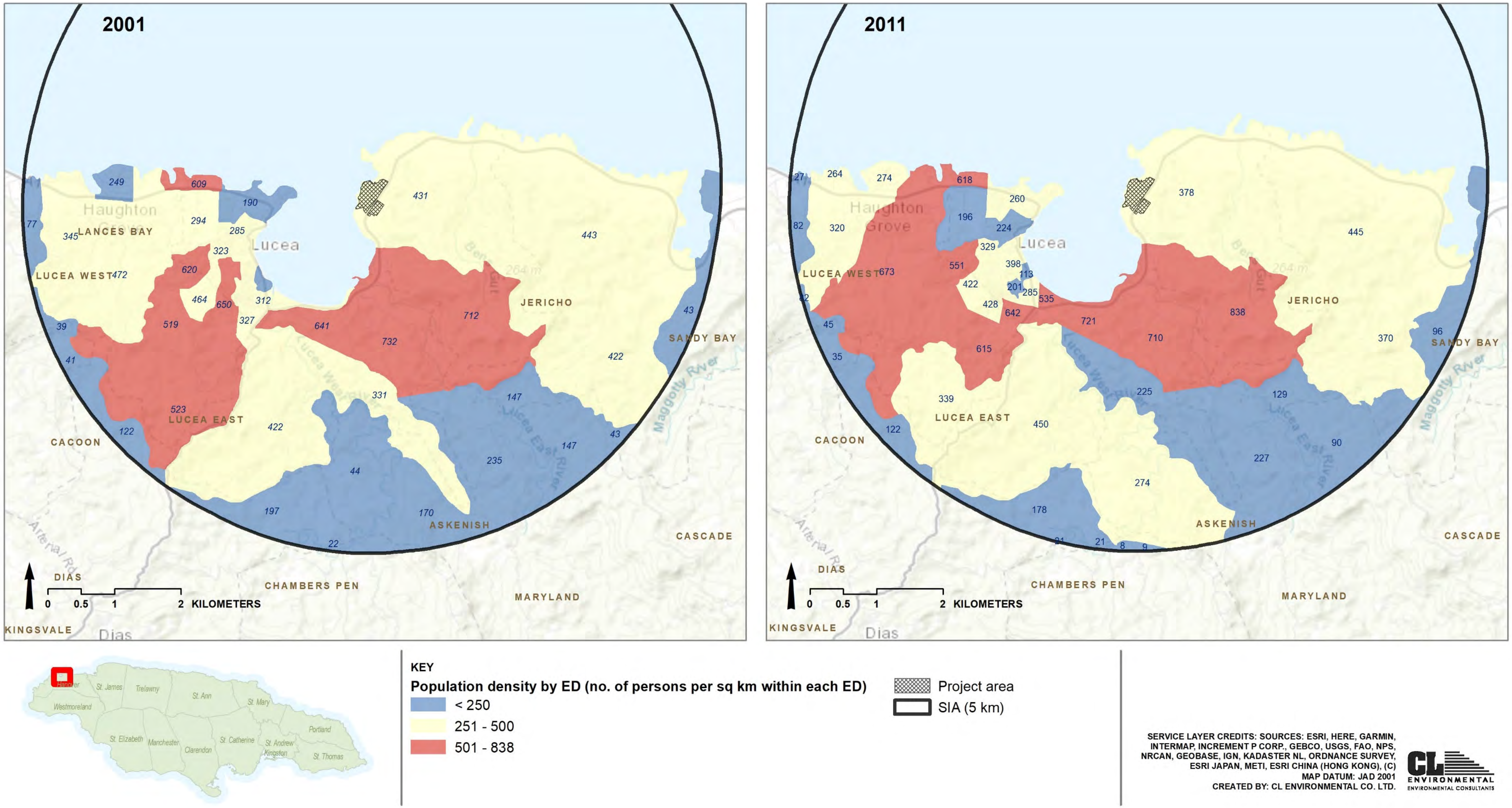
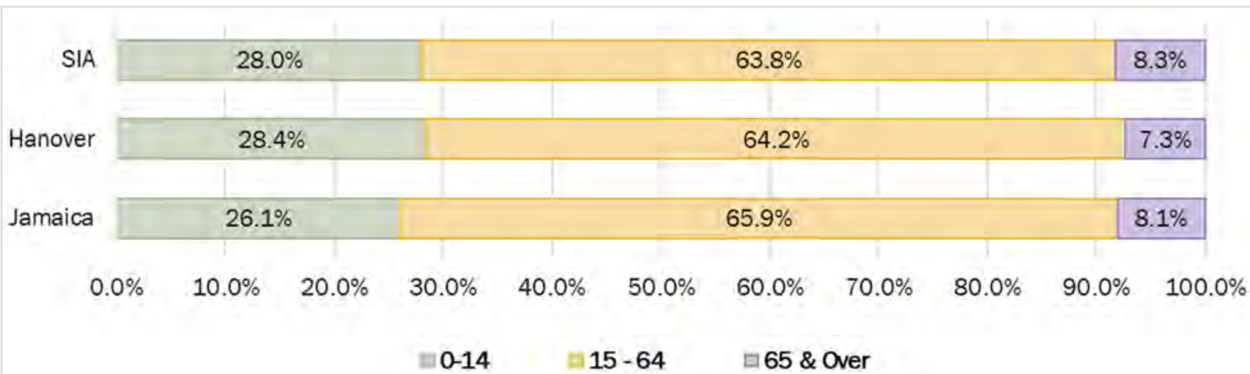


Figure 5-99 SIA 2001 and 2011 population represented by enumeration districts

5.4.2.2 Age and Gender Distribution

The community of Lucea exhibits a youthful population, with an average age of 32 years (Social Development Commission, 2018). Within the SIA, the 15-64 years' age category accounted for 63.8%., indicating a significant portion of working-age individuals. Likewise, in the broader Lucea community, the age composition of the population reveals that 66.4% of the population falls within the working-age bracket (15-64 years) (Social Development Commission, 2018).

The percentage distribution of age within the SIA for the 0-14 years cohort (28%) aligns closely with that observed for Hanover (Figure 5-100); this percentage is slightly higher than that for the community of Lucea, which stands at 24.3% (Social Development Commission, 2018).



Source: STATIN Population Census 2011

Figure 5-100 Age categories as percentage of the population for the year 2011

The demographic segment deemed more susceptible includes children under five years old and individuals aged 65 years and above. Within the SIA population, 9.1% constituted the vulnerable young category, while 8.3% comprised the elderly.

In 2011, the child dependency ratio for the SIA was calculated at 438.8 per 1000 persons of labour force age, while the old age dependency ratio stood at 129.8 per 1000 persons of labour force age. Consequently, the societal dependency ratio was determined to be 568.5 per 1000 persons of labour force age. These figures highlight that the youth, as indicated by the child dependency ratio, rely significantly more on the labour force for support compared to the elderly within the SIA (Table 5-40).

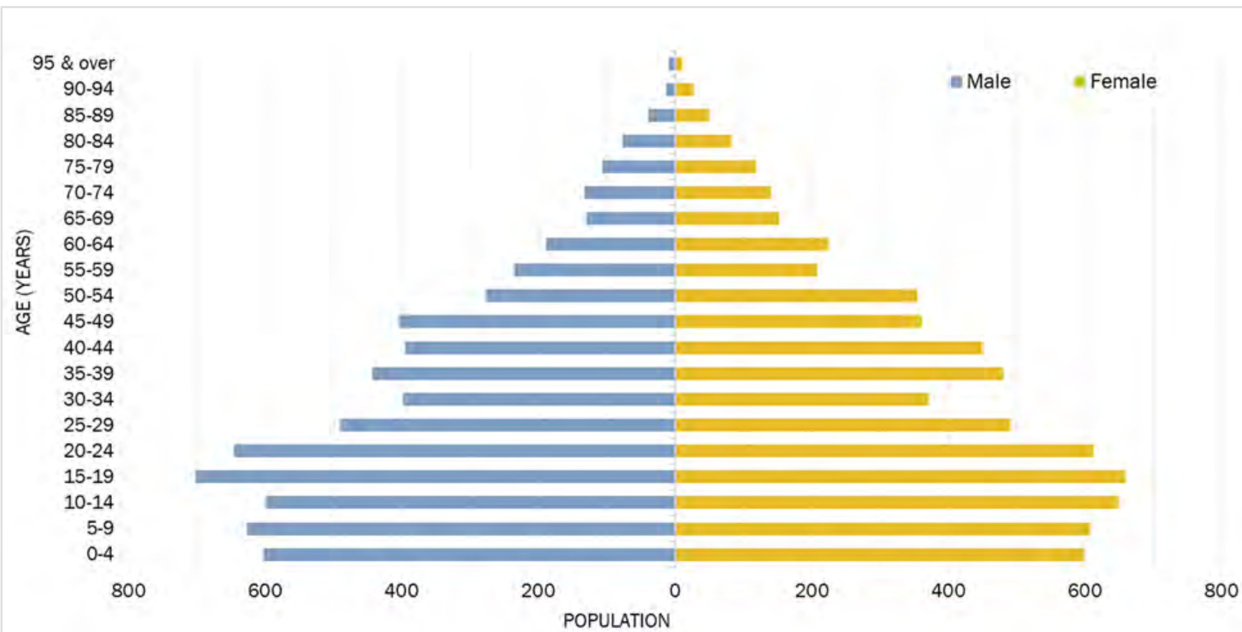
Table 5-40 Comparison of dependency ratios for the year 2011

Source: STATIN Population Census 2011

	Child Dependency	Societal Dependency	Old Age Dependency
Jamaica	395.4	517.8	122.4
Hanover	442.4	556.5	114.1
SIA	438.8	568.5	129.8

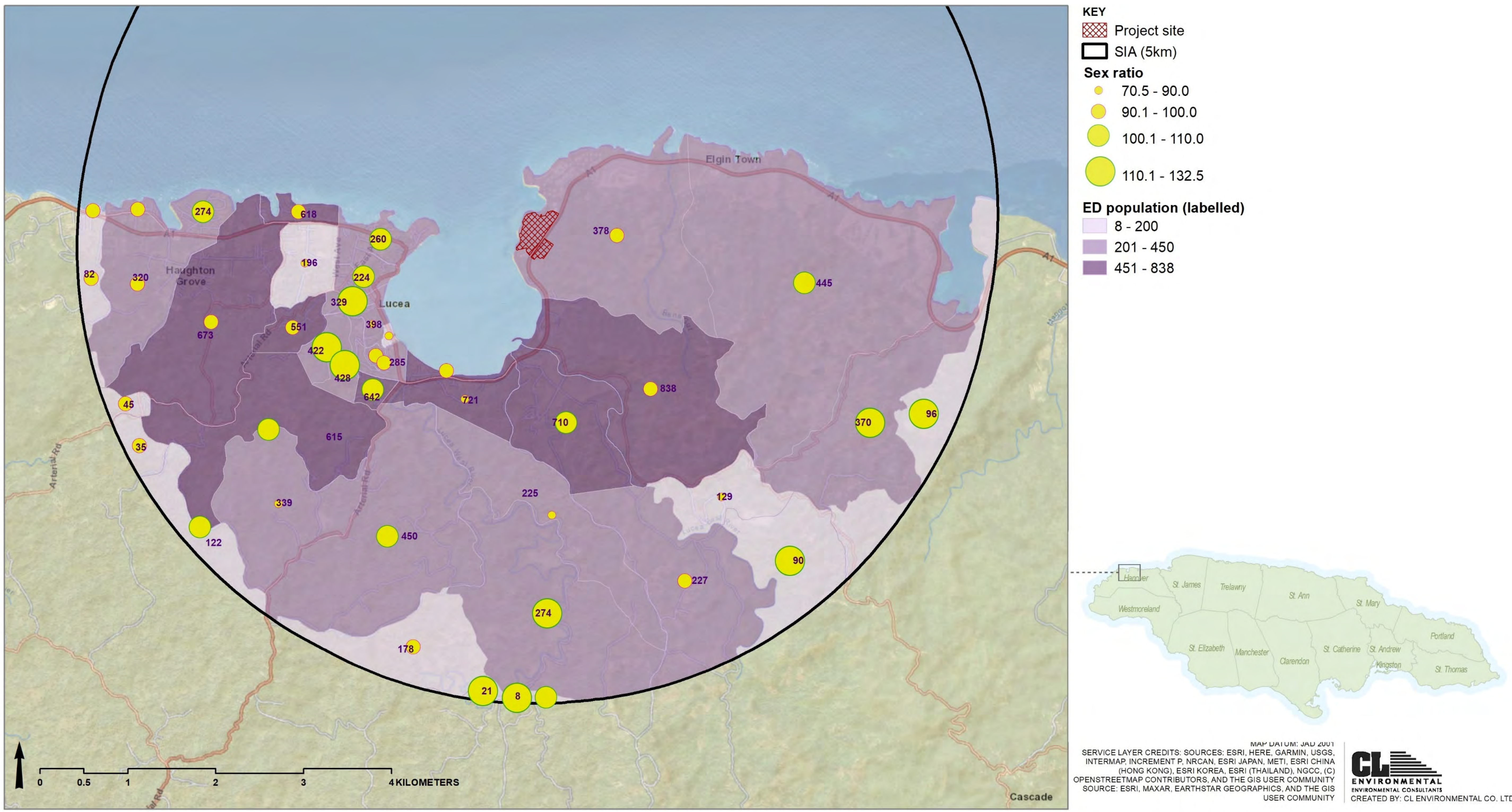
The community of Lucea exhibited an Age Dependency Ratio (ADR) of approximately 50.8 dependent persons per 100 persons of working age. The Age Dependency Ratio (ADR) measures the ratio of children (0-14) and elderly dependents (65 and over) to the working-age population (15-64 years), as defined by the Jamaica Survey of Living Conditions (JSLC) in 2009 (Social Development Commission, 2018).

The overall sex ratio within the SIA for all age groups was determined to be 98.2 males per one hundred females. Nonetheless, this ratio displays variation across different Enumeration Districts (EDs) within the SIA, ranging from a minimum of 70 to a maximum of 133 males per one hundred females (Figure 5-102). A higher proportion of females is observed across all age categories considered, except for the following age ranges: 0-4, 10-14, 15-19, 40-44, 45-49, and 60-64 years, where there is a greater percentage of males (Figure 5-101).



Source data: STATIN Population Census 2011

Figure 5-101 Population pyramid in 2011 for the SIA



Source data: STATIN Population Census 2011

Figure 5-102 Sex ratio by ED within the SIA

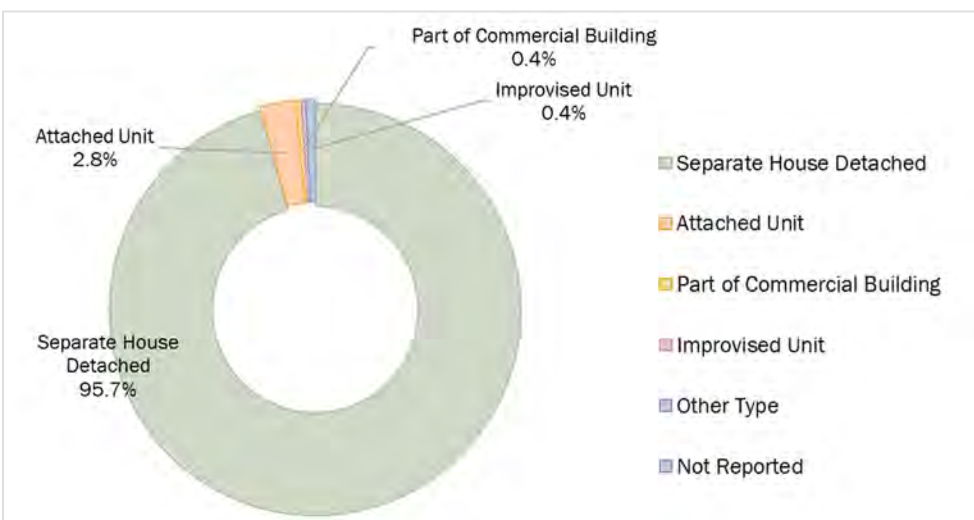
5.4.3 Housing and Utilities

5.4.3.1 Housing Categorization

For the purposes of this study, the definitions of housing unit, dwelling, and household are based on those provided by the population census conducted by the Statistical Institute of Jamaica (STATIN). According to these definitions:

- A **housing unit** is a building, or buildings used for living purposes at the time of the census.
- A **dwelling** is any building or separate and independent part of a building in which a person or group of persons lived at the time of the census". The essential features of a dwelling unit are both "separateness and independence". Occupiers of a dwelling unit must have free access to the street by their own separate and independent entrance(s) without having to pass through the living quarters of another household. Private dwellings are those in which private **households** reside. Examples are single houses, flats, apartments and part of commercial buildings and boarding houses catering for less than six boarders.

In 2011, the SIA comprised a total of 4,076 housing units, with 95.7% of them categorized as separate detached houses (Figure 5-103). Within these units, there were 4,404 dwellings, resulting in an average of 1.1 dwellings per housing unit. Additionally, there were 4,303 households recorded, indicating an average of 1.0 household per dwelling. Comparative analysis with national and regional ratios indicates that the SIA exhibited similar household-to-dwelling, average household size, and dwelling-to-housing unit ratios. This suggests that the housing situation within the SIA was consistent with broader trends observed within Jamaica (Table 5-41).



Source: STATIN Population Census 2011

Figure 5-103 Percentage of housing units by type within the SIA

Table 5-41 Comparison of national, regional and SIA housing ratios for 2011

Source: STATIN Population Census 2001

	Jamaica	Hanover	SA
Dwelling/Housing Unit	1.2	1.1	1.1
Household/Dwelling	1.0	1.0	1.0
Average Household Size	3.1	2.9	3.1

5.4.3.2 Household Size and Structure

The average household size in the SIA was calculated as 3.1 persons per household, which closely aligns with that observed for the community of Lucea at 3.4 persons (Social Development Commission, 2018).

The nuclear family structure, which is consisting of parents and their children typically living in one home residence, comprised the largest proportion (35%) of households in Lucea. Approximately 29.2% of households followed the extended family structure, while the single-member family structure accounted for 19.5%. Single-parent family structures constituted 14.2%, with the majority (11.8%) being female-headed. (Social Development Commission, 2018).

Regarding household composition from the perception survey (section 6.0), just over 18% of households consist of a single occupant, which may reflect a significant number of elderly residents, young professionals, or individuals preferring independent living. The largest segment, 26.8%, have two occupants, possibly indicating a mix of couples without children and roommates sharing living spaces. Households with three occupants account for 18.1%, and those with four occupants make up 15.5%, likely representing nuclear families with one or two children. Approximately 9% of households have five residents, and 12.5% have more than five individuals living in them, suggesting the presence of extended families or larger family units.

5.4.3.3 Living Conditions and Facilities

Housing Material and Condition

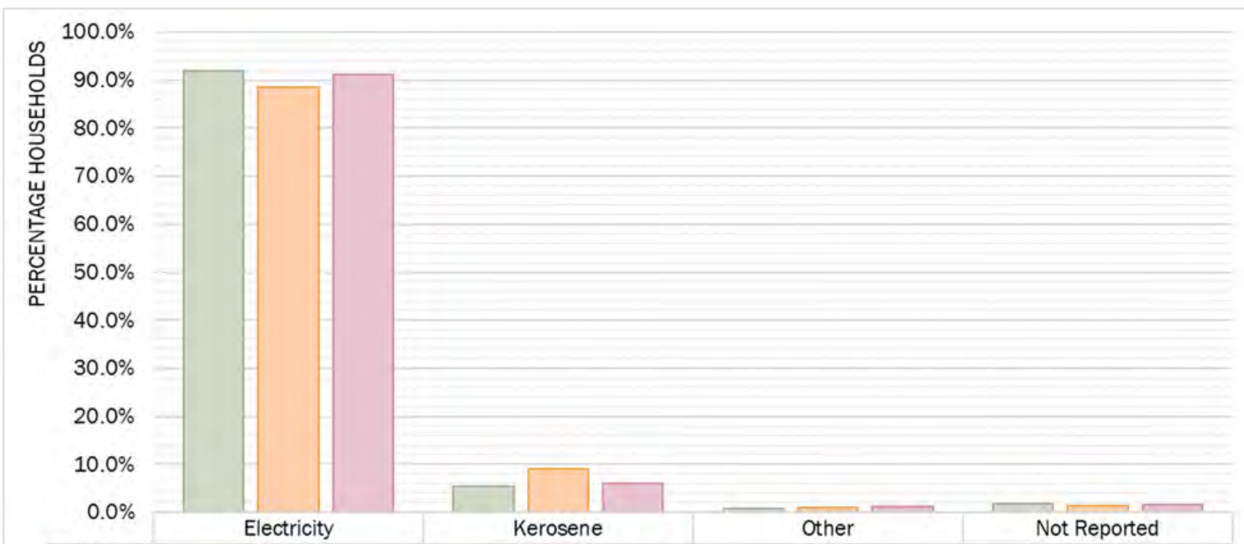
The choice of materials for the outer walls of dwellings often reflects the quality and durability of housing stock. In Lucea, board (40.9%) and blocks (39.3%) were the predominant materials used in dwelling construction (Social Development Commission, 2018). Approximately forty-two percent (41.8%) of houses in Lucea were in fair condition, indicating a need for minor repairs. Just over thirty-two percent (32.3%) were in good condition, while 11.9% were classified as very good, characterized by a solid physical structure, freshly painted appearance, and intact doors and windows (Social Development Commission, 2018).

The response from the public participation reflects slightly different trends (section 6.0). Regarding the construction materials used for dwellings, a significant majority of interviewees (62.7%) reported that their homes were constructed with concrete and blocks for walls. A notable portion (26.2%) indicated wood or board as the material for walls, while 10.8% mentioned a combination of both concrete and wood. A small fraction (0.3%) cited "other," specifying concrete (cement) board. For those whose homes featured both wall materials, this was primarily due to structural modifications aimed at expanding living space. In terms of roofing materials, 45.8% of respondents mentioned metal sheeting, while 43.4% indicated concrete. A further 9.6% reported roofs made from multiple materials such as metal sheeting and concrete, often due to similar structural expansions. Approximately 1% (0.9%) identified "other," specifying fibre shingle as the roofing material.

Lighting

Analysis of data across different scales, including the Social Impact Area (SIA), parish, and national levels, reveals that electricity is predominantly used for lighting among the population. Nationally, this service is primarily provided by the Jamaica Public Service Company Ltd. Within the SIA, approximately 91.1% of households utilize electricity (Figure 5-104) and within immediate vicinity of the project site, 87.3% (Figure 5-105) and in the broader community of Lucea, 70.3% (Social Development Commission, 2018). Moreover, nearly all respondents in the public perception survey (98.8%) reported using electricity for household lighting, with a small minority relying on alternative sources such as kerosene oil (0.6%) or solar energy (0.6%).

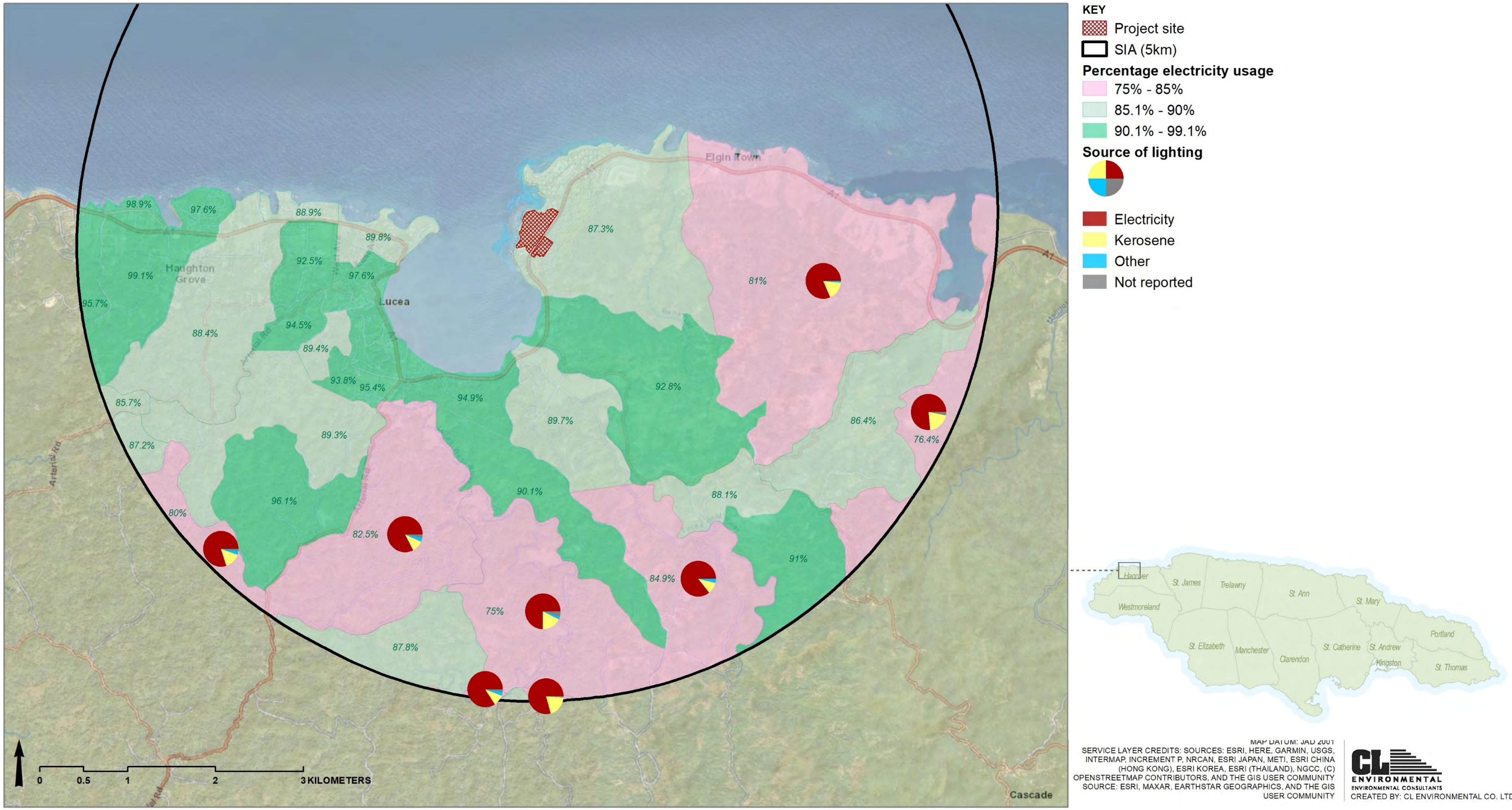
Spatial variability in electricity usage is observed, with some SIA EDs showing lower electricity usage rates, as low as 75%. In these EDs, kerosene emerges as the second most commonly used source of lighting (Figure 5-105).



	Electricity	Kerosene	Other	Not Reported
Jamaica	91.9%	5.5%	0.8%	1.8%
Hanover	88.4%	9.0%	1.0%	1.5%
SIA	91.1%	6.1%	1.2%	1.6%

Source: STATIN Population Census 2011

Figure 5-104 Percentage SIA households by source of lighting



Source: STATIN Population Census 2011

Figure 5-105 Percentage electricity usage for the year 2011 within the SIA

Domestic Water Supply and Demand

The National Water Commission (NWC) serves as the public agency tasked with providing Jamaica's domestic water supply. Similar to the trends observed at the community, parish and national levels, the majority of households within the SIA (74.5%) receive their domestic water supply from the NWC. Conversely, 11.3% of households rely on a private source, 8.5% utilize water trucks, and 2.4% obtain water from springs and rivers (Table 5-42).

Table 5-42 Percentage of households by water supply for the year 2011

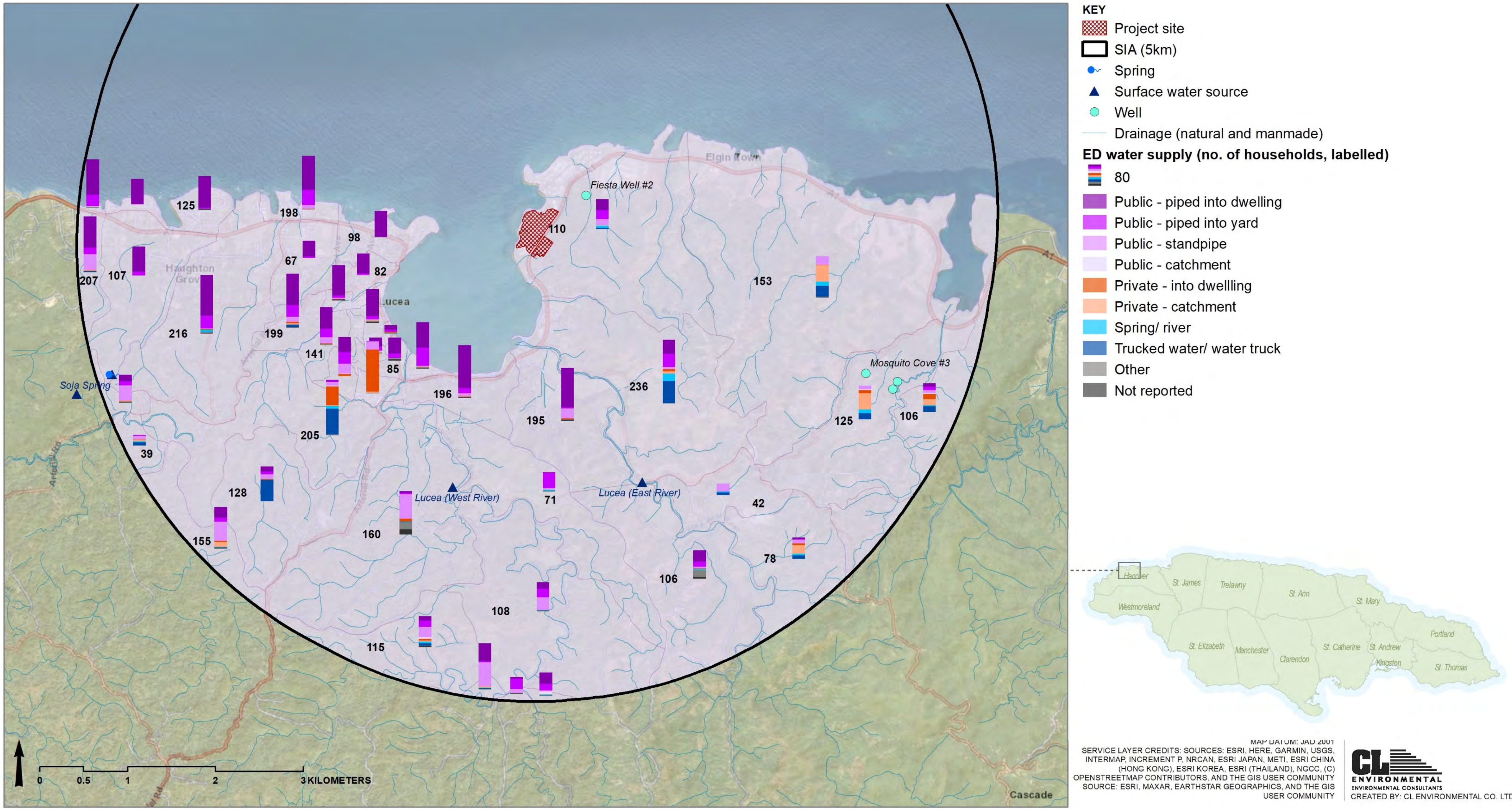
Source: STATIN Population Census 2011

	Category	Jamaica	Hanover	SIA
Public Source	Piped in Dwelling	49.7%	43.5%	46.7%
	Piped in Yard	16.5%	17.5%	14.8%
	Stand Pipe	7.1%	14.2%	12.6%
	Catchment	2.2%	1.3%	0.5%
Private Source	Into Dwelling	6.4%	3.5%	7.0%
	Catchment	9.8%	7.7%	4.3%
Other	Spring/ River	3.0%	4.3%	2.4%
	Trucked Water/Water Truck	2.1%	2.8%	8.5%
	Other	1.8%	3.5%	1.8%
	Not Reported	1.3%	1.6%	1.5%

From the perception survey (section 6.0), the vast majority (94.5%) accessed water from the public piped supply. A minority relied on rainwater harvesting (0.9%), community tanks (1.4%), public standpipes (0.5%), government water trucks (0.3%), private water trucks (2.0%), or neighbours (0.3%). Despite these options, 93.0% of respondents reported issues with their water supply, mainly citing irregular supply. Complete lack of water, absence of piped connections, low water pressure were other cited issues.

The diversity of domestic water sources in the community highlights the involvement of both public and private sectors in water supply infrastructure. It is also important to note that spatially, access to water varies, highlighting localized differences in access to water infrastructure and services within the SIA (Figure 5-106). In the eastern EDs of the SIA, public water sources are less prevalent compared to other areas. Within this eastern area, there are three wells available, along with another well located approximately 400 meters northwest of the project site. These wells likely serve as important alternative sources of water for rural communities in the eastern region. Riverine sources of water in the SIA include Lucea East and West River and Soja Spring (Figure 5-106).

Based on population growth rates calculated previously for the SIA, the estimated water demand for the SIA in 2024 is approximately 2,954,669.85 litres per day (approximately 780,541.34 gallons per day). This demand is projected to decrease to approximately 2,887,133.55 litres per day (approximately 762,700.13 gallons per day) over the next twenty-five years. These projections indicate anticipated changes in water usage patterns over time and suggest a gradual decrease in both water demand and wastewater generation within the study area over the specified time frame.



Source: STATIN Population Census 2011

Figure 5-106 Source of water supply by ED and water sources within the SIA

Wastewater Generation and Facilities

COMMUNITY

The prevalent type of toilet facility used in Lucea was a water closet not connected to a sewer system, accounting for 90.9% of households. Pit latrines were utilized by 8.8% of households, while just over seven percent (7.1%) reported sharing toilet facilities (Social Development Commission, 2018). From the perception survey (section 6.0), about 88.6% of respondents indicated that their homes had water closets, while 7.6% reported using pit latrines. Additionally, 3.8% of respondents stated that they had both types of toilet facilities.

Using the water demand as a basis for calculations, it is estimated that approximately 2,363,735.88 litres per day (approximately 624,433.07 gallons per day) of wastewater is generated within the study area for the year 2024. Over the next twenty-five years, based on calculated growth rates, this amount is expected to decrease to approximately 2,309,706.84 litres per day (approximately 610,160.11 gallons per day).

HOTEL WASTEWATER TREATMENT PLANT

The existing hotel wastewater treatment facility utilizes a mechanical (plug flow) aeration system designed to achieve tertiary treatment. This multi-stage process effectively cleanses hotel-generated sewage to a level suitable for irrigation purposes. The treatment train comprises the following unit processes (Figure 5-107 and Figure 5-108):

1. Grit Chamber: This primary unit removes inorganic materials like sand, gravel, and grit from the wastewater stream.
2. Holding Tanks: These tanks provide a temporary storage capacity for the influent wastewater, allowing for equalization of flow and composition before entering the subsequent treatment stages. These include the collection tank, buffer tank, clarified water (“dosing”) tank and irrigation tank.
3. Aeration Tanks: There are currently four (4) aeration tanks. Here, mechanical aeration introduces oxygen into the wastewater to facilitate the biological degradation of organic matter by microorganisms.
4. Secondary Clarifier: This unit allows the separation of the treated wastewater (effluent) from the settled biological solids (sludge).
5. Sludge Anaerobic Digestion “Cone” Tank: This tank allows for generated sludge to stabilize and be digested by anaerobic bacteria for subsequent haulage by a cesspool truck.
6. Sand Filters: These filters provide additional tertiary treatment by removing suspended particles and achieving further effluent polishing.
7. UV Disinfection System: Ultraviolet radiation is used to inactivate harmful pathogens remaining in the effluent, ensuring a high level of disinfection.

8. Chlorine Tablet Dosing Unit: This unit serves as a final disinfection step, employing chlorine tablets to provide residual disinfection within the treated wastewater for irrigation.

The raw influent enters the static fine screen for initial solids removal and is then held in the collection tank. It is transferred to the buffer tank for homogenous mixing and then to the aeration tanks in parallel series. It then enters the clarifier, where waste activated sludge (WAS) is sent to the sludge anaerobic digestion tank and return activated sludge (RAS) is sent to the aeration tanks. Clarified water is stored in the clarified water "dosing" tank to then be filtered by the sand filters. After filtration, water is sent through the UV system and then the chlorine tablet dosing station to be held in the irrigation holding tank until water is needed for irrigation at the hotel (Figure 5-108).

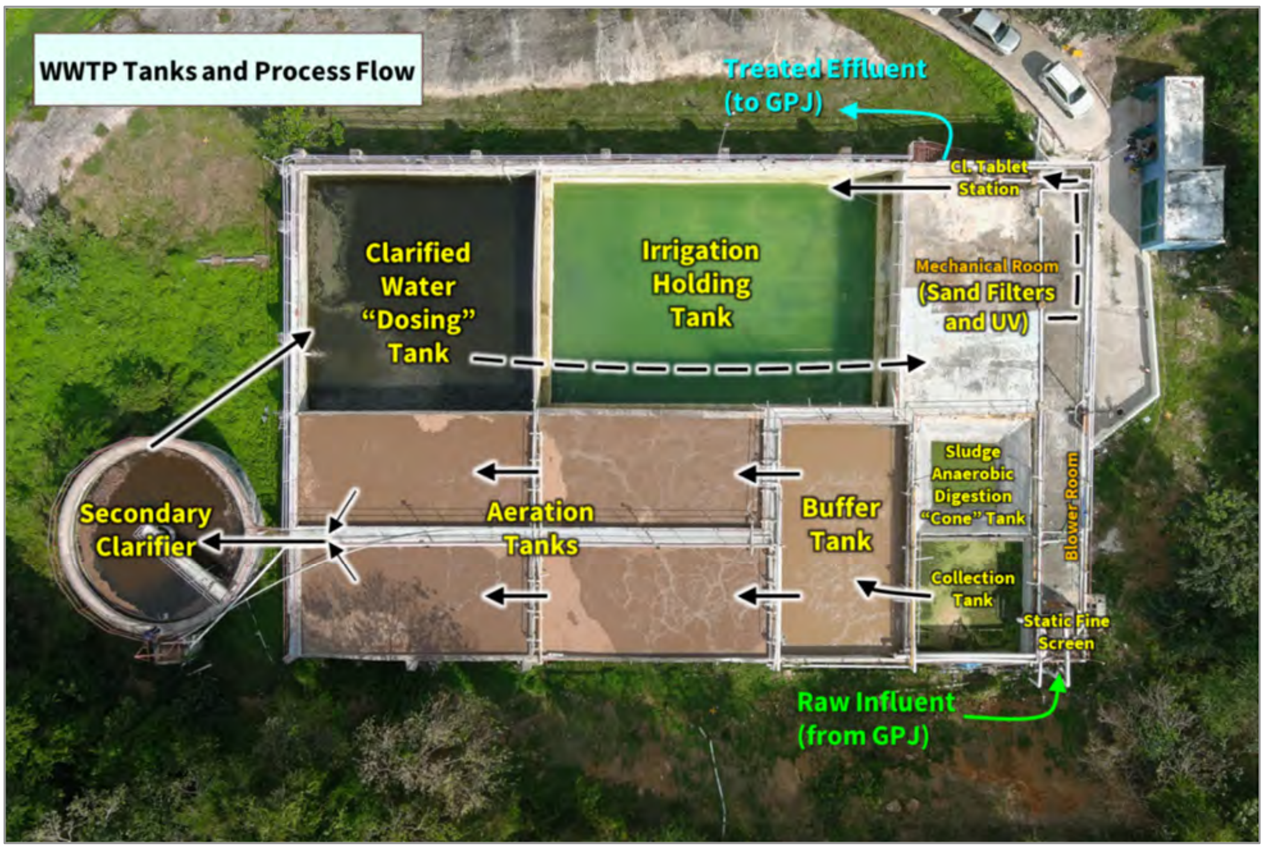


Figure 5-107 Layout of the existing GPJ WWTP

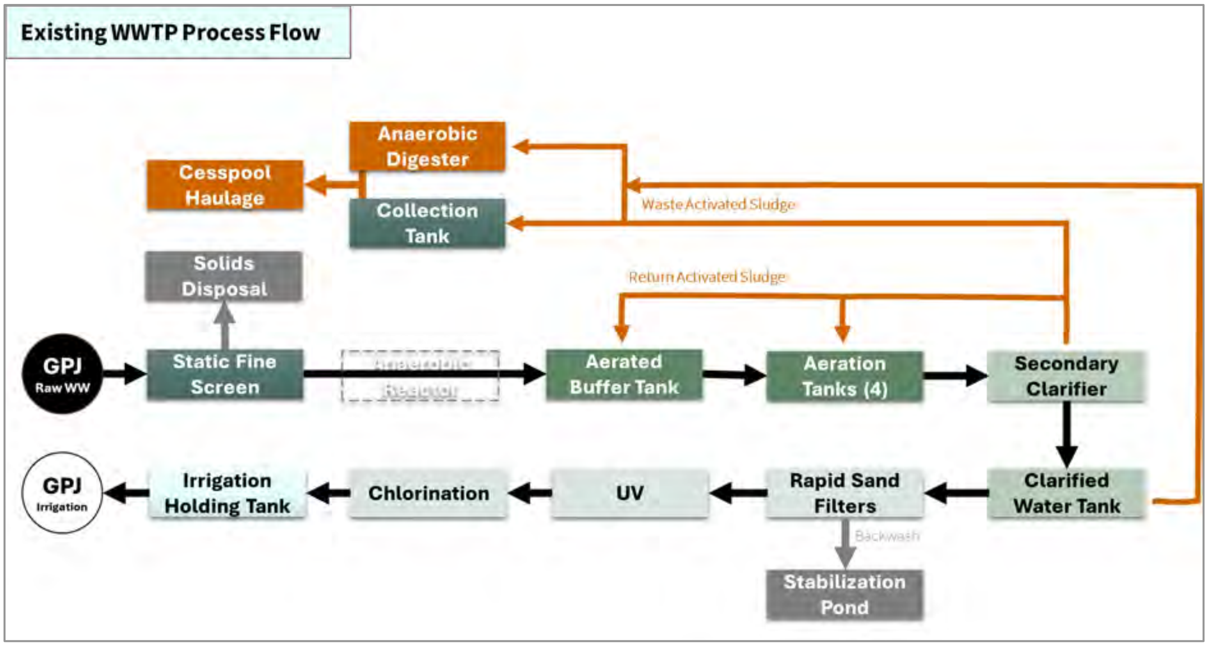


Figure 5-108 Flow chart of existing WWTP process flow

Solid Waste Generation and Disposal

The National Solid Waste Management Authority (NSWMA) oversees the collection of domestic solid waste within the study area. Garbage is collected once a week in residential zones. This service is offered at no cost to residents, with expenses partially subsidized by property taxes within the area.

In Lucea, garbage collection was available for only 49.3% of households, with 31.4% disposing of their garbage via communal receptacles (Social Development Commission, 2018). Among households where garbage collection occurred via truck, 53% stated that their garbage was collected on a weekly basis. Approximately 21.3% of households reported monthly collections, while 14.8% indicated collections every two weeks, and 10.9% reported collections twice weekly. (Social Development Commission, 2018).

Table 5-43 Methods of garbage disposal in Lucea

Source: (Social Development Commission, 2018)

Method	Percentage of Households
Bury	0.5
Communal Receptacle	31.4
Pick up by Truck	49.3
Burn	17.2
Dump in own yard	0.5
Dump on site	1.1
Total	**100.0**

From the public perception survey (section 6.0), 86.9% relied on public garbage trucks, although collection methods varied, sometimes being centralized rather than door-to-door. A small percentage used private collection (0.6%), while burning was reported by 12.5% as their main disposal method. Recycling participation was low, with 98.5% of respondents not engaging in recycling, while 1.5% actively participated through programs like Recycling Partners of Jamaica and local initiatives like Esher Primary School and D&G Bottle Return.

It is estimated that at the time of this study (2024), approximately 17,505.24 kilograms per day (approximately 17.51 tonnes per day) of solid waste was being generated within the study area. Over the next twenty-five years, based on calculated growth rates, this amount is expected to decrease slightly to 17,105.12 kilograms (approximately 17.11 tonnes) per day.

5.4.4 Livelihood and Socioeconomic Status

5.4.4.1 Education

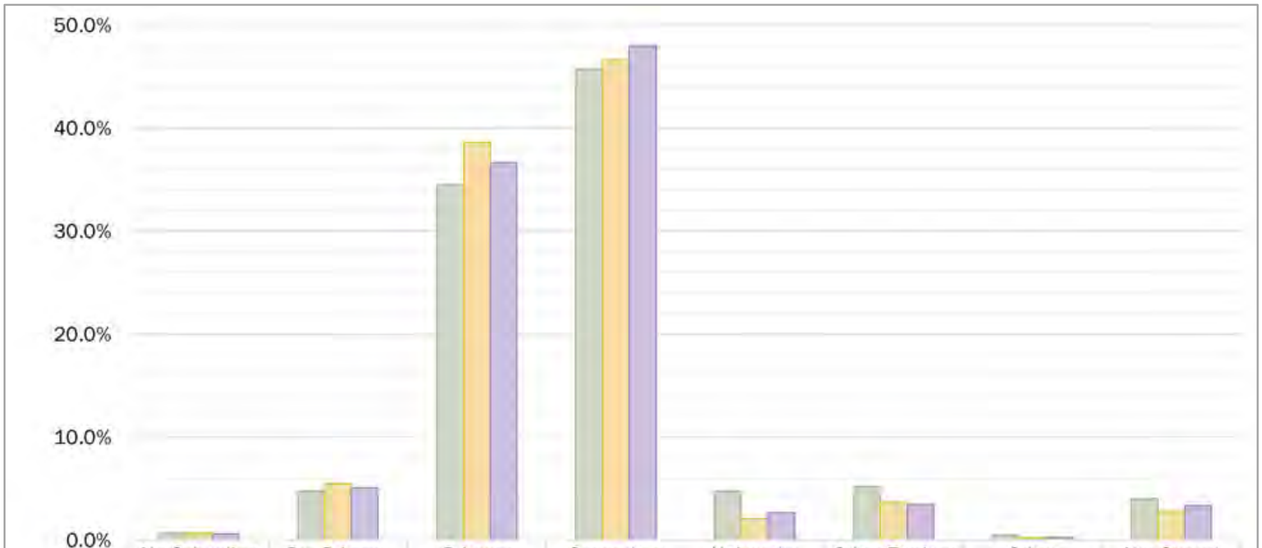
Attainment and Qualifications

A trend is observed towards the achievement of primary and secondary education as the highest level of academic attainment within the SIA population. According to STATI 2011 data, approximately 48% of individuals have attained secondary school education as their highest level, followed by 38.6% who have completed primary education. Tertiary education attainment, including university and other forms, stands at 6.1% in the SIA, which aligns closely with the parish and national levels of 8.4% and 9.9%, respectively (Figure 5-109).

The educational attainment trends among the SDC and perception survey populations are similar. According to the SDC community data for Lucea, 39.8% of household heads attained education up to the secondary level, while 20.3% of household heads achieved their highest level of education at the all-age level. Approximately fourteen percent (14.4%) had vocational level education, and 6.7% had attained education up to the university level (Social Development Commission, 2018). Data pertaining to the academic credentials of household heads in Lucea indicated that 60.9% possessed fewer than three (3) CXC's or equivalent qualifications, with the majority (56.1%) having no academic credentials. Among them, roughly 56% of male household heads and 56.3% of female household heads lacked academic qualifications (Social Development Commission, 2018).

Resulting from the public perception survey (section 6.0), 58.4% indicated high school as the last type of educational institution attended and approximately 15.7% reported that primary or all-age school was the last school they attended. Additionally, 10.8% mentioned college, 5.8% university, and 7.6% attended HEART/Vocational Training Institutions. About 1.7% of respondents indicated that they did not attend any type of educational institution.

Overall, there is a predominant focus on achieving primary and secondary education levels among the community, as reflected in both official STATIN and SDC data and public perception. This educational profile provides context for understanding the community's educational background and potential needs for further educational support or opportunities.



	No Schooling	Pre Primary	Primary	Secondary	University	Other Tertiary	Other	Not Stated
Jamaica	0.7%	4.8%	34.4%	45.7%	4.7%	5.2%	0.5%	4.0%
Hanover	0.7%	5.4%	38.6%	46.6%	2.0%	3.6%	0.2%	2.8%
SIA	0.6%	5.1%	36.6%	48.0%	2.6%	3.4%	0.3%	3.3%

Source: STATIN Population Census 2011

Figure 5-109 **SIA population 3 years old and over by highest level of educational attainment as a percentage for the year 2011**

Educational Institutions

Thirteen schools are located within the demarcated SIA (Figure 5-110):

1. Esther Full Gospel Basic School
2. Lucea Infant School
3. Rusea's High Campus School
4. Clare's Basic School
5. Hanover Pre and Preparatory School
6. Rusea's High Campus 2 School
7. Arthur Wint Basic School
8. Elgin Town Basic School
9. Lucea Christian Fellowship Church and Basic School
10. Lucea New Testament Basic School
11. Lucea Primary School
12. Charlemont All Age School
13. Jericho All Age School

Most of the schools within the SIA are located within the bounds Lucea community. The distribution of schools across the community of Lucea is described as being relatively uniform, with central locations that are easily accessible to students throughout the area (Social Development Commission, 2018). Schools within the SIA are in fair or good condition, with some operating below capacity (Table 5-44).

Table 5-44 Education institutions in Lucea, with those highlighted in yellow located within the SIA
Source: (Social Development Commission, 2018)

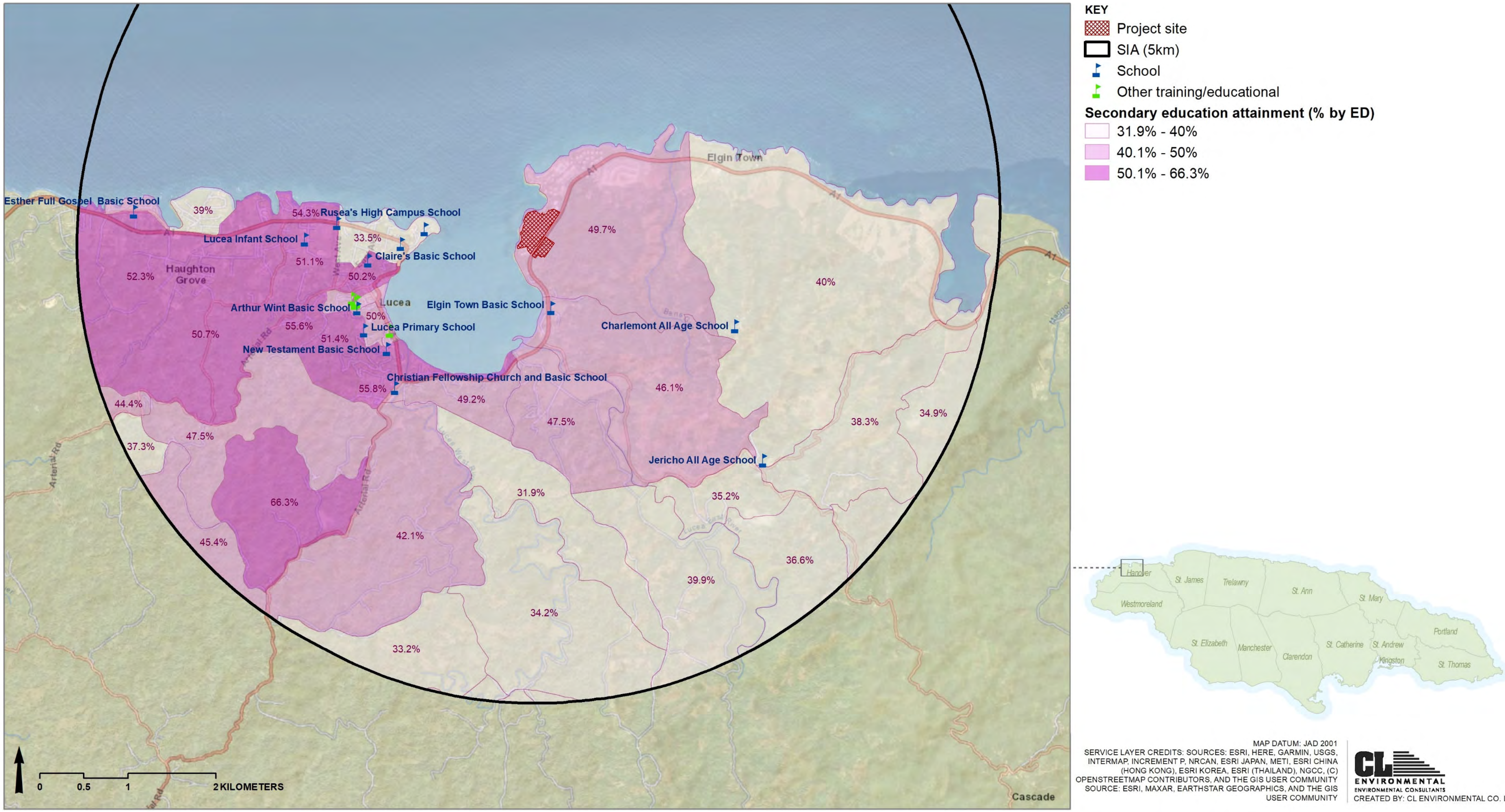
Name	Condition of Institution	Seating Capacity	Enrolment/attendance			# of Teachers	
			Males	Females	Total	With University Degrees	Without University Degrees
Little Tot's Nursery & Preschool	Good	61	10	18	28	1	1
Bright Minds Nursery, Pre and Kindergarten	Good	106	47	59	106	1	6
Arthur Wint Basic School	Good	160	83	67	150	1	6
St. Simon Basic School	Poor	40	11	8	19	0	0
Elgin Town Basic School	Good	100	33	22	55	2	2
Lucea Christian Fellowship Basic School	Fair	100	9	19	28	2	0
Passion Basic School & Day Care	Fair	70	38	45	83	2	2
Lucea Infant School	Good	300	128	131	259	8	1
Lucea New Testament Basic School	Good	60	11	9	20	0	2
Esher Full Gospel Basic School	Good	80	49	39	88	1	6
Hanover Pre and Preparatory School	Good	200	72	85	157	5	6
Clare's Preparatory School	Fair	60	33	30	63	4	0
St. Simon Primary School	Good	150	29	21	50	4	0
Esher Primary School	Good	615	292	323	615	15	2
Lucea Primary School	Good	900	324	400	724	26	0
Rusea's High School	Good	1860	808	970	1778	80	17

Skills Training

The skill set analysis revealed that 20.2% of Lucea residents possessed hospitality skills, while 14% had construction and cabinet making skills. Approximately 11.7% of residents had professional and technical skills, and 11% had agricultural and farming skills. Additionally, 10.2% of residents had secretarial/office clerk skills, and 8.9% had machine and appliance skills (Social Development Commission, 2018).

Approximately 67.1% of household heads had received training in a specific activity, occupation, or trade. Of those who reported having such training, just over fifty percent (50.1%) received formal training. Data further showed that among household heads with formal training, 25.1% obtained vocational certification and 18.3% achieved professional or technical certification. Additionally, about forty-three percent (42.6%) of household heads received training from experienced individuals, while 37.5% underwent 'on-the-job training'. (Social Development Commission, 2018).

Approximately sixty-seven percent (67.1%) of household heads had received training in a specific activity, occupation, or trade. Of those who reported having such training, just over fifty percent (50.1%) received formal training. Data further showed that among household heads with formal training, 25.1% obtained vocational certification and 18.3% achieved professional or technical certification. Additionally, about forty-three percent (42.6%) of household heads received training from experienced individuals, while 37.5% underwent 'on-the-job training'. (Social Development Commission, 2018).



Source: Schools (Social Development Commission, 2018) and Google Maps

Figure 5-110 Secondary education attainment by ED and schools within the SIA

5.4.4.2 Employment and Labour Force

In the Social Impact Area (SIA), the 15-64 years' age category accounted for 63.8%, indicating a significant portion of working-age individuals. Similarly, in the broader Lucea community, data from the Social Development Commission (2018) shows that 66.4% of the population falls within the working-age bracket (15-64 years). The total labour force in Lucea was estimated at eight thousand eight hundred and eighty-nine (8,889) individuals; among them, 46.7% were males and 53.3% were females (Social Development Commission, 2018).

Within the community cohort interviewed as part of the public perception survey for this project (343 respondents, see section 6.0), 38.5% indicated that they were self-employed, 27.4% were engaged in full-time employment, and 2.0% were employed part-time. Additionally, just over 13% reported being unemployed. Data from SDC covering a larger cohort within the general Lucea area, reveal full-time employment was the predominant category, encompassing 53.3% of employed individuals, while around twenty-eight percent (28.3%) were self-employed. The majority (75.4%) of workers in Lucea were engaged in service-related occupations, shop and market sales (32.3%), elementary occupations (27.2%), and craft and related trades (15.9%). (Social Development Commission, 2018).

Approximately thirty-nine percent (38.6%) of individuals in the labour force were unemployed. Among the unemployed, 36.6% were males and 63.4% were females, with youths (15-24) representing 27.1% of the unemployed. (Social Development Commission, 2018). Around forty-four percent (44.3%) of unemployed household members had been jobless for over five years, while 17.4% had been unemployed for less than 12 months. A significant 15.9% of household members had never been employed in their adult life, with close to thirty-one percent (30.6%) of unemployed males falling into this category (Social Development Commission, 2018).

Nearly half (46.5%) of household heads and 20.2% of household members cited retirement as their primary reason for unemployment. Additionally, survey findings revealed that 14.1% of household heads and 20.5% of other household members were actively seeking employment. Approximately 15.5% of household heads and 9.7% of household members attributed their unemployment to illness. Moreover, 5.6% of household heads and 12.4% of other household members reported inability to find work as the main reason for their unemployment.

5.4.4.3 Income and Socioeconomic Status

Household Income

In the community of Lucea, approximately fifteen percent (15.4%) of household heads earned less than $22,400 per month at the time of the study (Social Development Commission, 2018). Further examination of the data revealed that 16.6% of household heads earned between $22,400 and $44,799 per month, while 9.5% earned an income ranging from $44,800 to $64,799 per month. Only 14.2% of household heads reported an income exceeding $86,800.

More than fifty-one percent (51.4%) of households rely solely on their primary income source. Supplemental income is primarily derived from remittances (15.5%), state assistance (14.4%), and support from the local network of family and friends (15.1%) (Social Development Commission, 2018)

Poverty Levels

The poverty GIS dataset, formulated by the Planning Institute of Jamaica (PIOJ) with collaborative input from STATIN, the Social Development Commission (SDC), and the University of Technology, primarily delineates areas of poverty by community. The selected indicators were those most predictive of per capita consumption levels in households, utilizing data from the Jamaica Survey of Living Conditions (JSLC) 2002. Variables common to both the JSLC 2002 and the Population Census 2001 were identified and assessed for compatibility. The satisfactory variables were then applied to the census data to estimate the consumption levels of households across the entire island.

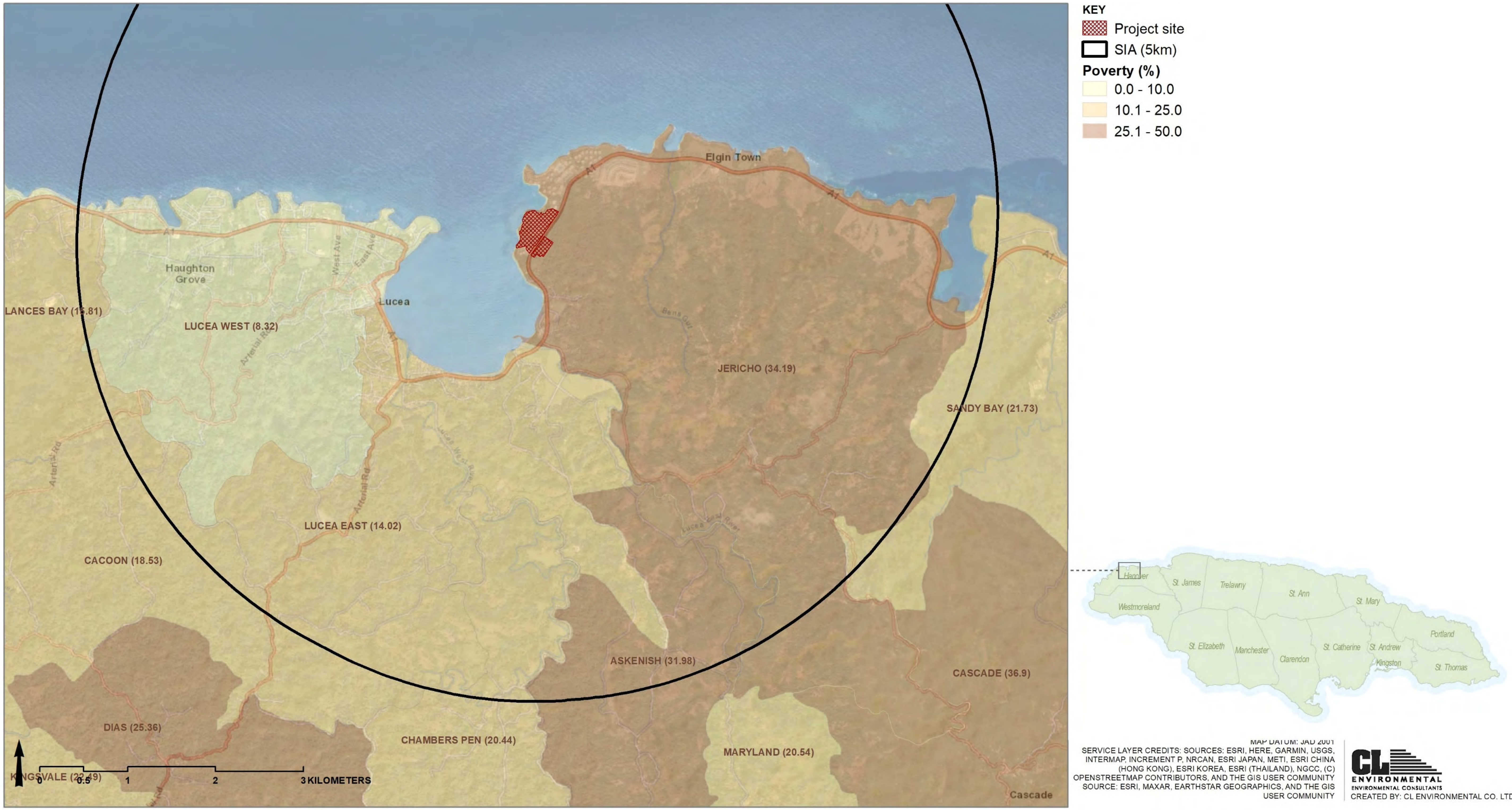
Households whose consumption levels fell below the poverty line for their respective regions were classified as being in poverty. The percentage of individuals in poverty within each community was used to rank the 829 communities. Within the SIA, poverty levels generally range from 8% to 34% of persons living in poverty, with the highest levels occurring in the community within which the project site is located, Jericho (Figure 5-111).

Poverty, as perceived within the community, denotes a condition characterized by a meagre standard of living and the inability to fulfil essential needs. Individuals classified as impoverished typically struggle to secure employment, lack access to skills training, or possess limited educational attainment. They often experience financial instability and suffer from diminished self-esteem. The community of Lucea delineates its socio-economic landscape into three distinct groups: the "Neglected Class," the "Trying Class," and the "Independent Class" (Table 5-45). As per the classification provided by engaged participants, 10% of Lucea's residents belong to the 'Neglected Class,' 65% are categorized under the 'Trying Class,' while 25% are identified as part of the 'Independent Class'. (Social Development Commission, 2018).

Table 5-45 Characteristics of socioeconomic groups in Lucea

Source: (Social Development Commission, 2018)

Independent Class 25%	*Trying Class* 65%	*Neglected Class* 10%
- Own and drives motor vehicles - Not sociable unless they need assistance - Have 0-1 child - Are business owners and other professionals such as bank managers, church owners, doctors, lawyers, returning residents - Can afford to take vacations - Can afford to eat two balanced meals per day - Are able to send their children to school for 5 days per week - Can afford higher education for their children - Lives in multi-storeys modern design block houses - Own more than one house and car - They are investors, they are frugal	- Are able to send their children to school for five days each week - Are employed in various occupations - sell on the streets or in the markets work in the supermarkets, small business owners, teachers - Neatly dressed - Has water closet toilets - Can afford four to five meals per day - Lives in block and board houses	- Lives in dilapidated houses or are homeless. - Some live for free with relatives. - Begs for a living on the street. - Some have more than five children. - Are unable to send children to school or children normally attend school two days or less for a week. - Always seeking help from others - Have one to two meals per day even up to four meals; meals are not balanced; some eat a lot of times due to constant begging. - Some survives by stealing things from other person's fruit trees or hustling - Children are often hungry and appear dirty - Don't own or drive cars - Often appear depressed - Have no toilet facilities - Some are well dressed even though they have little.



Data source: PIOJ (with contributions from STATIN, SDC and the University of Technology

Figure 5-111 Proportion of persons in poverty in each community within the SIA

5.4.5 Services and Infrastructure

5.4.5.1 Emergency Services and Issues

Healthcare

One health centre is located within the SIA in Lucea (Figure 5-112). This facility is a Type IV health centre situated within the community, offering a range of essential services. These include prenatal and postnatal care, family planning, child health services including immunizations, home visits, curative treatments, mental health support, family counselling, wound care, dental health services, and general medical care. Additionally, the Lucea community relies on the Noel Holmes Hospital located at Fort Charlotte, the sole secondary health care facility in the parish. Classified as a Type 'C' institution, Noel Holmes Hospital has a capacity of 55 beds and provides fundamental, non-specialist inpatient and outpatient services encompassing medicine, surgery, obstetrics, gynaecology, and paediatric care (Western Regional Health Authority, 2010) (Social Development Commission, 2018).

The utilization of public healthcare facilities by residents of Lucea surpassed the national average of 50.2%. Hospitals were frequented by 47.1% of households, while health centres were visited by 9.6% (Table 5-46) (Social Development Commission, 2018). In addition to these public facilities, private doctors (visited by 41.2% of Lucea households, Table 5-46), an infirmary, wellness clinic and other medical services are located in the Lucea area (Social Development Commission, 2023).

Table 5-46 Healthcare facilities utilized by households

Source: (Social Development Commission, 2018)

Health Service Used	Percentage
Private Hospital	1.1
Private Doctor	41.2
Government Hospital	47.1
Government Health Centre	9.6
Home Remedy	0.5
None	0.5
Total	**100.0**

During the public participation survey (section 6.0), it was found that healthcare services in the area predominantly relied on Noel Holmes Hospital as well. About 43.7% of respondents indicated using this public hospital for their healthcare needs, while 41.7% sought care from private doctors, and 28.6% utilized public clinics. Less than one percent (0.6%) mentioned using private hospitals [6]. Specifically, Noel Holmes Hospital was frequently mentioned both as the primary public hospital and the primary health

[6] Percentages exceeded 100.0% due to respondents sometimes using multiple healthcare providers for different reasons.

centre/clinic, reflecting varied healthcare choices based on medical conditions and timing of medical needs.

More than fifty-two percent (52.7%) of household heads reported encountering no difficulties when accessing healthcare for their families. Among those facing challenges, the main obstacles included long waiting periods at healthcare facilities (42.8%) and inadequate transportation (5.9%). (Social Development Commission, 2018). Regarding long-standing health issues, the data reveals the prevalence of several chronic diseases, with hypertension (33.6%), asthma (15.2%), and diabetes (15%) ranking among the top three health problems affecting residents of Lucea. (Social Development Commission, 2018).

Fire Stations

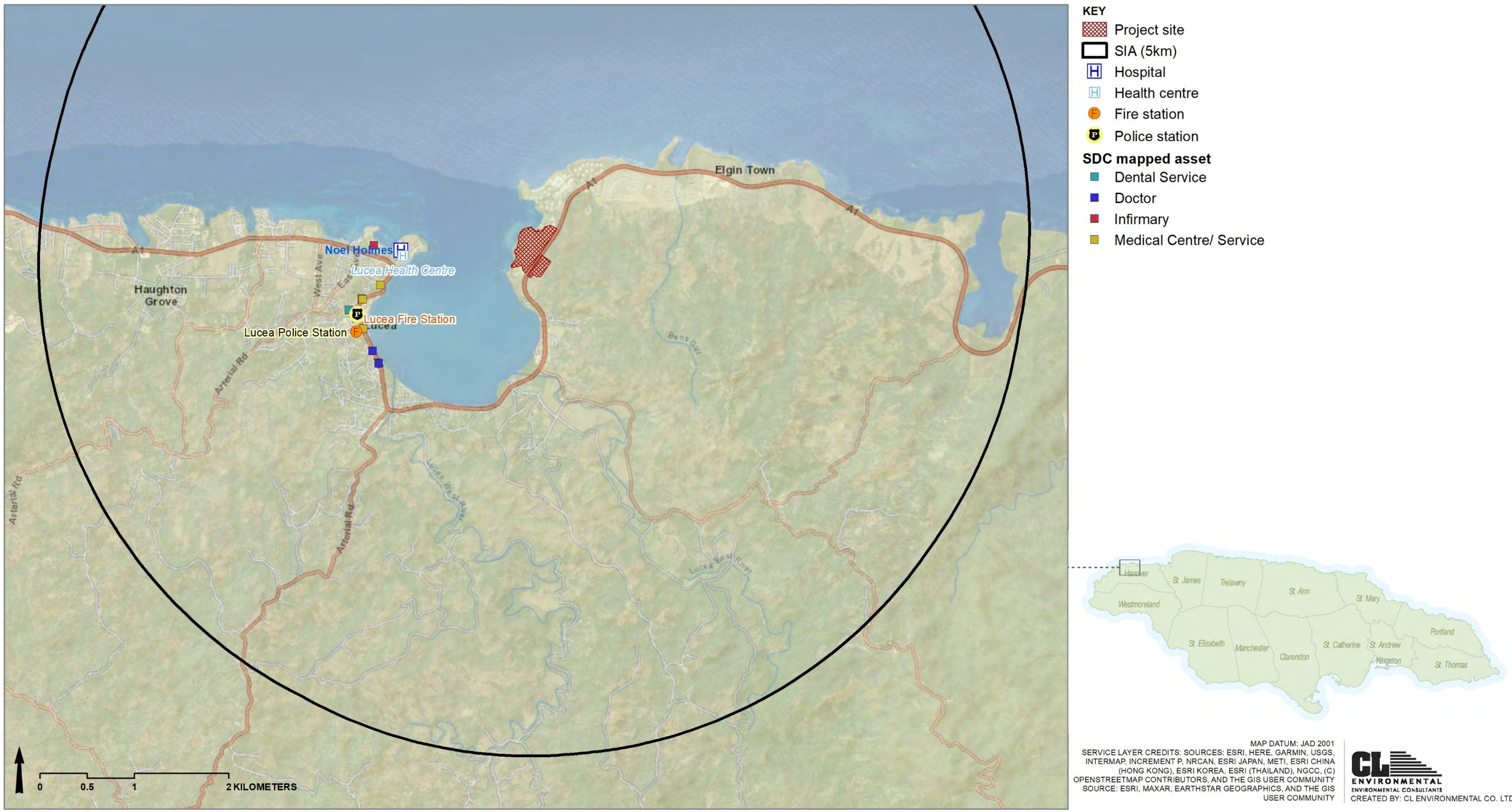
The community is supported by the Hanover Division of the Jamaica Fire Brigade, which operates from Cressy's Lane in Lucea, approximately 2 kilometres southwest of the proposed Phase 2 site (Figure 5-112). The division comprises one operational fire unit and an ambulance, staffed by 77 firefighters (Social Development Commission, 2018).

Police Stations and Safety Concerns

Lucea police station is situated approximately 2 kilometres southwest of the project site (Figure 5-112), along with the Hanover Divisional Headquarters. This station is staffed by 67 police officers, including 2 inspectors, 8 sergeants, and 7 district constables. Currently, two motor vehicle units are allocated to the station, with one designated for patrolling Lucea and the other for use by the Criminal Investigation Branch. Additionally, the station possesses 5 motorcycles; however, only 2 are operational (Social Development Commission, 2018). Furthermore, apart from serving the Lucea community, the station extends its services to the neighbouring communities of Cascade, Cash Hill, Maryland, Jericho, Askenish, Mount Peace, Chambers Pen, and Lances Bay (Social Development Commission, 2018).

About seventy-five percent (75.3%) of residents expressed feeling safe (56%) or very safe (19.3%) within the community. Nearly forty percent (38.8%) of respondents perceived the level of crime in their community as low, while 23.8% regarded it as high (Social Development Commission, 2018). Around forty-eight percent (47.8%) of household heads reported that crime in the community had increased over the past year, while another 27.7% believed it remained unchanged, and 15.3% indicated a decrease (Social Development Commission, 2018).

Safety and security concerns in the community included inadequate street lighting (59.1%), litter and garbage accumulation (32.6%), deteriorating infrastructure (25.1%), and the presence of gangs and gang-related violence (24.3%). (Social Development Commission, 2018).



Data sources: MGI, Social Development Commission (SDC) (2023)

Figure 5-112 Emergency, health and postal services located in the SIA

5.4.5.2 Road Network and Accessibility

The primary roadway, designated as A1 and named the North Coast Highway, runs parallel to the coastline, providing access to the proposed project site. Key roadways such as the Kew Bridge to Great River main road, the Lucea to Green Island main road, and the Lucea/Glascow main roads connect Lucea with neighbouring parishes of St. James and Westmoreland (Social Development Commission, 2018). The community's road infrastructure also comprises parochial roads, internal paved and unpaved roads, tracks, and pathways. While some internal roads are in good condition, the majority are in poor condition, hindering smooth transportation (Social Development Commission, 2018).

In Lucea, approximately thirty-nine percent (39.4%) of households have access to transportation. Licensed taxis are the primary mode of transportation, utilized by 79.4% of households. Robot taxis are used by approximately thirty-three percent (33.4%) of households, while 33.2% have access to private motor cars owned by household members (Table 5-47). Buses serve 32.1% of households (Social Development Commission, 2018).

Public transportation within and to/from the community is highly dependable, with each district having its own route taxis. Lucea also has its own route taxi association, and the Lucea Transportation Centre serves as a hub for residents traveling within and outside the parish (Social Development Commission, 2018).

Table 5-47 Main types of transportation utilised by households in Lucea

Source: (Social Development Commission, 2018)

Means of Transportation	Percentage of Households
Motor car (owned by household member)	33.2
Motor car (not owned by household member)	4.0
Motor cycle (owned by household member)	1.3
Motor cycle (not owned by household member)	0.3
Robot taxi (unlicensed)	33.4
Licensed taxi	79.4
Bus	32.1
Bike	5.1
Bicycle	1.9

5.4.5.3 Communication

The study area receives landline services from Flow Jamaica Limited (formerly LIME Jamaica Limited). Wireless (mobile) communication is offered by Digicel Jamaica Limited and Flow, while internet connectivity is facilitated through Flow's network.

The vast majority (98.7%) of households in Lucea had telephone service. Approximately ninety percent (90.2%) of households used cellular telephone service, while 8.7% had both landline and cellular phone service, and 1.1% had landlines exclusively (Social Development Commission, 2018). Similarly, 86.6% of the public perception cohort used mobile phones, 11.4% utilized both mobile and fixed-line services, and 2.0% did not use any telephone service. Awareness of fixed-line services in the community varied, with 42.6% acknowledging their presence, 35.2% unsure, and 22.2% reporting their absence.

About sixty-seven percent (66.5%) of households reported having Internet access. Among these households, approximately sixty-five percent (65.3%) accessed the Internet via cellular phones, 14.7% used ADSL modems, 14.3% utilized wireless connections, and 5.6% accessed the Internet via portable modems. (Social Development Commission, 2018).

Two post offices exist within the SIA, specifically in Lucea and Claremont (Figure 5-112).

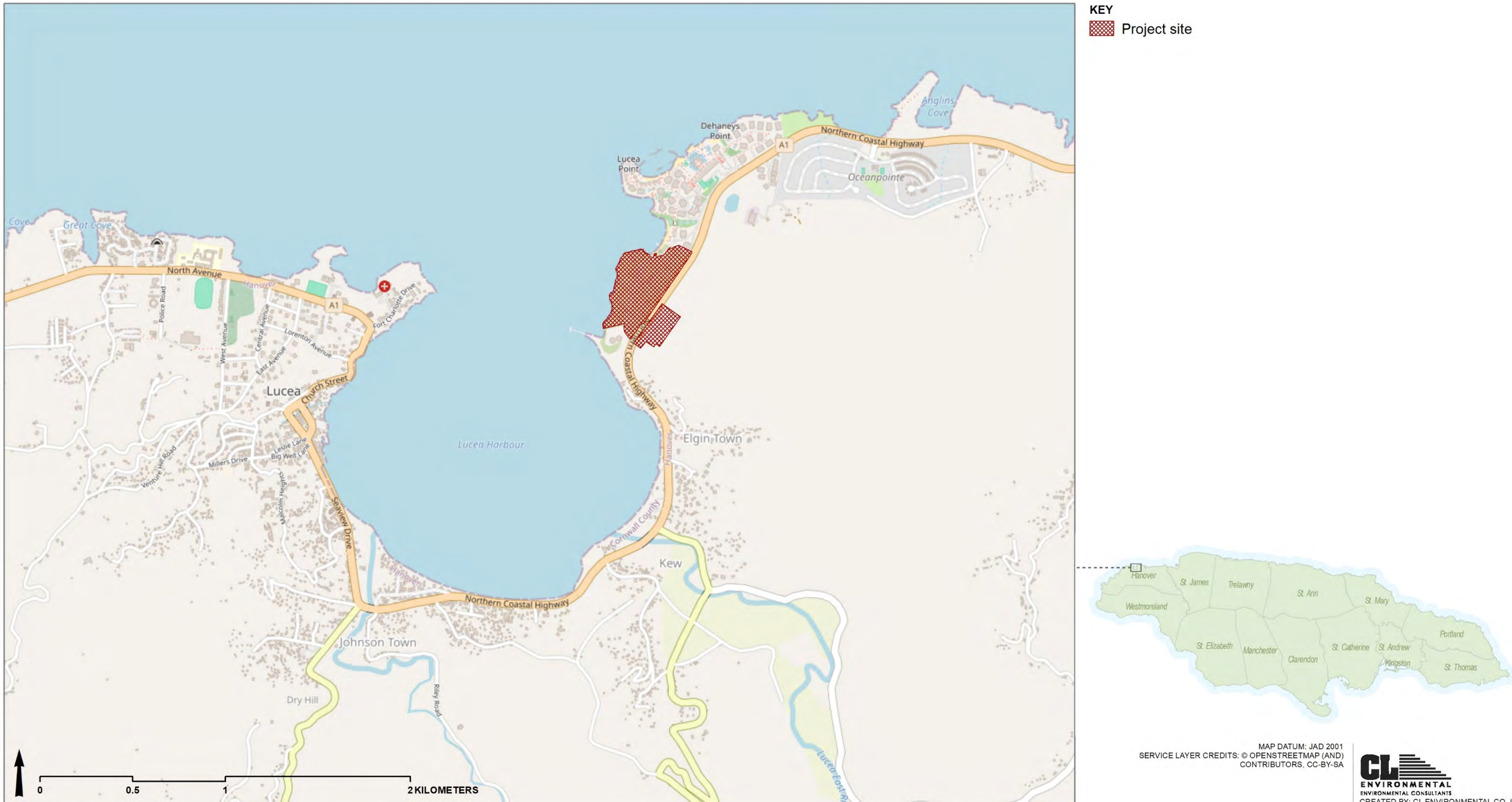


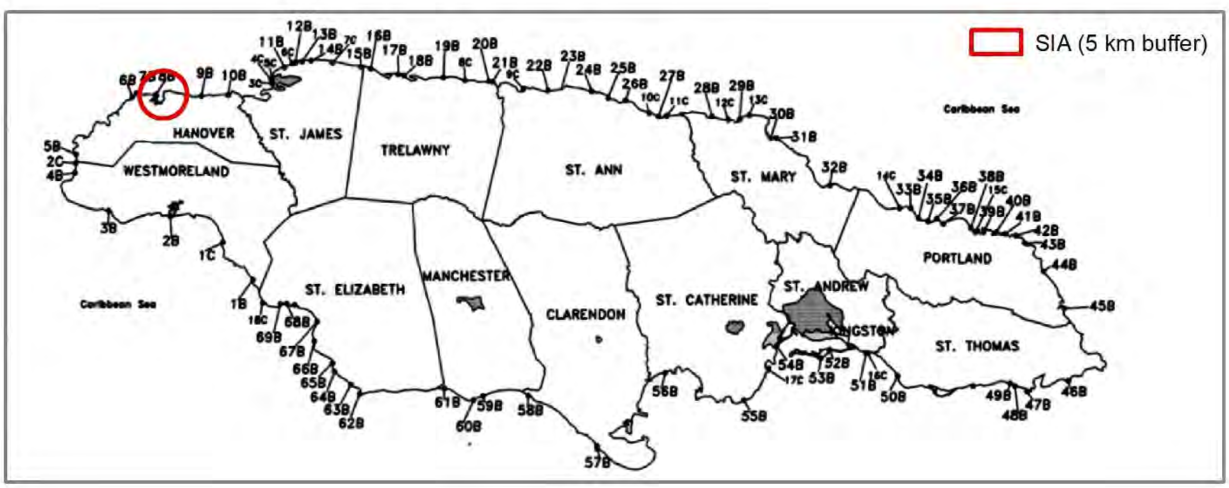
Figure 5-113 Road network in the SIA

5.4.5.4 Recreational and Religious Amenities

Lucea boasts several recreational venues providing entertainment, such as playfields, nightclubs, game rooms, and community centres, along with restaurants and bars. Moreover, numerous churches serve the community's religious needs (Social Development Commission, 2023) (Figure 5-131).

During the perception survey (section 6.0), when asked about the presence of recreational spaces in their community, 28.9% of respondents noted the availability of such spaces, while 65.0% indicated the absence of any recreational facilities. Among those reporting the presence of a recreational facility, 89.9% mentioned its accessibility to individuals of all ages and those with special needs, though 8.1% noted accessibility challenges. Regarding maintenance, 83.8% of respondents with a recreational facility in their community described it as being in "good condition."

Other major recreational attractions within the SIA include the various historical landmarks in Lucea (section5.4.9) and Dolphin Cove, approximately 2km east of the existing Grand Palladium hotel (Figure 5-131). Watson Taylor Park public bathing beach (8B,Figure 5-114), as well as Point Beach, opposite the Oceanpointe community, are accessed by locals.



Source: (Natural Resources Conservation Authority, 2000)

Figure 5-114 Public bathing beaches in Jamaica, with those located within the project SIA circled in red

5.4.5.5 Commercial and Financial Facilities

Lucea offers various financial services, including banks, ATMs, and other financial institutions. Additionally, the town hosts a range of retail shops, beauty salons, barber shops, and other businesses (Social Development Commission, 2023) (Figure 5-131).

5.4.5.6 Community Resources and Needs

Households in Lucea expressed the highest satisfaction levels with government provisions for education and water supply in the community (Table 5-48). Approximately 58.6% and 57.3% of respondents indicated being collectively very satisfied and satisfied with the quality of these services, respectively (Social Development Commission, 2018). Moreover, over fifty-four percent (54.5%) of residents were either very satisfied or satisfied with government provisions for public transportation, while 42.8% expressed satisfaction with government provisions for street lighting. However, satisfaction levels were lower for health care services, with only 37.4% of residents collectively expressing satisfaction (Social Development Commission, 2018) Conversely, 72.4% of residents expressed collective dissatisfaction with government provision for roads in the community. Additionally, 50.5% of residents were collectively dissatisfied with garbage collection services, while 45.4% expressed dissatisfaction with government provision for street lighting in the community.

Table 5-48 Quality of government services in Lucea

Source: (Social Development Commission, 2018)

Services	Very Satisfied	Satisfied	Neither Satisfied nor Dissatisfied	Dissatisfied	Very Dissatisfied	No response	Not Applicable	Total
Housing	4.8	29.7	28.3	24.3	5.1	6.7	1.1	**100.0**
Water supply	7.0	50.3	12.6	21.0	8.3	0.5	0.3	**100.0**
Health Care services	4.5	32.9	20.1	24.3	14.7	3.2	0.3	**100.0**
Sewage disposal And Drainage	1.9	22.7	11.0	24.3	14.7	2.1	23.3	**100.0**
Street lighting	5.9	36.9	10.4	31.0	14.4	1.1	0.3	**100.0**
Education	8.3	50.3	18.3	15.0	5.4	2.4	0.3	**100.0**
Garbage removal	4.5	26.0	14.4	29.2	21.4	0.5	4.0	**100.0**
Crime prevention by police	4.5	29.7	23.3	26.2	12.8	3.2	0.3	**100.0**
Roads	1.9	14.7	10.7	35.8	36.6	0.3	-	**100.0**
Public Transportation/ Bus Service	9.6	45.0	15.0	10.4	4.5	1.3	14.2	**100.0**

The participants in the household survey undertaken by SDC (Social Development Commission, 2018) pinpointed the following as the primary development priorities/needs in Lucea:

- Mitigate elevated levels of youth unemployment (14-24 years)
- Mitigate elevated levels of adult unemployment (25 years and over)
- Enhance road conditions
- Enhance skill levels
- Curtail elevated levels of high school dropouts (Social Development Commission, 2018)

5.4.6 Traffic

5.4.6.1 Road Conditions

The Oceanpointe development encountered just before the hotel, houses a stoplight entrance that impacts the traffic going into the hotel and continuing westbound along Lucea main road (Figure 5-115). The hotel's entrance is a T-intersection with one leg providing entrance and exit to the hotel property and the two others allowing movement along the main arterial road heading to Negril in the west and Montego Bay in the east.

The observed posted speed limit on the modelled segment of the Lucea main road was noted to be 50km/h. Based on the posted speeds, the minimum required stopping sight distance was determined to be 65m. By traversing the area, the sight distance was deemed to be satisfactory within the majority of the roadway areas adjacent to and accessible by the site.

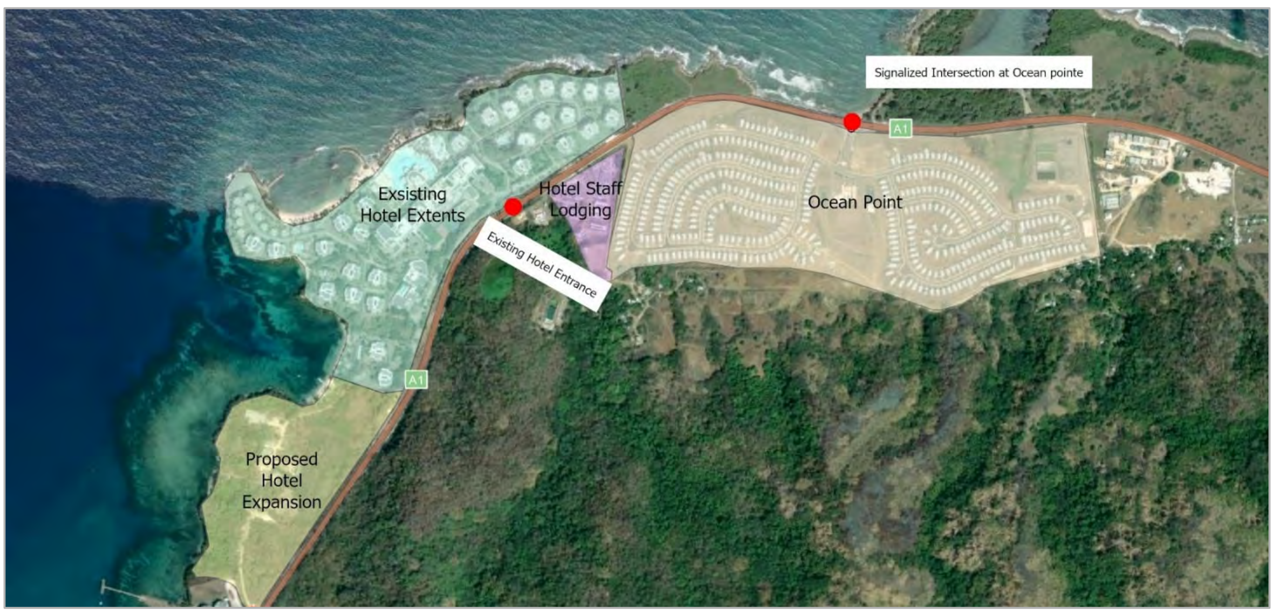


Figure 5-115 Location of existing hotel entrance and intersections in project area

5.4.6.2 Traffic Volumes

Traffic count data were collected by the NWA over 10 days from May 7 to May 16, 2024, with continuous 24-hour monitoring each day. Additionally, data were gathered at the hotel's entrance to determine the turning counts for traffic entering and exiting the hotel. This data is crucial as it provides information on the existing roadway conditions, detailing vehicle numbers, types, and peak traffic times. It also offers insights into the number of vehicles flowing in and out of the hotel and how these vehicles impact the main road traffic. The NWA data was collected via hydraulic strips placed east of the entrance of the

Oceanpointe development, while the hotel turning counts were recorded using a traffic camera focused on the hotel's gate.

The following limitations of the study should be noted:

- The Turning Traffic Counts were limited to five (5) days at the existing hotel and were not taken concurrently with the NWA which may be affected by the variance between daily traffic trends.
- The Vehicle counts were conducted in a relatively short period seasonal variations were not measured.

Figure 5-116 Traffic counter locations

Palladium Guest Entrance Intersection

The Palladium guest entrance intersection, located along the Lucea main road, is a two-way road that includes a short right-turn lane for vehicles entering and exiting the Grand Palladium property. The following traffic trends were identified:

1) There is a morning peak for hotel commuters between 1100 and 1200 hours.
2) The afternoon peak hour for vehicles entering the hotel is between 1400 and 1500 hours, which closely aligns with the main road's westbound peak from 1300 to 1400 hours. However, the eastbound peak occurs later, from 1700 to 1800 hours.

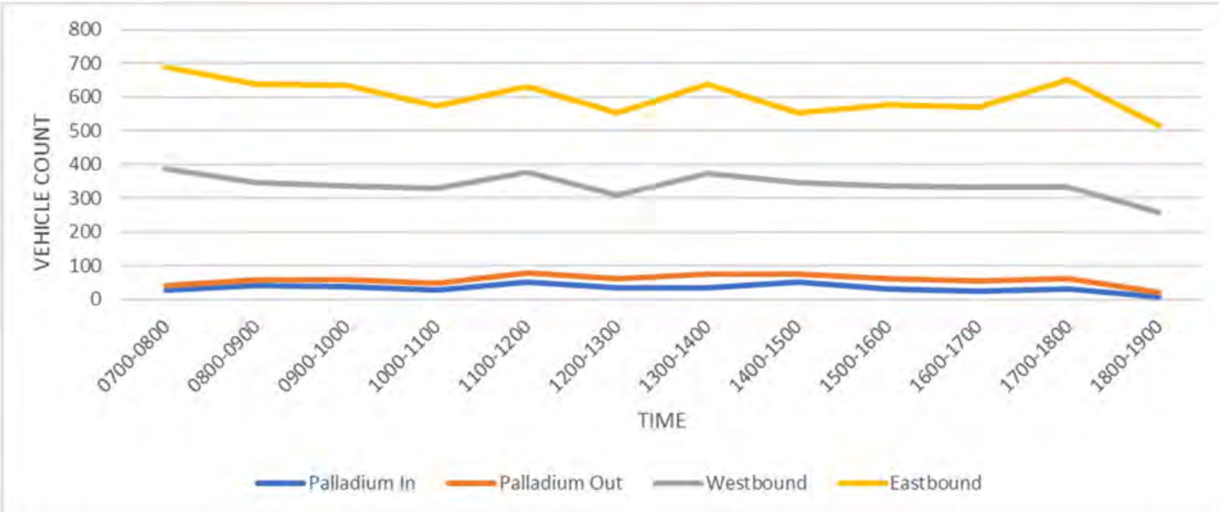


Figure 5-117 **Comparative hourly traffic flow volume trends at Grand Palladium Intersection**

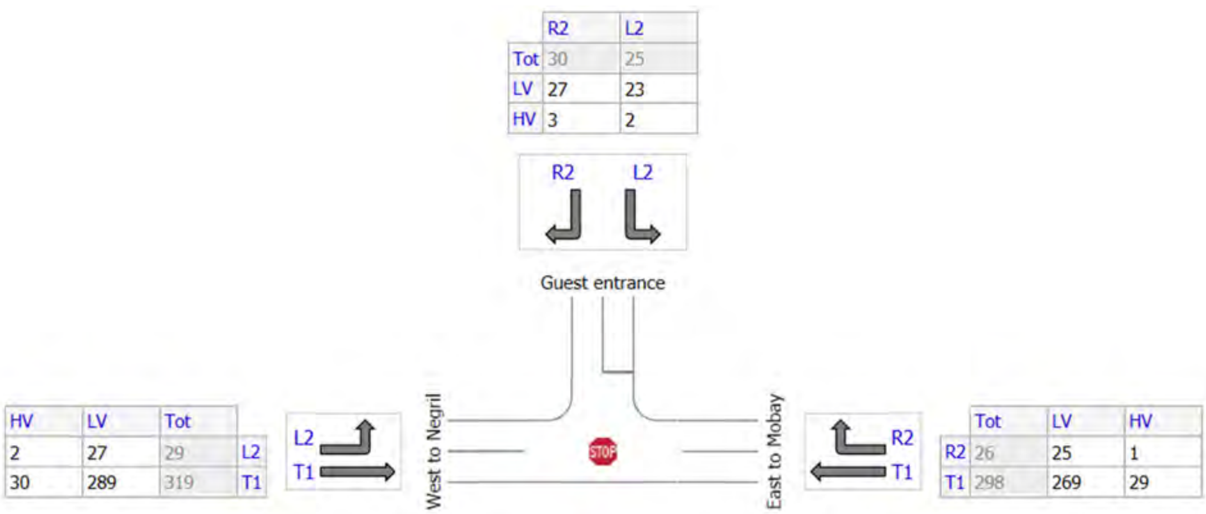


Figure 5-118 **Number of vehicles moving in various directions at the hotel main entrance at peak hour**

Oceanpointe Intersection

The Oceanpointe Intersection, a three-way signalized single-carriageway located 800 meters from the Grand Palladium Hotel, provides Oceanpointe residents access to the main arterial road. This intersection features the only stoplight in the parish of Hanover, making it critical to assess its traffic impact on the hotel. The following trends were identified from the traffic counts:

1) The morning peak hour for both eastbound and westbound traffic is from 0700 to 0800.
2) The afternoon peak hour is from 1700 to 1800 for eastbound traffic and from 1300 to 1400 for westbound traffic.
3) The ITE trip generation model was applied to estimate traffic flows in and out of the development, based on a representative model for single-family detached housing with 430 units.

Plate 5-27 Aerial view of the Oceanpointe intersection

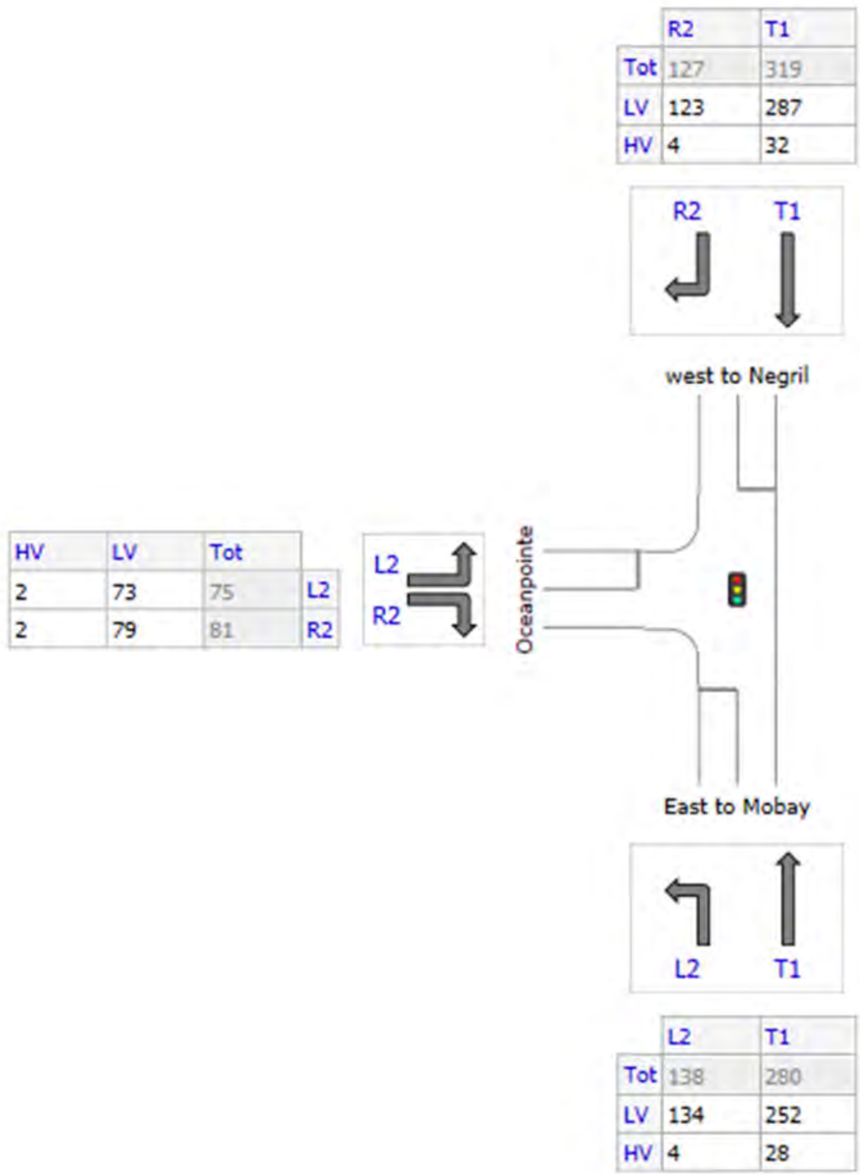


Figure 5-119 Traffic volume peak hour counts at Oceanpointe Intersection

5.4.6.3 Mode of Transportation

The resort mainly caters to foreign guests who are mostly transported by bus. Presently, 10 buses are used to transport hotel workers, and 60 employees commute using individual taxis or private vehicles. Staff members residing in the staff village (approximately 200) use the tunnel for commuting, which does not impact the gate.

Figure 5-120 **Hotel entrance traffic flow**

5.4.6.4 Traffic Modelling

Analysing the existing scenario provides a baseline for understanding the expected impacts of the proposed developments. The current weekday performance along Lucea's main road (A1) and at the Grand Palladium's entrance shows a generally good to satisfactory level of service. The main road achieves an average level of service (LOS) of A, with a B recorded only in the evening for traffic heading to Montego Bay. At the Grand Palladium's entrance, the LOS is B for both AM and PM peak periods.

Drivers on the Lucea main road (A1) experience minimal delays, typically no greater than 15 seconds, resulting in mostly free-flowing traffic. At the Grand Palladium's entrance, delays during peak times can reach up to 15 seconds. The PM peak period represents the worst scenario for vehicle delays on the main road, while both AM and PM peaks are the most challenging for vehicles entering the Oceanpointe Development, which does not significantly impact the hotel. This level of service remains consistent during both AM and PM weekend scenarios.

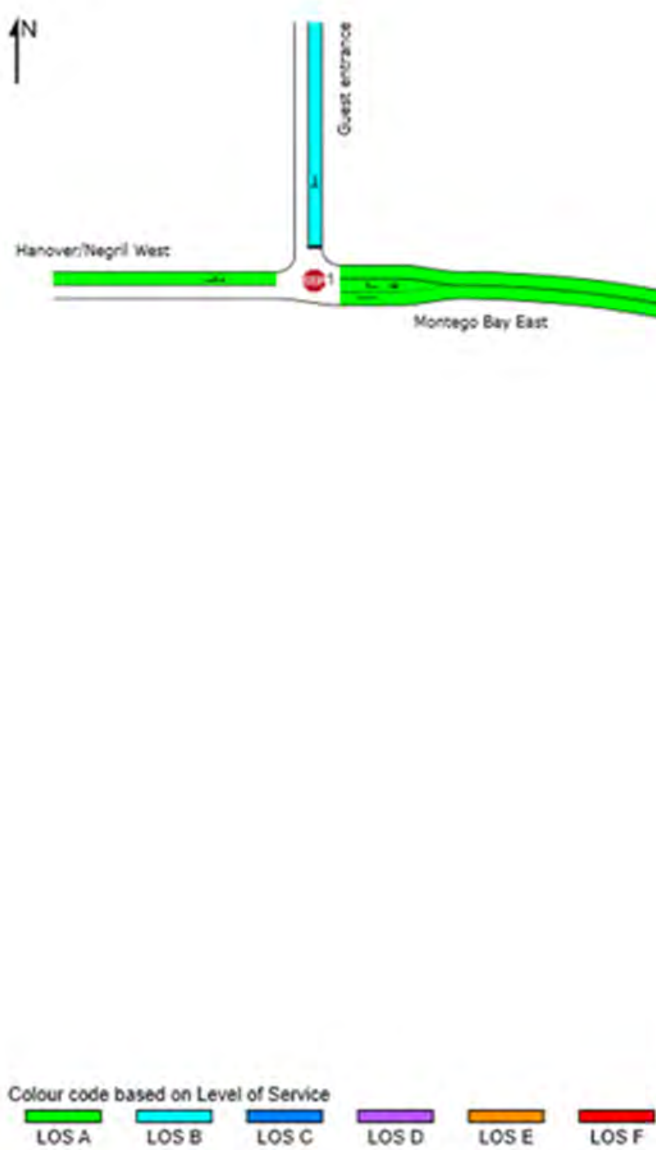


Figure 5-121 **Level of Service for Grand Palladium's entrance - existing condition - AM Peak – weekday**

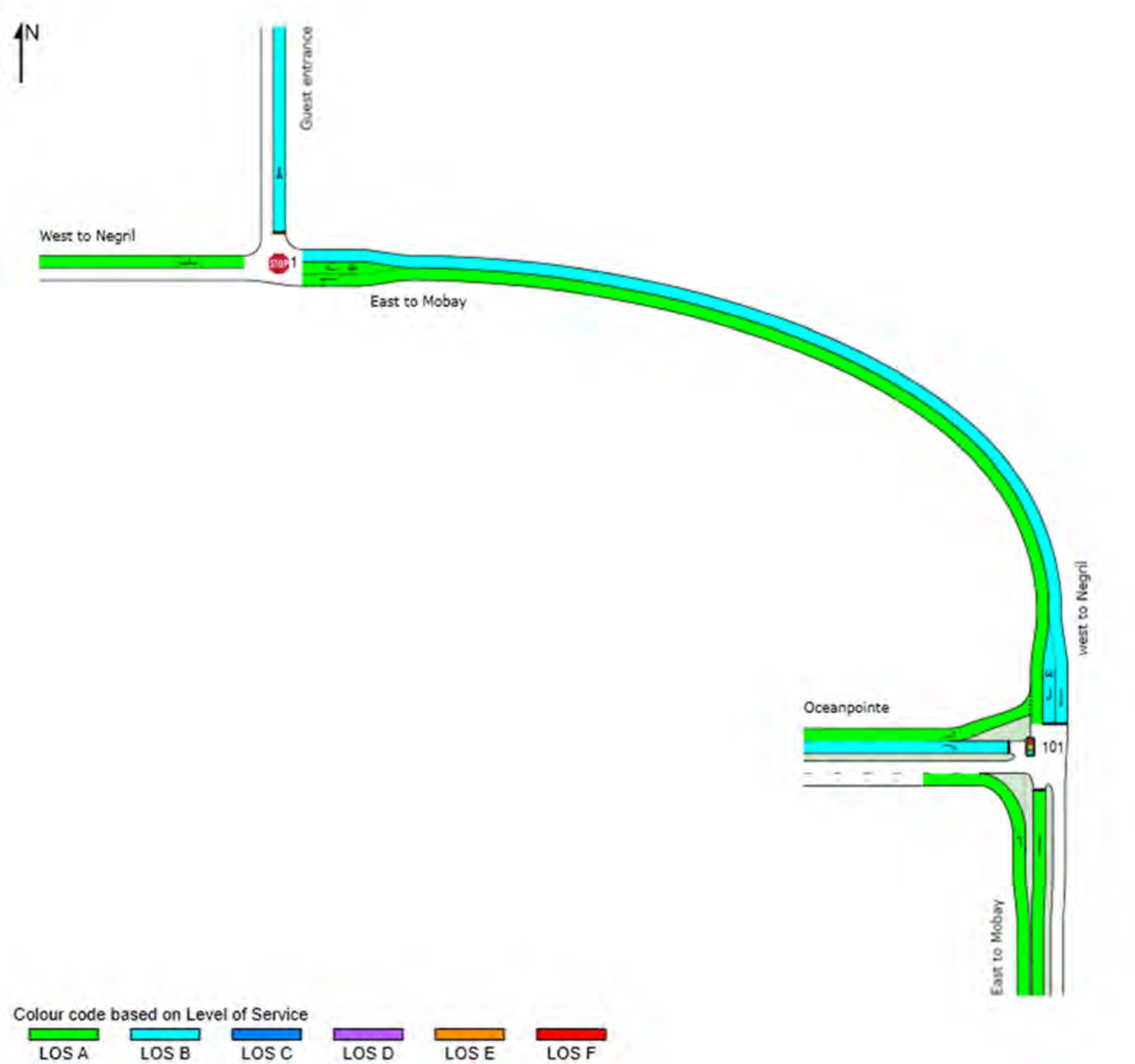


Figure 5-122 Level of Service for Grand Palladium's entrance - existing condition – Peak PM – weekday

5.4.7 Economic Activities

5.4.7.1 Tourism

Accommodations

Tourism is a significant activity along Jamaica's north coast, with the proposed expansion positioned approximately 24km west of Montego Bay, the most popular tourist region in the country. In addition to the Grand Pallidum hotel, smaller-sized guest accommodations are situated along the coast within the SIA.

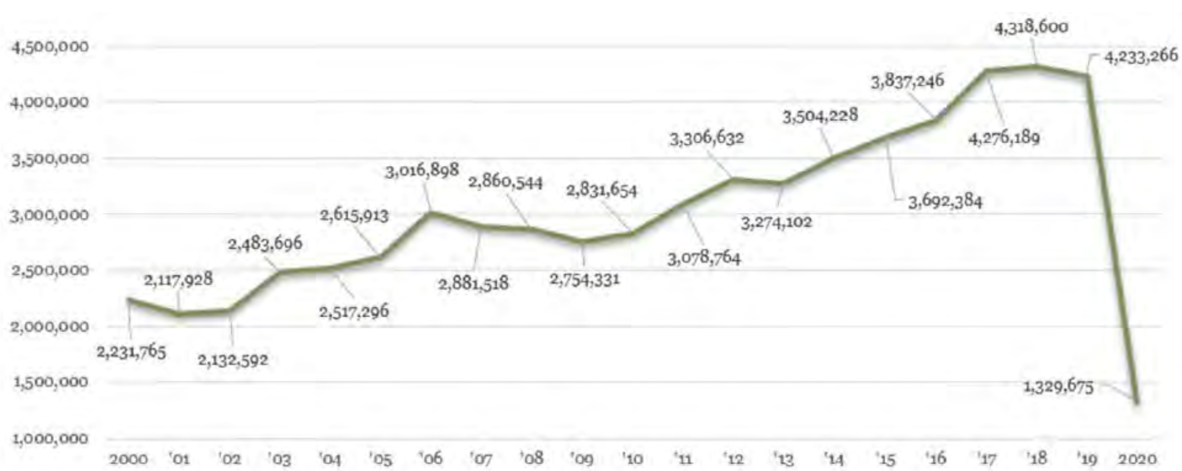
International and Regional Trends

The year 2020 witnessed the most significant crisis in international travel on record. The emergence of the COVID-19 pandemic led to an unparalleled health, social, and economic emergency. According to the World Tourism Organization (UNWTO), international tourist arrivals plummeted by 74.0% in 2020 compared to the previous year, reaching a historic low of 381 million (Jamaica Tourist Board, 2020). All global regions experienced decreases in international tourist arrivals in 2020. The Americas, which includes Jamaica, saw a decline of 150.1 million international tourists, bringing the total down to 69.0 million.

The Caribbean Tourism Organization (CTO) reported that in 2020 there was an estimated 11.1 million visitors who came to 'enjoy the un-equalled and diverse experiences' the Caribbean had to offer. This marked a reduction of around 21.0 million tourists, representing a 65.5% decline from the 32.0 million visitors recorded in 2019. Notably, no Caribbean destination witnessed growth in tourist arrivals during 2020, as all faced travel restrictions, border closures, and port closures aimed at curbing the spread of COVID-19 (Jamaica Tourist Board, 2020).

Arrivals to Jamaica

Total visitor arrivals for the year 2020 reached a total of 1,329,675, which was 68.6% below the 4,234,150 arrivals recorded in 2019; this figure represents 2,903,595 less arrivals than in 2019 (Figure 5-123). The COVID-19 pandemic had a substantial impact on visitor arrivals to Jamaica (Jamaica Tourist Board, 2020); however, post-COVID, Jamaica's tourism sector recovered and achieved remarkable success in 2023, surpassing the visitor figures from both 2022 and the pre-pandemic record set in 2019. According to the Jamaica Tourist Board, approximately 4.1 million travellers visited the country in 2023, representing a 16 percent increase from the previous year and a 7.5 percent surge compared to the visitor count in 2019 (Caribbean National Weekly, 2024).



Source: (Jamaica Tourist Board, 2020)

Figure 5-123 Visitor arrivals to Jamaica, 2006-2020

The most popular resort region to which visitors stay in Jamaica is Montego Bay; in 2020, 34.4% of visitors stayed in Montego Bay, followed by Ocho Rios (20.1%) (Jamaica Tourist Board, 2020). The accommodation of choice which visitors stayed during 2020 was Hotels with 560,314 or 63.6% (Table 5-49).

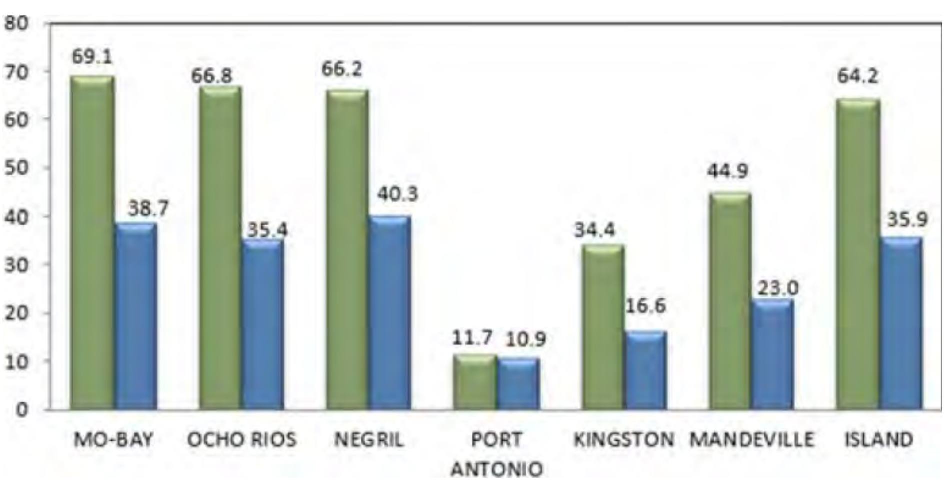
Table 5-49 Visitors to Jamaica by type of accommodation and region, 2020

Source: (Jamaica Tourist Board, 2020)

ACCOMMODATION	Kingston	Mandeville	Montego Bay	Ocho Rios	Port Antonio	Negril	Other Areas	Total	% Share	Average Length of Stay
Hotels	18,034	11,465	248,474	131,147	528	150,513	153	560,314	63.6%	6.3
Resort Villas	4	1,956	14,057	7,070	1,138	4,477	36	28,738	3.3%	8.8
Guesthouses	2,784	1,251	3,792	1,685	468	5,289	335	15,604	1.8%	12.8
Apartments	203	-	1,656	2,588	-	518	-	4,965	0.6%	12.1
Private Homes	59,922	36,988	32,681	33,208	7,887	15,115	71,223	257,024	29.2%	20.0
Other/Not Stated	2,298	1,054	2,369	1,375	333	944	5,386	13,759	1.6%	14.9
Total	**83,245**	**52,714**	**303,029**	**177,073**	**10,354**	**176,856**	**77,133**	**880,404**	**100.0%**	**10.7**
% Share	9.5%	6.0%	34.4%	20.1%	1.2%	20.1%	8.8%	100.0%		
Average Length of Stay	15.8	17.8	7.5	9.5	20.0	8.6	18.7	10.7		

HOTEL ROOM OCCUPANCY

The average available room capacity fell by 35.7% in 2020, moving from 24,432 rooms in 2019 to 15,709 rooms in 2020. In the resort region of Montego Bay, the annual hotel room occupancy rate was 38.7%, compared to 69.1% recorded in 2019. The total number of room nights sold fell by 66.1% moving from 9,578 rooms in 2019 to 5,782 rooms in 2020. The number of stopovers that intended to stay in Montego Bay at hotel accommodations declined from 833,689 in 2019 to 248,474, a decrease of 70.2% in 2019. (Jamaica Tourist Board, 2020).

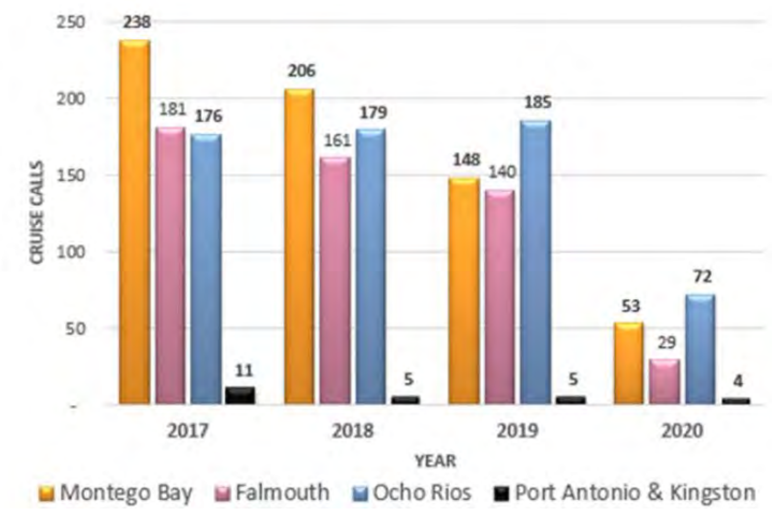


Source: (Jamaica Tourist Board, 2020)

Figure 5-124 Hotel room occupancy by resort area (2019- green, 2020 – blue)

CRUISE PASSENGERS

The port of Montego Bay accounted for 100,248 passengers or 22.3%.



Source: (Jamaica Tourist Board, 2020)

Figure 5-125 Cruise calls by port of arrivals, 2017-2020

VISITOR EXPENDITURE

Gross visitor expenditure in 2020 was estimated at approximately US$1.256 billion; this represents a decrease of 65.5% against the estimated US$3,639 billion earned in 2019 (Jamaica Tourist Board, 2020).

EMPLOYMENT

In 2020, the average number of employees per room was approximately 1.22. The closure of properties in response to the Covid-19 pandemic significantly impacted the number of individuals directly employed in the accommodation sub-sector. Between April and May, around 90% of accommodation staff were laid off. By the end of 2020, approximately 30% of tourism workers had returned on a full-time basis, with an additional 10-20% working part-time. This resulted in a substantial decrease in employment, from 51,226 in 2019 to 30,655, marking a significant decline of 40.2%.

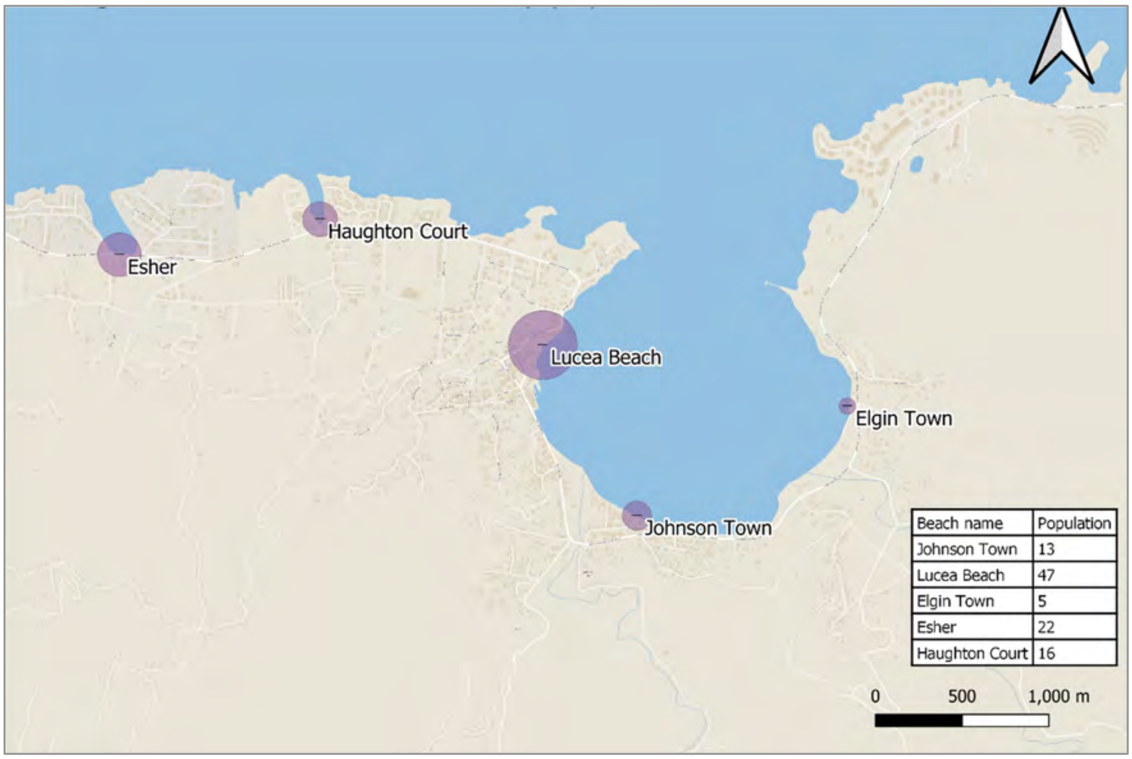
The main resort regions of Montego Bay, Ocho Rios and Negril accounted for 25,089 persons or 81.8% of the total number of persons employed directly in the accommodation sub-sector (Jamaica Tourist Board, 2020).

5.4.7.2 Fisheries

Fishing Beaches and Fisherfolk

Fishing represents a significant economic activity in Lucea, with five fishing beaches located near the town (Figure 5-126). According to estimates from the Oracabessa Marine Trust (2020), approximately 140 fishers operate across these beaches: Elgin Town, Haughton Court, Johnson Town, Lucea, and Esher.

However, data from the National Fisheries Authority (NFA) for the 2023/2024 financial year indicate that there were 24 licensed vessels and 69 licensed fishers operating from these beaches, with Lucea accounting for about 80% of them (Table 5-50); this suggests that not all fishers are licensed. The Oracabessa Marine Trust (2020) also notes varying licensing statuses among the beaches, with an overall current licensing rate of 42% (Figure 5-127 and Figure 5-128).



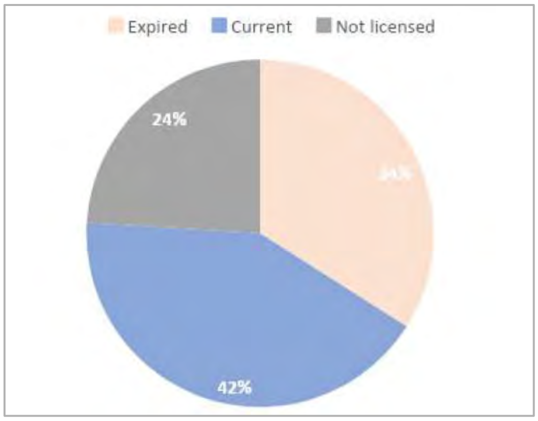
Source: (Oracabessa Marine Trust, n.d.).

Figure 5-126 **Fishing beaches in Lucea showing population size**

Table 5-50 **Fishing beaches within 5km radius of Grand Palladium, and the number of licenced boats and fishers as of the 2023/24 financial year**

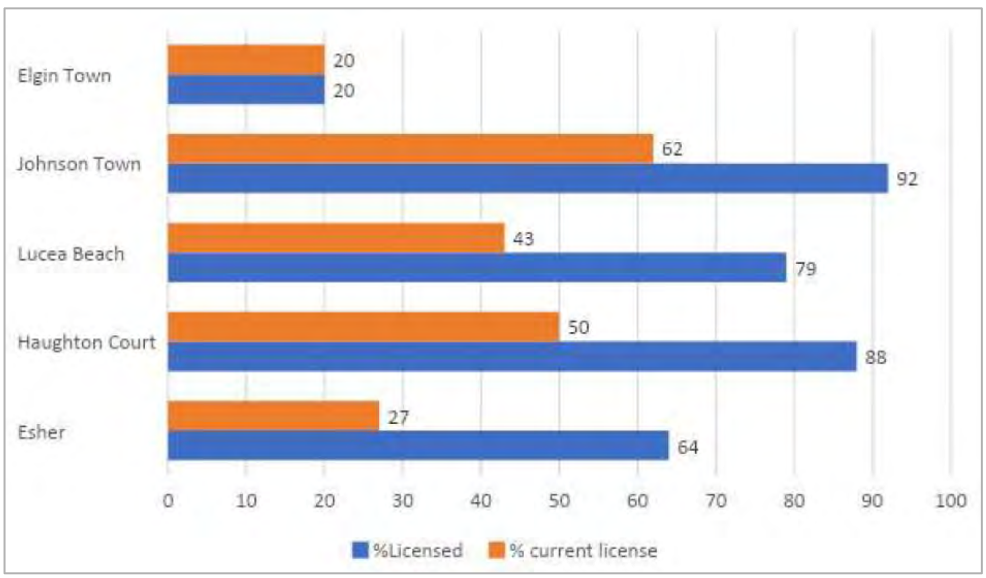
Source: (Roberts, 2024)

Fishing Beach	Vessel Quantity	Fishers
Elgin Town	0	0
Haughton Court	0	2
Johnson Town	4	8
Lucea	20	57
Mosquito Cove	0	2
Total	***24***	***69***



Source: (The Oracabessa Marine Trust, 2020)

Figure 5-127 Fishers distributed by license status



Source: (The Oracabessa Marine Trust, 2020)

Figure 5-128 Percent of licensed fishers and percent of fishers with current licences at each beach

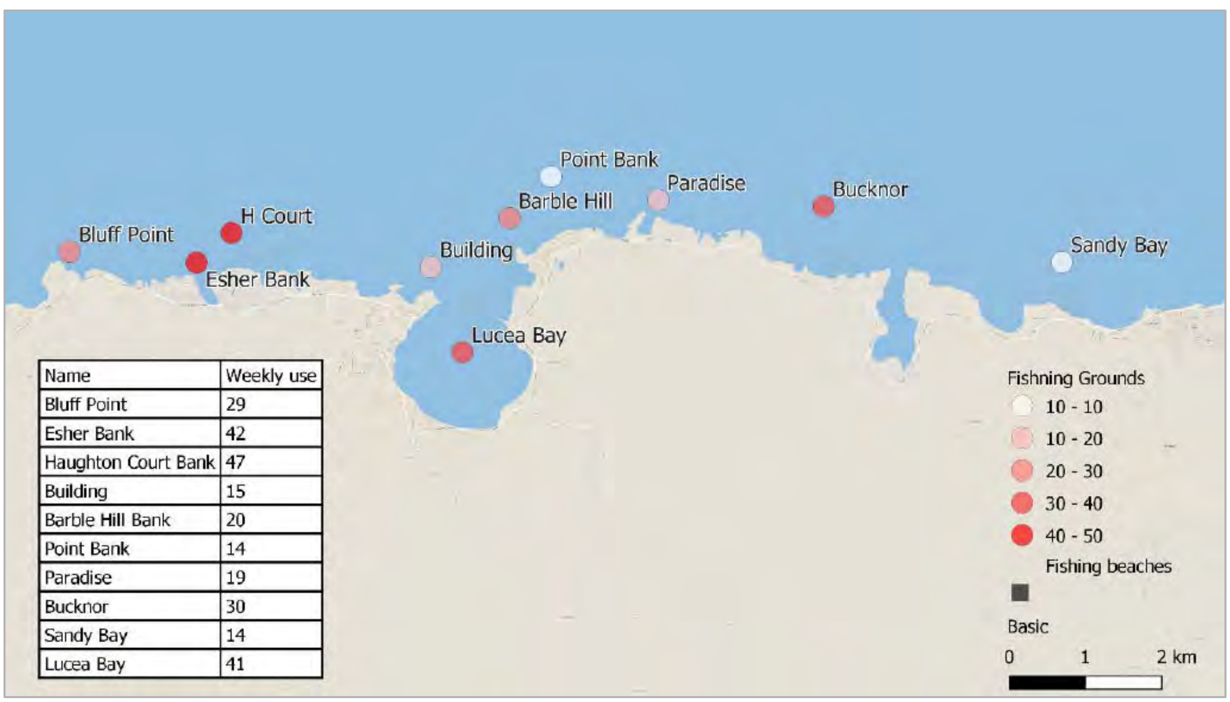
Resulting from a survey undertaken at the Lucea Fishing Beach for the purposes of this EIA (see section 6.3), it was found that affiliation with recognized organizations was significant among the interviewed fishers, with 84.6% registered with the NFA and 76.9% as members of the Lucea Fishers Association. The Lucea Fishers Association represents Lucea's fishers and currently includes 35% of the fishers in the area, with members from all local fishing beaches (The Oracabessa Marine Trust, 2020). Since its inception, the association has been highly active and instrumental in laying the groundwork for establishing the Lucea Fish Sanctuary.

The fishing community is predominantly male, with most members being over the age of 45. Additionally, the majority of fishers come from families where at least one parent was or still is involved in the fishing industry, indicating that fishing is often a family tradition (The Oracabessa Marine Trust, 2020).

Fishing Methods and Grounds

Many fishers use boats and often fish either alone or with one or two others. Those with boat engines practice outrigger fishing for pelagic fish. Other common fishing methods include bottom fishing with hook and line, net fishing, and fish pot fishing using traps, which target benthic species in inshore waters and require substantial investment in gear (The Oracabessa Marine Trust, 2020). Most fishers report having over 30 years of experience, while only a small number have been fishing for less than 5 years. This indicates a low rate of recruitment into the industry in recent years (The Oracabessa Marine Trust, 2020).

Fishing grounds most commonly used by Lucea fishers are: Bluff Point, Esher, Haighton Court, Building (Fort Chalotte), Barble Hill Bank, Point Bank, Paradise, Bucknor, Sandy Bay and Lucea Harbour (The Oracabessa Marine Trust, 2020). The use of each fishing ground varies, with Lucea Bay, Esher and Haughton Court being the most popular. Lucea fisherfolk also operate from areas extending west to Negril and east to Montego Bay, including locations like Dolphin Bank, Dolphin Point, and Sandy Bay (see section 6.3).



Source: (The Oracabessa Marine Trust, 2020)

Figure 5-129 Locations of most commonly used fishing grounds by Lucea fishers, scald by weekly use

Economic Importance

Fishers play a crucial economic role within households, as 86% are household heads and 43% are sole providers (The Oracabessa Marine Trust, 2020). Resulting from the perception survey undertaken for the EIA, it was found that fishing is the primary source of employment for all interviewed fishers, with experience spanning from 18 to over 30 years for most. Conversely, it was noted by The Oracabessa Marine Trust (2020) that a significant number of fishers have supplementary sources of income, often referred to as part-time fishers, with only 38% relying solely on fishing. Part-time fishers engage in fishing when they are not occupied with other work or during the migratory fish season along Jamaica's coastal waters

Based on the EIA perception survey, regarding average weekly income from fish sales, 61.5% reported earnings above $10,000.00, while 23.1% earned between $8,001.00 and $10,000.00 per week. Observations of changes in earnings or fish characteristics were acknowledged by 84.6% of fishers, with around 72.7% noting a decline in earnings.

5.4.8 Land Use and Zoning

5.4.8.1 Historical Land Cover

During the 1700s to 1800s, significant developments shaped the landscape of Lucea. The construction of the Lucea Parish Church marked a cornerstone in the town's history. Lucea emerged as a bustling sugar port and pivotal market centre, buoyed by its designation as a free port. The arrival of European and Jewish settlers further enriched the town's cultural fabric, engaging in diverse trades such as merchants, haberdashers, and goldsmiths. Notably, Fort Charlotte was renamed in honour of Queen Charlotte during this period, adding to the town's historical significance. The establishment of Ruseas High School in 1777 and the adornment of the Clock Tower with a clock underscored the town's commitment to education and infrastructure. Additionally, the construction of a Georgian Brick Barracks reinforced Lucea's strategic importance (Social Development Commission, 2018).

Moving into the 1980s, Lucea witnessed modernization and industrial growth. The establishment of the Jockey Jamaica International Factory signalled a shift towards manufacturing. Educational institutions also saw consolidation, with Rusea's High School and Hanover Secondary School merging to streamline resources. Furthermore, the construction of the Lucea Resident Magistrate Court and the development of the Esher Housing Scheme addressed legal and housing needs within the community (Social Development Commission, 2018).

In the 1990s, infrastructure focused on law enforcement, with the construction of the Hanover Police Division Headquarters enhancing security measures. From 2000 to the present, Lucea experienced a blend of infrastructural development and challenges. The construction of the North Coast Highway improved connectivity and accessibility, while the reconstruction of the Lucea Family Court bolstered legal services (Social Development Commission, 2018). The establishment of the Grand Palladium and

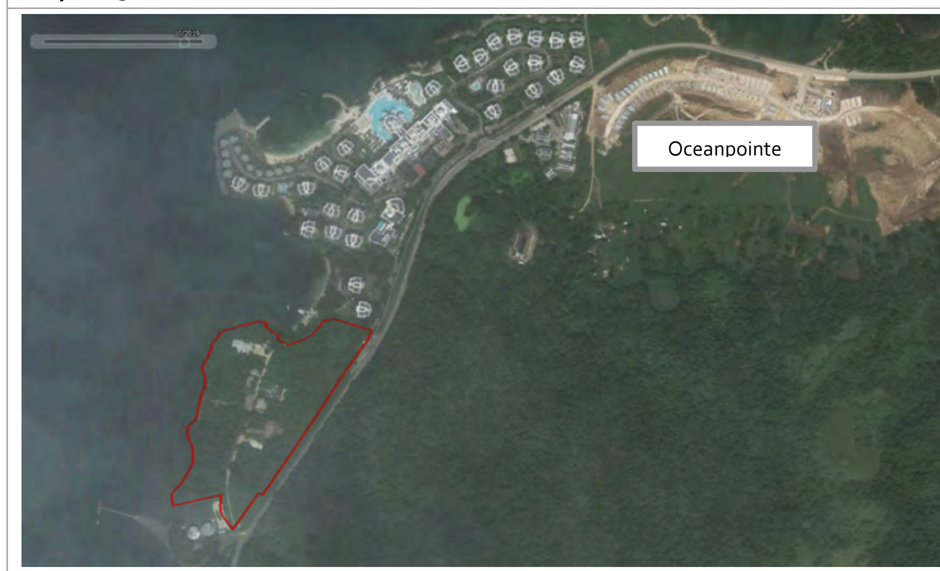
Lady Hamilton Resort aimed to significantly bolster tourism and economic activity within Lucea (Table 5-51). This expansive resort complex provided a luxurious destination for visitors, offering a wide range of amenities and accommodations. Additionally, the construction of the gated housing community, Oceanpointe, marked another notable development in the area. Designed to offer residents a secure and modern living environment, Oceanpointe added to the diversity of housing options available in Lucea. Both projects contributed to the town's growth and development, attracting tourists and residents alike while stimulating economic opportunities in the region.

5.4.8.2 Current Land and Building Use Patterns

Land cover within the SIA comprises buildings, infrastructure, disturbed broadleaved forest, secondary forest, fields, bamboo, and plantation crops (Figure 5-131). The buildings within the SIA serve various purposes typical of a large town, including retail, financial, religious, and health facilities, among others. Located just 230 meters south of the project site are shops and a church, while 630 meters south is the Elgin Town Church and Basic School, along with a playfield and restaurant.

At the project site itself, urban tree cover prevails, along with buildings, unpaved roadways, other infrastructure and various areas used for temporary storage of furniture, construction materials, various supplies and solid waste. To the immediate north of the proposed site is the existing hotel (Phase 1). The major highway runs parallel to the eastern boundary, and on the eastern side of the roadway, there are secondary forests and fields.

Table 5-51 Google Earth images of project site (red boundary) and surrounding area between May 2005 and September2023

 **May 2005**	 **February 2007**	 **April 2009**
 **October 2019**	 **December 2020**	 **September 2023**

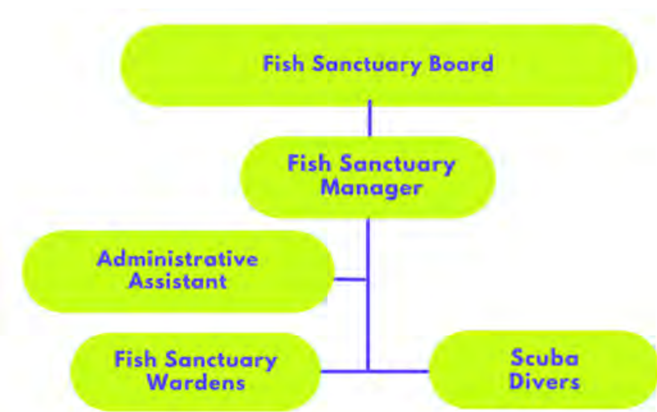
5.4.8.3 Protected Areas

Protected areas examined here include all areas of land or water protected by various laws in Jamaica, as well as international agreements, which fall within or in proximity to the project area; these include fish sanctuaries, protected areas (declared and proposed), national parks, forest reserves, marine parks, game reserves and national heritage and monuments.

Lucea Fish Sanctuary

The Lucea fish sanctuary was recently gazetted on March 29, 2024; it was legally established under the Fisheries Act and falls under the mandate of the National Fisheries Authority. A substantial portion of its landward boundary runs parallel to the shoreline of both the proposed project site and the existing hotel (Figure 5-131). Furthermore, the proposed coastal project features fall directly within the boundary of the sanctuary. This highlights the potential ecological significance and regulatory considerations associated with the project's location in relation to conservation efforts.

The Lucea fish sanctuary is a collaborative initiative between Grand Palladium Resort, Lucea Fishers Association, and the Budd Family Foundation, aimed at achieving sustainability for fisheries and supporting the social and economic development of the Lucea communities. With regard to the management of the protected area, an MOU governs the relationship between the parties and forms the Lucea Fish Sanctuary Board (Figure 5-130) (Oracabessa Marine Trust, n.d.).



Source: (Oracabessa Marine Trust, n.d.)

Figure 5-130 Outline of the corporate structure of the Licea fish sanctuary management partnership

A Draft Management Plan was created and outlines the objectives and goals for the sanctuary over a three-year period, advancing towards the long-term vision through a four-pillared approach: promoting compliance with fisheries laws, advancing environmental conservation, increasing public environmental education, and supporting sustainable fishing practices. Each of the four focus areas has an associated management programme detailed in the plan, with specific goals and indicators to be achieved within the set timeframes (Oracabessa Marine Trust, n.d.):

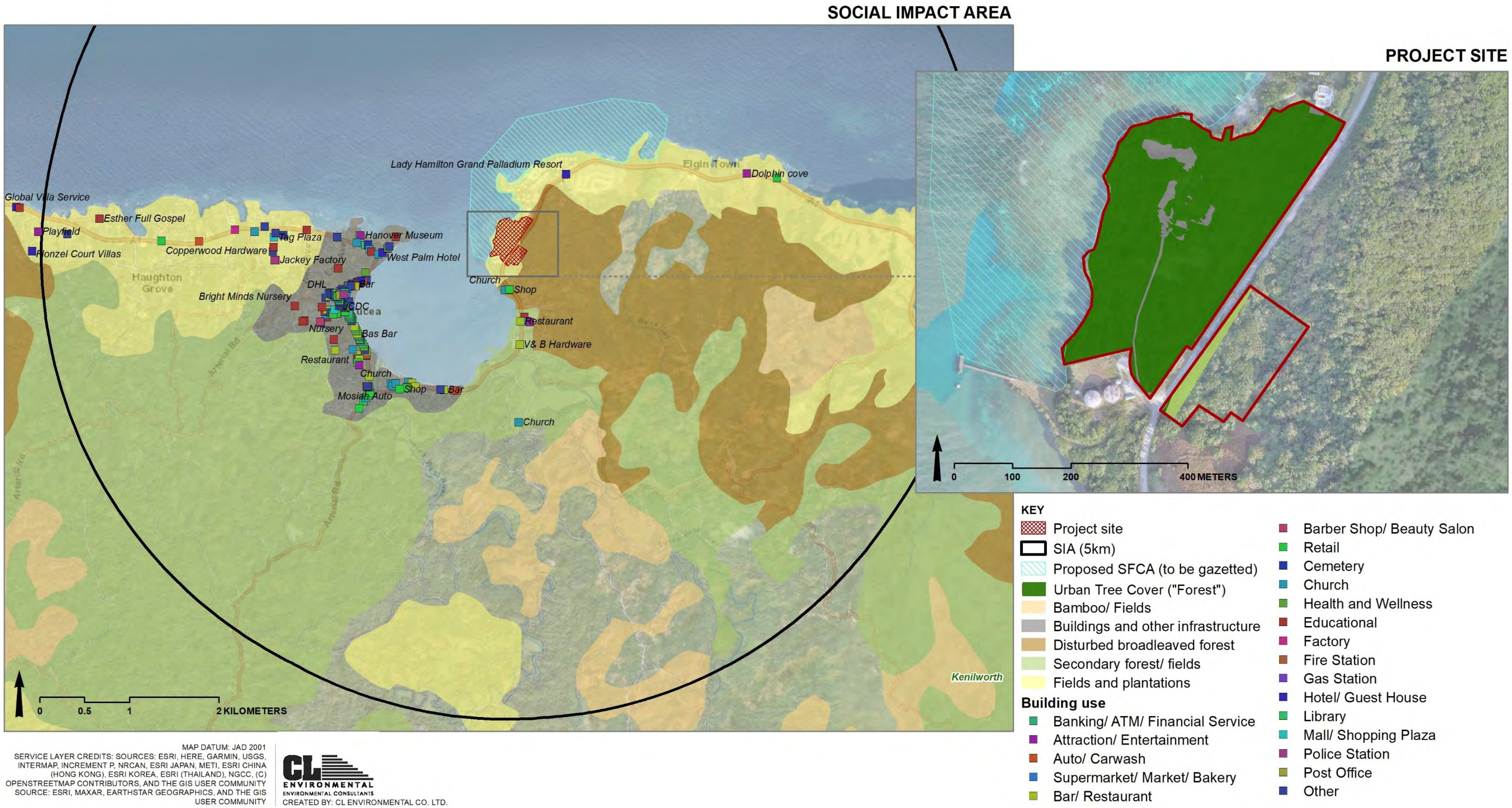
1. **Enforcement Programme**: aims to promote compliance with fish sanctuary regulations and other fisheries laws, minimizing breaches. It will encourage the fishing community to respect the sanctuary and adhere to its rules and regulations. By promoting compliance with fisheries laws, the program seeks to achieve a more holistic approach to fisheries management.
2. **Conservation Programme**: aims to maintain and improve the health of habitats within the fish sanctuary. By taking an ecosystem-based approach to management, the program seeks to achieve healthy ecosystems within the protected area. This approach focuses on meeting conservation objectives for target species by ensuring their ecosystems are healthy and capable of supporting their populations.
3. **Public Education Programme**: aims to increase public awareness of the fish sanctuary and garner support. The sanctuary will serve as a resource for various stakeholders to enhance their understanding of the marine environment, the benefits of marine ecosystem services to communities, the issues impacting the marine environment, and the roles stakeholders can play in improving human-marine relationships.
4. **Fisheries Support Programme:** aims to assist the fishing community in optimizing the use of local fisheries resources and adopting sustainable fishing strategies and management practices.

Fort Charlotte JNHT Site

Another notable protected asset in Lucea is Fort Charlotte, designated as a Jamaica National Heritage Trust site. Initially constructed in 1745 as Lucea Fort, it was later renamed in 1778 to honour Queen Charlotte, the consort of King George II. This historical fortification holds significance in Jamaica's cultural and architectural heritage, representing a key landmark in the town of Lucea.

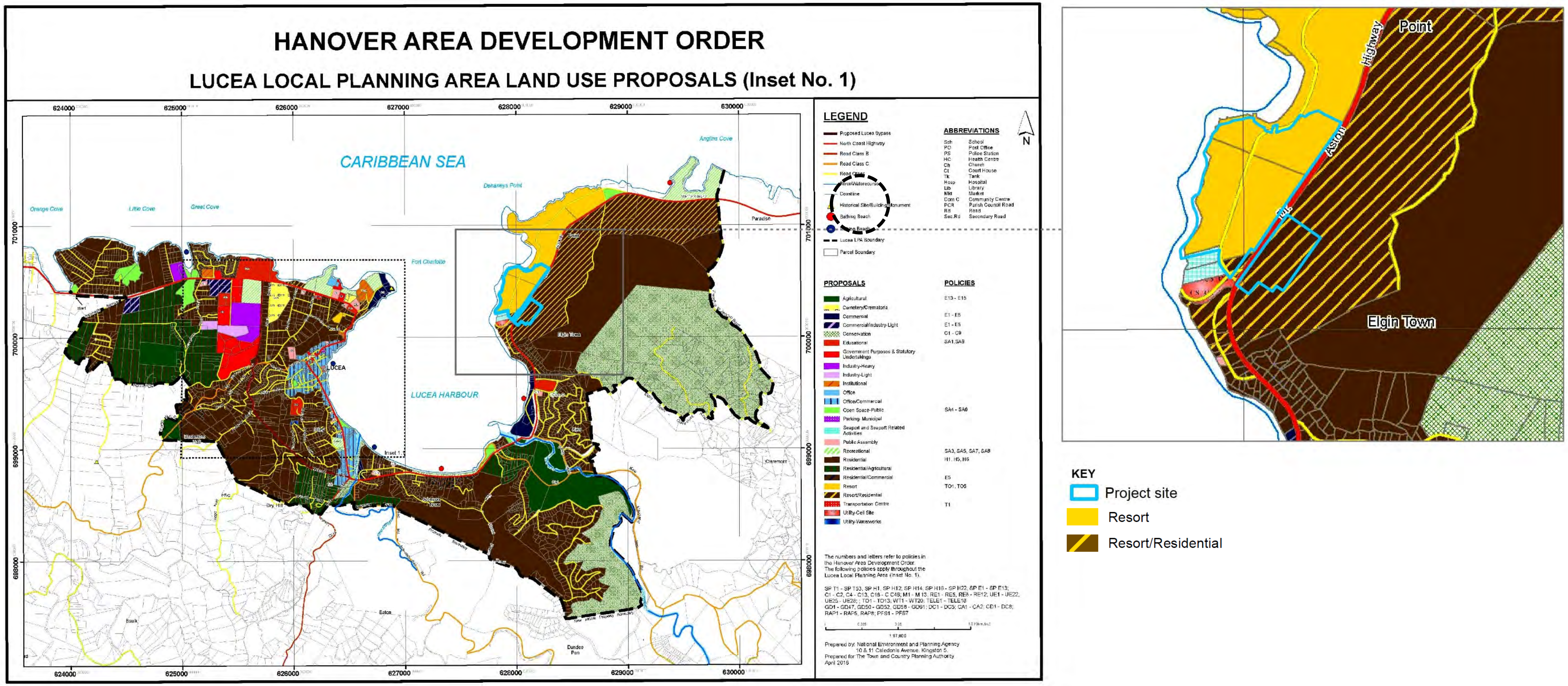
5.4.8.4 Zoning Regulations

The proposed project falls under the jurisdiction of the Town and Country Planning (Hanover Area) Provisional Development Order, 2018. Specifically, the project area is situated within an area zoned as Resort and Resort/Residential in the Lucea Local Planning Area Land Use Proposal (Inset No. 1) (Figure 5-132). This zoning classification aligns with the nature and intended use of the proposed project, making it suitable and appropriate within the designated zoning regulations outlined by the Provisional Development Order.



Data sources: Land use (Forestry Department), protected areas (NEPA, MGI and Fisheries), building use (Social Development Commission (SDC), 2023)

Figure 5-131 Land use, building use and protected areas within the SIA and at the project site



MAP DATUM: JAD 2001
SERVICE LAYER CREDITS: © OPENSTREETMAP (AND) CONTRIBUTORS, CC-BY-SA

CL ENVIRONMENTAL
ENVIRONMENTAL CONSULTANTS
CREATED BY: CL ENVIRONMENTAL CO. LTD.

Figure 5-132 Lucea Local Planning Area Land Use Proposal (Inset No. 1), Town and Country Planning (Hanover Area) Provisional Development Order, 2018 in relation to the project site

5.4.9 Cultural Heritage

5.4.9.1 Lucea

Lucea showcases a rich cultural heritage evidenced by its meticulously preserved historic structures. Situated around a natural harbour with panoramic views of the adjacent hillsides, the town is renowned for its bustling market and the cultivation of the esteemed local yam variety, known as 'Lucea Yam'. Over time, Lucea, serving as the capital town, has been referred to by various appellations, including Saint Lucea, St. Lucia, and St. Lucea. This historical complexity elucidates the presence of a clock tower within the town, originally intended to grace the island of St. Lucia in the Eastern Caribbean (Social Development Commission, 2018).

However, historical documentation reveals an intriguing narrative surrounding the clock's arrival in Hanover. Initially designated as a gift from Germany to the inhabitants of St. Lucia, the clock found its way to Hanover due to an inadvertent error by the ship's captain. Despite this discrepancy, the residents of Lucea chose to retain the clock, which was subsequently installed in 1817 atop a clock tower designed by a German landowner in the parish. Notably, the tower's apex emulates the distinctive helmet worn by the German Royal Guard, imparting a unique architectural flair to Lucea's landscape. (Social Development Commission, 2018)

Key features of interest include (Social Development Commission, 2018):

- Lucea Harbour: Renowned as one of the finest and safest harbours on the island, Lucea Harbour boasts exceptional safety owing to its near-complete isolation from the open sea, connected only by a narrow channel at its entrance. Notably, during the devastating 1951 hurricane, ships from Kingston and Montego Bay sought refuge within its protective confines.
- Old Lucea Court House: Situated prominently in the town centre, the Old Lucea Court House currently serves as the headquarters for the Hanover Municipal Corporation and houses the iconic Lucea Clock Tower.
- Lucea Parish Church: Constructed in 1725, the Lucea Parish Church stands as a testament to the rich historical heritage of the parish of Hanover, serving as the oldest extant building within its bounds.
- The Hanover Museum: Situated on the grounds of a former barracks and workhouse for women, which later evolved into a prison and police headquarters, the Hanover Museum offers insight into the region's multifaceted history and cultural evolution.
- Animal Hills: Home to the Hoggs, Deer, and Lamb families, Animal Hills provides a picturesque backdrop against which to explore the natural beauty and rural charm of the Hanover region.
- Fort Charlotte: Holds the distinction of being recognized as a Jamaica National Heritage Trust site in Lucea. Originally built in 1745 under the name Lucea Fort, it underwent a renaming in 1778 to honour Queen Charlotte, consort to George II.

5.4.9.2 Project Site

Approach

The Jamaica National Heritage Trust (JNHT) conducted an Archaeological Impact Assessment on the proposed expansion site between October 3 and October 6, 2023 (Jamaica National Heritage Trust, 2023). The research objectives of this assessment were to determine the existence of historical and archaeological resources, evaluate their condition, and assess their socio-economic significance within the context of the proposed development, as well as legislative and regulatory frameworks. Additionally, the assessment aimed to identify and forecast potential positive and negative impacts, both short- and long-term, and propose mitigation measures for adverse effects.

The study employed a multifaceted methodology, incorporating documentary research (relevant historical documents, journals and books, aerial photographs and/or satellite imagery, maps and other contemporary data found in the nation's repositories), archaeological field surveys including the excavation of test units, artifact sampling, vegetation analysis, photographic examination, and interviews. The survey techniques employed were dictated by the nature of the topography, vegetation cover, accessibility and time allowed for the survey. These techniques were deemed appropriate to provide the best possible coverage and accuracy of the results. The background information on the site was derived from primary documentary sources supported by secondary narratives (Jamaica National Heritage Trust, 2023).

Results

HISTORICAL BACKGROUND

The project site is situated on parts of the historical Point Estate property in the vicinity of Dehaney's Point (the headland on the eastern side of Lucea Harbour). The Taino population were the first inhabitants of the Point Estate. A number of Taino artefacts identified at this location speak to their occupation of this site (Jamaica National Heritage Trust, 2023).

The Point Estate was initially owned by Philip Dehaney, who acquired a 200-acre land patent in the parish of St. Elizabeth in 1677 (Plat Book). It is worth noting that the parish of Hanover was not established until 1723; before that, Westmoreland was created from St. Elizabeth in 1703, and Hanover was separated from Westmoreland in 1723. During the early 18th century, the Point Estate was amongst a series of estates owned by the Dehaneys. In 1739 one David Dehaney owned 3872 acres in Hanover (List of Sugar Plantations 1739). Sugar cane (*Saccharum officinarum*) was the dominant crop established on these estates. Most of the estate's sugar, rum and molasses were shipped from the wharf at Point Estate (Jamaica National Heritage Trust, 2023).

The Point Estate, historically reliant on wind power, transitioned to more efficient watermills by the 19th century. Evidence suggests infrastructure investments like dams and aqueducts were made for water supply. The estate was managed by various individuals, with enslaved Africans forming the majority of its population. The property underwent changes in ownership and land use over time, transitioning from sugar cultivation to cattle farming, and later deriving income from pimento, bananas, and coconuts (Jamaica National Heritage Trust, 2023).

Source: (Jamaica National Heritage Trust, 2023)

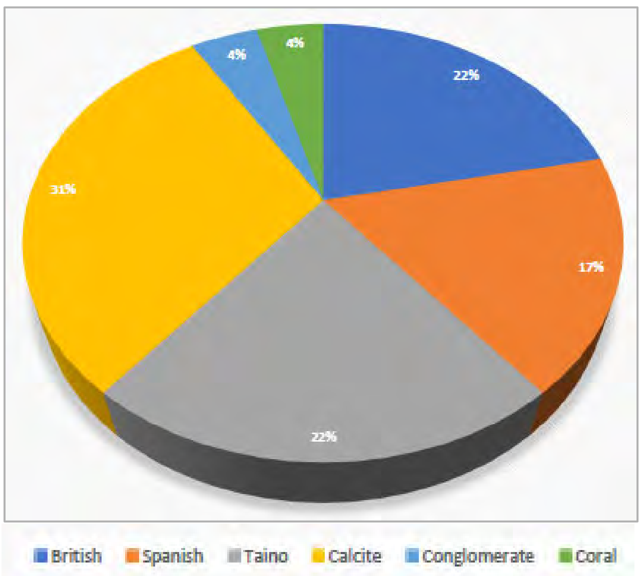
Figure 5-133 James Roberson's 1804 Map showing Point Estate with both wind and animal mill

ARTEFACTS

A total of 22 artefacts were discovered at the Point Estate site, including Taíno pottery sherds indicating Taíno occupation (Plate 5-). The Taíno typically crafted coarse earthenware for various purposes, including domestic use, burials, and offerings, often incorporating shell and stone inclusions. Smooth river stones were used for tools. Additionally, artefacts reflecting British and African Jamaican occupation were found, including ceramics like pearlware and stoneware Figure 5-134. Most artefacts were found along the seashore, likely washed down. The artefacts span from 650 AD to the late 19th century (Jamaica National Heritage Trust, 2023).

Source: (Jamaica National Heritage Trust, 2023)

Plate 5-28 Taino earthenware artefact taken from random surface (beach)



Source: (Jamaica National Heritage Trust, 2023)

Figure 5-134 Origin of material found and represented for the different units where artefactual samples were taken

Discussion and Conclusion

The study area does not have any physical features of this sugar plantation era however a few artefacts have been identified and are evidence of this past. Along the beach area there was wave action undercutting sections of the cliff where the team found Taino and pieces of European artefacts such as ceramics. Desk-based research and field survey did not uncover any substantial evidence of Taino occupation of the study area. Though, pieces of Taino artefacts were found it is a possibility that these Taino earthenware sherds may have been transported from the Taino site on the hill which is located on the opposite side of the main road. These pieces might have been transported by way of surface run off.

6.0 PUBLIC PARTICIPATION

6.1 APPROACH

6.1.1 Survey Area and Sample Size

The survey area for the perception study was established to be a two-kilometre radius around the proposed site boundary. Using the Raosoft calculator[7] set at 95% confidence level and the population within the 2km buffer of the proposed site (3,683 persons), the total sample size was estimated to be 348 persons. Using the ratio of the sample size versus the total survey area population (1:10.58), the sample sizes for each ED within the survey area was calculated (Figure 6-1). These ED sample sizes were used to guide the number of questionnaires randomly administered within each ED.

6.1.2 Target Groups and Questionnaires

Residents and fishers were the major target groupings for the public participation survey. Questionnaires (Appendix 10) were administered within the 2km survey area during the period May 13 - 17, 2024, to a total of 343 residents and 13 fishers. Additionally, introductory meetings were held with various stakeholders, including the NFA, Lucea Fisheries Association (LFA), Lucea Fish Sanctuary and the neighbouring Lucea Caribbean Molasses Company (Jamaica) Limited - Cane Point Pier, in order to garner their thoughts about the proposed expansion in relation to the fish sanctuary and fisheries activities in the area.

6.1.3 Challenges

During the survey exercise some challenges were experienced; these included:

- A lack of participation by residents in the gated Oceanpointe community, wherein only three surveys were administered. Despite full cooperation being received by the Homeowners Association (HOA), many community members did not attend the scheduled session to participate. Additionally, of the few community members who attended the session, after providing project details, some persons opted not to participate in the survey exercise.
- Properties being used for Airbnb or short-term rentals in the Oceanpointe and Haughton Court Communities. Information received during the survey exercise suggested that many homes in these communities were now used mainly for short-term vacation rentals. Consequently, there were no full-time occupants in residence.

It should be noted that percentages presented are for the total number of persons offering responses; in instances where respondents did not offer an answer, they were not considered part of the analysis for that specific question(s).

[7] Sample Size Calculator by Raosoft, Inc.

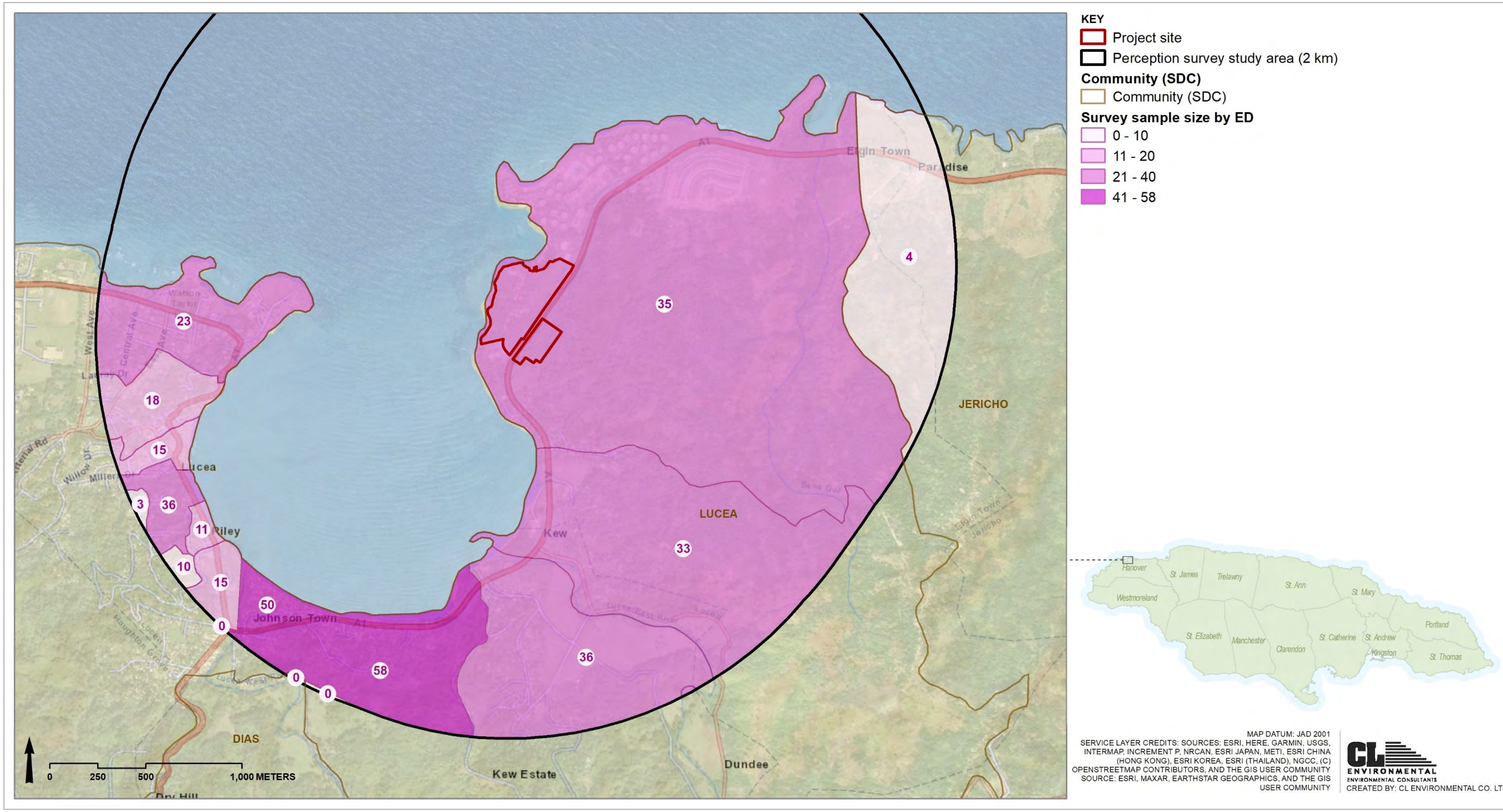


Figure 6-1 Survey sample size by ED for a 2 km buffer around the proposed project site

6.2 COMMUNITY

6.2.1 Cohort Description

Of the 343 respondents in the community perception survey, age cohort distribution was as follows; 7.3% were 18-24 years of age, 16.6% were 25-34 years, 17.8% were age 35-44 years, 19.5% were age 45-54 years, 21.3% were age 55-64 years and 17.5% were older than sixty-five years of age. Approximately sixty percent (60.1%) of respondents were male while 39.9% were female.

Respondents were from twelve main communities. These communities were Johnson Town (13.6%), Riley Road (7.6%), Brissette (15.6%), Malcolm Heights (12.0%), Kew (15.2%), Lucea (5.0%), Elgin Town (12.0%), Haughton Court (8.2%), Haughton Gardens (6.1%), Prosper (3.2%), Oceanpointe (0.9%) and Pointe (0.6%). The Oceanpointe community is a gated community (Figure 6-2).

While limited responses were received from some communities (such as Oceanpointe and Pointe) and may not be representative of the community, they have been incorporated in the overall analysis.

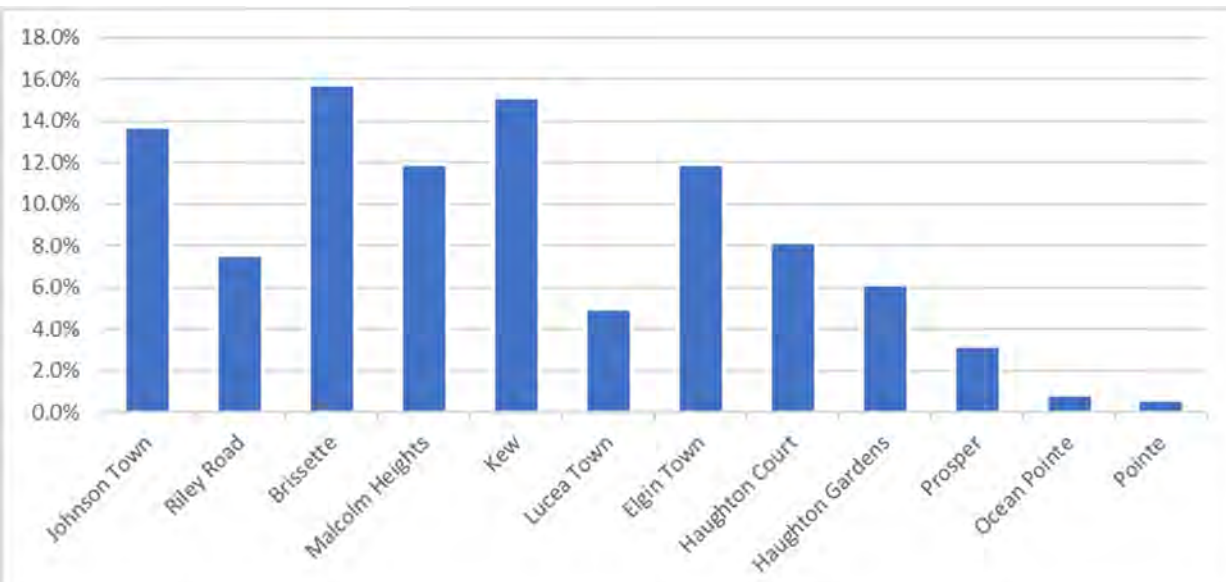


Figure 6-2 Respondent participation by community

6.2.2 Overview of Responses

6.2.2.1 Livelihood and Education

Of those persons interviewed who offered a response, 38.5% indicated that they were self-employed, 27.4% indicated that they were engaged in full-time employment, while 2.0% stated that they were employed on a part-time basis. Just over thirteen percent (13.4%) stated they were unemployed. Approximately eighteen percent (18.1%) of individuals were retired. Less than one percent (0.6%) of respondents stated "other" and further indicated that they were students. Additionally, 68.8% of interviewees when asked confirmed that they were the head of their household while 31.2% indicated that they were not the household head.

Regarding the number of persons residing in households, just over eighteen percent (18.4%) of households had one occupant while 26.8% had two occupants, 18.1% had three occupants and 15.5% had four persons living in the household. Approximately nine percent (8.7%) had five persons living in the household and 12.5% of households had more than five persons residing.

Approximately sixty-nine percent (68.8%) of survey participants resided in their community for more than fifteen years. Just over twelve percent (12.2%) stated that they lived in their community for between ten and fifteen years while 10.0% resided for between five and ten years. Just over seven percent (7.3%) resided in their community for between one and five years and 1.7% for less than a year.

Of those interviewed, approximately twenty-nine percent (28.5%) of respondents declined to offer a response relating to their personal weekly income. Approximately eight percent (8.2%) of persons indicated that they did not have a weekly income, while 6.7% indicated that their weekly income was under $13,000.00 per week. Approximately six percent (5.5%) of interviewees indicated that their weekly income was $13,000.00 per week; 15.5% stated that their weekly income was between $13,001.00 and $16,000.00, while 14.0% stated a weekly income ranging between $16,001.00 and $20,000.00. Approximately twenty-two percent (21.6%) indicated that their weekly income was more than twenty thousand dollars ($20,000.00).

Regarding the last school attended, 1.7% of persons stated that they did not attend any type of learning institution. Approximately sixteen percent (15.7%) stated primary/all age school as the last school attended, 58.4% indicated high school, 10.8% college, 5.8% university and 7.6% HEART/Vocational Training Institution.

As it pertained to education, 55.1% of those interviewed stated that no member of the household was currently attending school while, 44.9% of interviewees indicated someone in the household was attending school. As it related to the school being attended 27.3% stated that the school being attended was infant/basic, 53.2% stated primary/all age, 48.7% stated high school, 2.6% stated college, 1.3% stated university while 1.3% stated that HEART/a vocational training institute was the school being attended. It should be noted that percentages exceeded one hundred as multiple persons within households attend school.

6.2.2.2 Recreational Amenities

When respondents were asked about the presence of recreational spaces in their community 28.9% of respondents indicated that a recreational space was present while 65.0% stated that no recreational space was present in the community. The remaining 6.1% of interviewees expressed uncertainty. Recreational spaces named were:

- Green Space within community (informally used) - (79.8%)
- Watson Taylor Park - (15.2%)
- Elgin Town Community Centre – (2.0%)
- Lucea Primary School - (2.0%)
- The Learner's Centre – (1.0%)

As it pertained to the recreational facility's accessibility to persons of all ages and those with special needs, 89.9% of those confirming that a recreational facility was present in their community stated that the facility was accessible while 8.1% stated that the facility was not accessible to all ages and those with special needs. Two percent (2.0%) of respondents expressed uncertainty when asked about the facility's accessibility.

When asked if the facility was maintained in good condition 83.8% of interviewees confirming that a recreational facility was present in their community indicated that the facility was maintained and could be described as being in "good condition". Just over twelve percent (12.2%) of respondents stated that the facility was not maintained while 4.0% indicated that they did not know if the facility was maintained.

6.2.2.3 Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 75.8% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 24.2% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Approximately forty-four percent (44.3%) of those interviewed stated that they were aware of the project while 55.7% stated that they were not aware (Figure 6-3).

Of the 44.3% of interviewees confirming awareness of the proposed project, 1.3% stated that awareness of the project was via the television medium, 0.7% also stated newspaper, and 98.7% stated "word of mouth' as the medium by which they were made aware of the project. Percentages exceeded 100.0% as some respondents indicated that they were made aware of the project through multiple media.

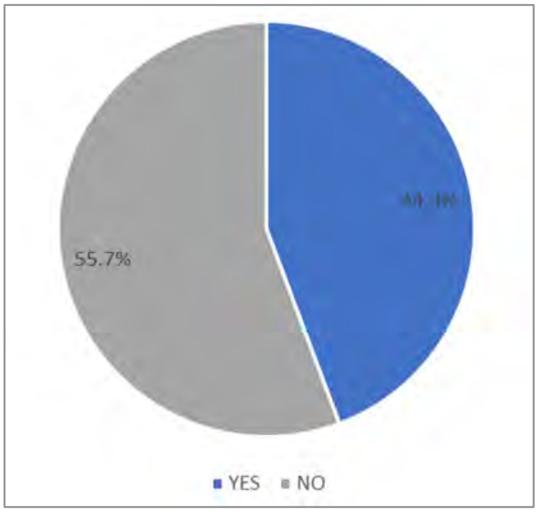


Figure 6-3 Awareness vs unawareness of respondents of the proposed project

When asked about awareness of the project's details. 90.8% of survey respondents indicated that they were not aware of the project details while 9.2% confirmed awareness of the project of details. Regarding awareness of specific details, of the 9.2% of respondents confirming awareness of the project details:

- 50.0% stated that they knew of the proposal to construct 16 overwater villas, while 50.0% stated that they were not aware of this detail.
- 92.9% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 35.7% stated that they were aware of the project including modifying a section of the existing beach, while 64.3% stated that they had no previous knowledge of this detail.

6.2.2.4 Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Just under twelve percent (11.7%) of interviewees stated that they were unaware of the existing hotel having problems/issues, while 81.6% of persons stated that there were no problems/issues. Approximately seven percent (6.7%) of respondents indicated that there have been problems/issues with the existing hotel. Of this 6.7%, the following problems were highlighted:

- Smell of sewage effluent in the ambient air – (52.2%)
- Inadequate signs on approach to and outside the hotel – (8.7%)
- Operations have caused reduced water supply to surrounding communities – (8.7%)
- Sewage discharge into ocean – (4.3%)
- Limited Staff parking (resulting in staff parking on the main road) – (4.3%)
- Increased motor vehicle collisions from cross turning traffic – (4.3%)
- Hotel not employing local (Lucea and environs) residents – (4.3%)

- Flooding on the hotel property – (4.3%)
- Increased crime and violence during construction – (4.3%)
- Loss of recreational space – (4.3%)
- Negative impact on the ecosystem – (4.3%)
- Union busting – (4.3%)

Percentages exceeded 100.0% as some respondents stated multiple problems with the existing hotel.

In response to whether the highlighted issues were resolved, 65.2% (of the 6.7% confirming problems with the existing hotel) stated that the issues were not resolved, 30.5% stated that the issues were resolved, while 4.3% expressed uncertainty.

As it regarded problems at the proposed Phase 2 project site, 79.3% of survey respondents indicated that there have not been any issues, while 20.7% stated that they did not know of any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 5.0% of those interviewed expressed uncertainty while, 75.8% of interviewees indicated that they did not have any concern while 19.2% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems)- (43.9%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (24.2%)
- Loss of beach access (6.1%)
- Possible pollution from sewage effluent – (6.1%)
- Increased crime (influx of criminal elements) - (4.5%)
- Increased motor vehicle collisions caused by lack of adequate parking on the hotel property – (4.5%)
- Loss of Livelihood for fisherfolk – (4.5%)
- Increased traffic congestion (in Lucea) – (3.0%)
- Loss of marine wildlife – (3.0%)
- Increase in fugitive dust (dust pollution) – (3.0%)
- Possible relocation – (3.0%)
- The proposed hotel expansion will not improve community development – (1.5%)
- Whether competent workers will be employed for project implementation – (1.5%)
- Possible beach erosion of neighbouring beach (in the vicinity of the molasses storage tanks) – (1.5%)
- Destruction of Coral Reef (1.5%)

Percentages exceeded 100.0% as some respondents expressed multiple concerns.

When asked about possible suggestions to address highlighted concerns, the following suggestions for Fiesta Jamaica Limited were put forward:

- Employ local (Lucea and environs) workers – (19.7%)
- Find and alternative source (and not use Logwood) for potable water supply - (12.1%) (Desalination and the Great River Treatment facility in St James were suggested)
- Upgrade the existing NWC water supply (Logwood facility) – (9.1%)
- Erect/install appropriate traffic (directional) signs and/or speed bumps – (4.5%)
- Host a job fair to ensure equal employment opportunities – (4.5%)
- Properly manage sewage treatment plant – (4.5%)
- Provide an area for locals to access the beach – (3.0%)
- Create and artificial reef – (3.0%)
- Create additional water catchment – (1.5%)
- Employ water conservation practices – (1.5%)
- Use water trucks to supply the hotel – (1.5%)
- Provide a suitable location for persons who may face relocation – (1.5%)
- Engage Chinese contractors – (1.5%)
- Wet the site regularly – (1.5%)
- Cover trucks carrying construction material – (1.5%)
- No suggestion offered – (28.8%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 7.3% expressed uncertainty, 88.6% stated that they had no concerns, while 4.1% indicated that they were concerned about a section of the beach being modified. Concerns highlighted were:

- Loss of marine life - (21.4%)
- Damage to the beach and coastline – (21.4%)
- Damage to Lucea Harbour – (14.3%)
- Possible damage to the coral reef – (14.3%)
- Pollution of the ocean – (14.3%)
- Impact on (damage to) the ecosystem - (7.1%)
- Possible beach erosion of neighbouring beach (in the vicinity of the molasses storage tanks) - (7.1%)
- Loss of beach access - (7.1%)
- Loss of fishing area – (7.1%)
- Will modification influence/change natural water pattern (movement) – (7.1%)

Percentages exceeded 100.0% as multiple concerns were expressed.

Suggestions put forward to address highlighted concerns were that Fiesta Jamaica Limited should:

- Implement measures to mitigate potential damage to the ecosystem (14.3%)
- Ensure that beach modification design does not alter the natural water pattern (movement) – (14.3%)
- Allow free movement along the section of shoreline/beach – (14.3%)
- Provide additional design detail information – (7.1%)
- Monitor the beach area adjacent to the molasses storage tanks area – (7.1%)
- No suggestion offered (42.9%)

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately fifty-four percent (53.9%) of respondents stated that they knew what the term meant while 46.1% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 8.2% expressed uncertainty, 83.6% stated that they had no concerns, while 8.2% indicated that they were concerned about suites being built over water. Concerns expressed were:

- Damage to coral reef and/or sea floor – (32.1%)
- Will the villas be able to withstand adverse weather conditions/events – (25.0%)
- Improper solid waste disposal from the over water suites (during operation) (17.9%)
- Damage to Lucea Harbour – (10.7%)
- Loss of fishing area – (10.7%)
- Loss of Marine Life – (10.7%)
- Pollution of the sea (during construction) – (7.1%)
- Overall ecosystem damage – (3.6%)

Percentages exceeded 100.0% as multiple concerns were expressed.

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Ensure villas are built to withstand adverse weather conditions/events – (10.7%)
- Construct adequate sewer treatment plant – (7.1%)
- Construct an artificial reef – (7.1%)
- Not build the overwater suites – (3.6%)
- Establish an environmental monitoring and oversight team - (3.6%)
- Compensate for medical expenses caused by pollution to the sea – (3.6%)
- Allow fisherfolk to access the fishing area – (3.6%)

- Establish a marine life protected area (sanctuary) – (3.6%)
- Ensure that villas do not impede access the boat/ship channel and pier – (3.6%)
- Use less harmful chemicals (during construction and/or operation) – (3.6%)
- No suggestion offered (49.9%)

6.2.2.5 Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response. Of these respondents, 2.6% of individuals confirmed that they depended on the proposed site while 97.4% stated that they did not depend on the site (Figure 6-4).

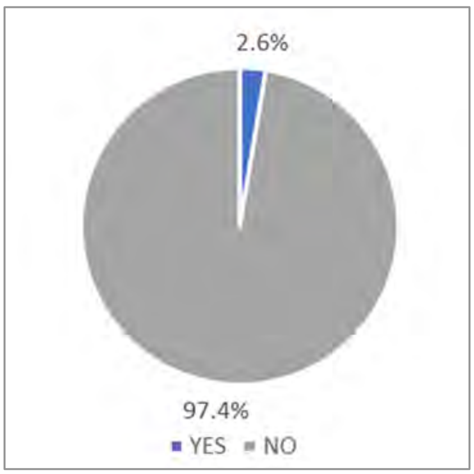


Figure 6-4 Percentage of respondents indicating dependence vs non-dependence on the proposed site

When asked further what aspect of the proposed site was used 44.4% of these respondents indicated that they used the sea, 44.4% stated the beach and 11.2% stated that land was used. Additionally, 44.4% of these survey participants indicated that the area was used for fishing. A similar 44.4% stated that the area was used for recreation/swimming while 11.2% indicated farming.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Just under sixty-five percent (64.7%) of respondents indicated that the project would not affect their life in any way, while 9.0% were not sure if the project would affect their life. Of the 26.3% of persons anticipating some effect on their lives, 3.0% anticipated a negative impact while 23.3% anticipated a positive impact from the project (Figure 6-5).

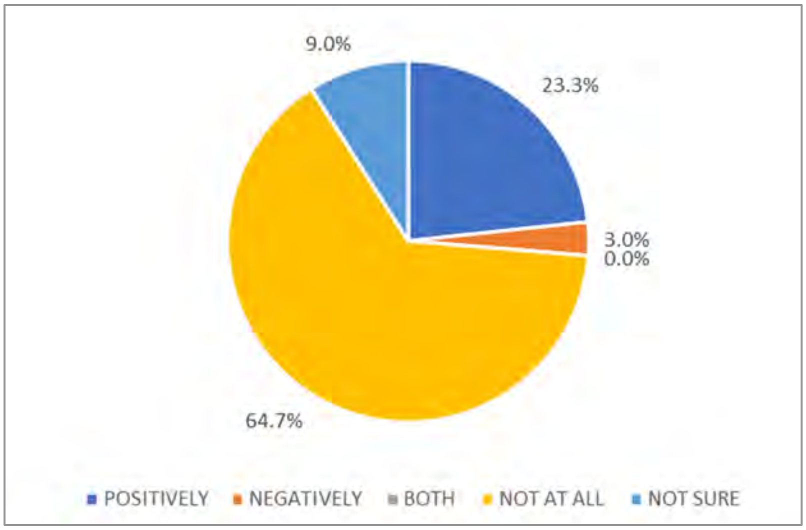


Figure 6-5 **Percentage of respondents and the potential impact of the project on respondents lives/livelihood**

For those anticipating some positive effect, they anticipated:

- Employment opportunity (83.8%)
- Increased opportunity to generate income (13.8%)
- Increased Tourist presence in the area – (5.0%)
- Improved infrastructure – (2.5%)
- Property appreciation (1.3%)

Percentages exceeded 100.0% as some respondents anticipated multiple positive impacts.

For those anticipating a negative effect, they anticipated:

- Increased traffic congestion (30.0%)
- Increased fugitive dust in ambient air – (20.0%)
- Reduced water supply – (20.0%)
- Loss of fishing area (10.0%)
- Loss of beach access – (10.0%)
- Increased competition for Airbnb Business – (10.0%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered:

- Wet the area frequently (during construction - (10.0%)
- The hotel should establish/find an independent potable water source - (10.0%)

- Allow access for fishing - (10.0%)
- Allow beach access - (10.0%)
- No suggestion offered - (60.0%)

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately ten percent (9.9%) stated that they were unsure if there would be an impact while 17.2% of individuals interviewed indicated that the project would not have any impact on the community. Approximately seventy-three (72.9%) percent of respondents anticipated that the project would impact their community. Of these respondents, 65.9% of interviewees anticipated a positive effect, 4.7% anticipated a negative effect and 2.3% anticipated both positive and negative impacts on the community. For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (90.6%)
- There will be community/national development - (14.5%)
- Increased Tourist presence in the area – (7.3%)
- Infrastructure improvement – (3.4%)
- Increased income opportunity - (1.7%)
- Economic Growth – (0.9%)
- Property appreciation - (0.4%)

Percentages exceeded 100.0% as multiple responses were offered.

For those anticipating a negative effect on the community, the following were stated:

- Reduced water supply - (54.2%)
- Increased crime/Influx of criminal elements into the community - (16.6%)
- Increased traffic congestion - (16.6%)
- Increase in motor vehicle collisions – (4.2%)
- Loss of fishing area (4.2%)
- Foul sewage odour in ambient air - (4.2%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered by respondents:

- The hotel should establish/find an independent potable water source - (25.0%)
- Upgrade the existing NWC water supply (Logwood facility) – (8.3%)
- Provide more water trucks – (8.3%)
- Employ local (community) persons (4.2%)
- Employ traffic wardens – (4.2%)

- Upgrade the hotel entrance by improving the roadway and installing additional signs – (4.2%)
- Increase security presence in the area – (4.2%)
- No suggestions (41.6%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Approximately fifty-five percent (54.5%) of respondents stated that the project would not have an impact on the environment, while 26.5% stated that they were unsure if there would be any impact. Nineteen percent (19.0%) of interviewees anticipated an impact to the environment. Of these respondents, just under seventeen percent (16.6%) anticipated a negative effect while 2.4% anticipated a positive effect on the environment.

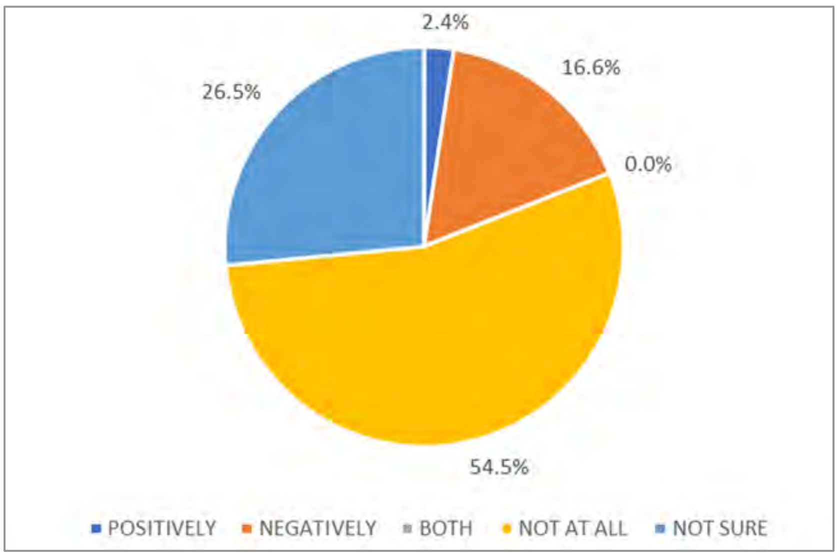


Figure 6-6 Percentage of respondents and the potential impact of the project on the environment

For those anticipating a positive effect on the environment, the following were stated:

- Infrastructure upgrades (75.0%)
- Community Development (37.5%)

Percentages exceeded 100.0% as some respondents offered multiple responses.

It should be noted that those anticipating a positive impact on the environment were anticipating an impact on the physical environment. For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (36.8%)
- Loss of marine wildlife - (22.8%)
- Improper discharge of sewage effluent into the ocean (17.5%)

- Damage to coral reef – (12.3%)
- Loss of vegetation – (10.5%)
- Loss of fish sanctuary - (8.8%)
- Overall ecosystem damage - (7.0%)
- Loss of beach access – (3.5%)

Percentages exceeded 100.0% as multiple responses were offered.

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Wet the site regularly (during construction) – (17.5%)
- Ensure pollution prevention measures are in place (8.8%)
- Replant trees to replace lost vegetation – (7.0%)
- Preserve a section of the site in its undisturbed state – (3.5%)
- Implement measures to mitigate against ecosystem damage - (3.5%)
- The government environmental regulatory agency (NEPA) should be engaged to monitor and give project oversight (1.8%)
- Do not develop the property (1.8%)
- Create an artificial reef – (1.8%)
- Encourage mask wearing as a personal protective measure to minimise dust impacts – (1.8%)

Some respondents (52.5%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.2.6 Housing and Social Services

As it related to housing 100.0% of interviewees offered responses. Approximately fifty percent (49.9%) of respondents stated that they owned the house they lived in, 1.7% stated that their residence was leased, 20.7% lived in rented homes, 0.6% lived in government own housing, 1.2% indicated that they squatted in their residence while 25.7% stated that they lived in family-owned homes. Less than one percent (0.2%) stated "other" and further indicated that they lived in the homes owned by their employers.

As it pertained to the land on which dwelling homes were located 100.0% of interviewees offered responses. Approximately thirty-four percent (33.5%) of respondents stated that they owned the land on which the house is located, 10.2% stated that the land was leased, 2.6% indicated that lands were government owned, 1.5% indicated that they squatted on the land, while 31.2% stated that their homes were built on family-owned land. Twenty-one percent (21.0%) stated "other" and indicated that the home they lived in was rented or employer owned, but there was no arrangement made with respect to the land.

Regarding the type of wall that dwellings were made of 62.7% of interviewees indicated that the walls of their homes was made of concrete and blocks, 26.2% stated wood/board while 10.8% stated that walls were made of both concrete and blocks as well as wood/board. Less than one percent (0.3%) of respondents indicated "other" and specified concrete (cement) board as the wall construction material. It should be noted that for respondents who indicated that the walls of their homes were made of both materials, this was mainly due to structural additions to increase habitable living space.

Regarding the type of roof that dwellings had, 45.8% of respondents indicated that the roof of their homes was metal sheeting, while 43.4% stated concrete and 0.3% stated wood as the roof material. Just under ten percent (9.6%) of interviewees stated that their roofs were made of multiple materials, and specified metal sheeting and concrete as the materials. This was due to structural additions to increase habitable living space. Approximately one percent (0.9%) stated "other" as the roof material and specified fibre shingle as the type of roof material.

As it pertained to the type of toilet facility present 100.0% of respondents offered a response. Approximately eighty-nine percent (88.6%) of respondents indicated that their homes had water closets, while 7.6% stated that pit latrine was the toilet facility. Just under four percent (3.8%) of participants indicated that they had both toilet facilities, pit latrine and water closet.

As it related to what the household used for lighting 100.0% of respondents offered a response. Just under ninety-nine percent (98.8%) of interviewees stated that electricity was used while 0.6% stated kerosene oil was used for household lighting and 0.6% stated solar as the household lighting source. Regarding the type of fuel used mostly for cooking 100.0% of respondents offered a response. Ninety-five percent (95.0%) of persons interviewed indicated that gas was used mostly, 0.6% stated electricity, 1.5% stated wood as the cooking fuel, while 2.9% stated that they mostly used coal for cooking.

On the issue of the main source of household domestic water supply 100.0% of survey participants offered a response. Approximately ninety-five percent (94.5%) of respondents confirmed that their household domestic water supply was the public piped water supply. Less than one percent (0.9%) of respondents stated that the main source of domestic water was rainwater harvesting, 1.4% indicated the community tank while 0.5% stated the public standpipe. Under once percent (0.3%) indicated the government water truck and 2.0% stated private water truck. Less than one percent (0.3%) of participants stated "other" as the main source for domestic household water supply and further explained that water was sourced from nearby neighbours.

As it pertained to respondents' having any problems with the domestic water supply 100.0% of interviewees offered a response, and 93.0% of those who responded indicated that there were problems with the water supply while 7.0% indicated that there were no problems with the domestic water supply. For those persons who confirmed that there were problems with the domestic water supply, 84.0% indicated that the water supply was irregular, 11.6% stated that the area had no water at all, 0.3% stated that no pipes were run in the area, while 9.4% stated that water pressure was low. It should be noted that, respondents explained that periods without water ranged between a few days to up to three months. Percentages exceeded 100.0% as some respondents stated that they had multiple problems with the domestic water supply.

On the issue of telephone service used by survey participants, 100.0% of respondents offered a response. Just under eighty-seven percent (86.6%) of interviewees indicated that that they used mobile telephone service, while 11.4% indicated that they used both mobile and fixed line service. Two percent (2.0%) of respondents indicated that they did not use any type of telephone service.

As it pertained to respondents' awareness of fixed line telephone service being in their community, 100.0% of respondents offered a response. Approximately thirty-five percent (35.2%) of respondents stated that they did not know of fixed line service being in the community, while 22.2% stated that the community did not have fixed line service. Just under forty-three percent (42.6%) of interviewees stated that fixed line telephone service was present in the community.

Regarding the main method of garbage disposal for households 100.0% of respondents offered a response. Approximately eighty-seven percent (86.9%) of those interviewed indicated that the public garbage truck was the main garbage disposal method, 0.6% indicated private collection while 12.5% indicated that burning was the main method used to dispose of garbage. It should be noted that in some instances collection by the public garbage truck was from a central location within communities and not house to house. Additionally, not all communities have proper garbage skips, instead residents dumped their garbage at one location for later collection by the garbage truck.

As it pertained to recycling, 98.5% of respondents indicated that they did not participate in recycling while 1.5% stated that they recycled. Recycling Partners of Jamaica, Esher Primary School, Chambers Pen CDC and D& G Bottle return were the named recycling programmes/partners.

On the issue of where healthcare was mostly obtained, during the survey exercise it was realised that health clinic services are offered mainly through the Noel Holmes Hospital. Approximately forty-four percent (43.7%) of interviewees stated that their healthcare needs were mostly sourced through the public hospital, 41.7% stated the private doctor and 28.6% stated the public clinic. Less than one percent (0.6%) of interviewees stated the private hospital. As it pertained to the specific healthcare provider, the public hospital most referenced was the Noel Holmes Hospital, while the health centre/clinic most referenced was also "Noel Holmes Hospital". Percentages exceeded 100.0% as some respondents offered multiple responses and explained that care was sought based on the specific medical condition and/or the time-of-day medical attention was needed.

6.2.2.7 Natural Hazards

When asked about flooding, 100.0% of respondents offered a response. Of these respondents 63.0% of respondents indicated that their community was not affected by flooding, 0.6% indicated that they did not know if the community was affected, while just over thirty-six percent (36.4%) stated that their community experienced frequent flood events. Of the 36.4% of survey participants confirming community flooding 96.8% stated that flooding occurred only in times of heavy rainfall, 1.6% stated each time there was a rain event and 1.6% also stated that flooding occurred only during times of hurricanes.

Regarding the frequency of rain events resulting in community flooding, respondents stated the following:

- Once weekly – 1.6%
- Once monthly – 12.8%
- Once in three months – 30.4%
- Once in six months – 36.0%
- Once in a year – 14.4%
- Less than once in a year – 4.0%
- Unsure – 0.8%

It should be noted that survey participants indicated that flood events will occur multiple times over a short period of time depending on the rainfall pattern. The affected areas named were the:

- Johnson Town Community (to include the Johnson Town old road)
- Riley Road
- (Sections of) Brissette
- Kew River
- Main Road (in the vicinity of Elgin Town and Kew)
- Sea Wall/ Lucea Main Road
- Malcolm Heights Road
- Haughton Gardens Road (Millers Drive)
- Keep Left (The intersection of the Dias Main Road and Seaview Drive (the main road into Lucea))
- Roadway in the Vicinity of the Oceanpointe Gated Community

It should be noted that the areas named for the most part encompass the town of Lucea and it immediate environs.

As it pertained to the depth of flood water, 12.9% stated that water levels were less than 0.3 metres (1.0 foot) in depth, while 75.0% stated that water levels ranged between depths of 0.3-1.5m (1.0-5.0ft). Just under eleven percent (10.5%) stated more than 1.5m as the depth of flood water while 1.6% expressed uncertainty.

Regarding whether there were problems with frequent flooding at or near the proposed site 100.0% of respondents offered a response. Fifty-six percent (56.0%) of interviewees, stated that the area was not affected by flooding, while 12.5% stated that they did not know if the area was affected, and 31.5% stated that the area was affected by flooding. Of the 31.5% of those stating that there were flooding problems at or near the proposed site, 99.1% stated flooding occurred only on times of heavy rains, while 0.9% stated that flooding occurred during hurricanes.

When asked about the frequency of occurrence of rain events causing flooding at or near the proposed site, respondents stated the following:

- Once weekly – 0.9%
- Once monthly – 14.8%
- Once in three months – 35.2%
- Once in six months – 22.2%
- Once in a year – 10.2%
- Less than once in a year – 11.1%
- Unsure – 5.6%

Affected areas named were:

- Grand Palladium
- Kew Community
- The Town of Lucea
- Sea Wall/ Lucea Main Road
- Haughton Gardens Road (Millers Drive)
- Keep Left (The intersection of the Dias Main Road and Seaview Drive (the main road into Lucea))
- Brissette Road and Community
- Malcolm Heights
- Riley (Road) Bridge (near Keep Left)
- Roadway in the Vicinity of the Oceanpointe Gated Community

As it pertained to the depth of flood water at or near the proposed site, 7.5% stated that water levels were less than 0.3 metres (1.0 foot) in depth, while 73.8% stated that water levels ranged between depths of 0.3-1.5m (1.0-5.0ft) and 16.8% stated more than 1.5 metres (5ft). Just under two percent (1.9%) of respondents expressed uncertainty.

On the issue of whether the proposed area was affected by sea level rise or storm surge 100.0% of interviewees offered a response. Approximately twenty-seven percent (27.4%) of respondents stated that they did not know if the area was affected while 66.2% stated that the area was not affected, and 6.4% indicated that the area was affected by storm surge or seal level rise.

6.2.2.8 Importance of Area

Regarding whether there was any site nearby considered to be a protected area, historic area or area of national, historic or environmental importance, 100.0% of interviewees offered a response. Twenty-three percent (23.0%) of interviewees stated they did not know of any such area or site, 39.1% stated that no such area was located near to the proposed area while 37.9% indicated that there was an area/site considered to be a protected area or area of historic, national, or environmental importance.

The main places named were:

- Fort Charlotte
- Lucea Harbour
- Lucea Pier
- The Fish Sanctuary near Palladium
- The Lucea Town Clock
- The Noel Holmes Hospital
- Watson Taylor Park
- Palladium Lands (historical burial site)
- Lucea Anglican Church

6.2.3 Community Analysis

Percentages presented for each community cohort are for the total number of persons within the specific community offering responses. Where community respondents did not offer an answer to a question, they were not considered part of the analysis for the specific question(s).

6.2.3.1 Johnson Town

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 66.0% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 34.0% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Approximately forty-three percent (42.6%) of those interviewed stated that they were aware of the project while 57.4% stated that they were not aware. Of the 42.6% of interviewees confirming awareness of the proposed project, all (100.0%) stated "word of mouth' as the medium by which they were made aware of the project.

When asked about awareness of the project's details. 85.0% of survey respondents indicated that they were not aware of the project details while 15.0% confirmed awareness of the project of details. Regarding awareness of specific details, of the 15.0% of respondents confirming awareness of the project details:

- No one (0.0%) interviewed stated that they knew of the proposal to construct 16 overwater villas.
- 100.0% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 33.3% stated that they were aware of the project including modifying a section of the existing beach, while 66.7% stated that they had no previous knowledge of this detail.

Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Just under thirteen percent (12.8%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 74.4% of persons stated that there were no problems/issues. Approximately thirteen percent (12.8%) of respondents indicated that there have been problems/issues with the existing hotel. Of this 12.8%, the following problems were highlighted:

- Smell of sewage effluent in the ambient air – (50.0%)
- Sewage discharge into ocean – (16.7%)
- Limited Staff parking (resulting in staff parking on the main road) – (16.7%)
- Increased motor vehicle collisions from cross turning traffic – (16.6%)

In response to whether the highlighted issues were resolved, 66.7% (of the 12.8% confirming problems with the existing hotel) stated that the issues were not resolved, while 33.3% stated that the issues were resolved.

As it regarded problems at the proposed Phase 2 project site, 78.7% of survey respondents indicated that there have not been any issues, while 21.3% stated that they did not know of any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 6.4% of those interviewed expressed uncertainty while, 74.5% of interviewees indicated that they did not have any concern while 19.1% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems- (55.6%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (22.2%)
- Increased motor vehicle collisions caused by lack of adequate parking on the hotel property – (22.2%)
- Possible relocation – (11.1%)

Percentages exceeded 100.0% as some respondents expressed multiple concerns.

When asked about possible suggestions to address highlighted concerns, the following suggestions were put forward, Fiesta Jamaica Limited should:

- Employ local (Lucea and environs) workers – (22.2%)
- Find and alternative source (and not use Logwood) for potable water supply - (22.2%) (Desalination and the Great River Treatment facility in St James were suggested)
- Upgrade the existing NWC water supply (Logwood facility) – (33.4%)
- Erect/install appropriate traffic (directional) signs and/or speed bumps – (22.2%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 12.8% expressed uncertainty, 83.0% stated that they had no concerns, while 4.2% indicated that they were concerned about a section of the beach being modified. Concerns highlighted were:

- Damage to Lucea Harbour – (50.0%)
- Impact on (damage to) the ecosystem - (50.0%)
- Loss of fishing area – (50.0%)
- Will modification influence/change natural water pattern (movement) – (50.0%)

Percentages exceeded 100.0% as multiple concerns were expressed.

Suggestions put forward to address highlighted concerns were that Fiesta Jamaica Limited should:

- Implement measures to mitigate potential damage to the ecosystem (50.0%)
- Ensure that beach modification design does not alter the natural water pattern (movement) – (50.0%)

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately fifty-seven percent (57.4%) of respondents stated that they knew what the term meant while 42.6% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 2.1% expressed uncertainty, 85.1% stated that they had no concerns, while 12.8% indicated that they were concerned about suites being built over water. Concerns expressed were:

- Damage to coral reef and/or sea floor – (33.3%)
- Will the villas be able to withstand adverse weather conditions/events – (33.3%)
- Damage to Lucea Harbour – (33.3%)
- Improper solid waste disposal from the over water suites (during operation) (16.7%)
- Loss of fishing area – (16.7%)

- Overall ecosystem damage – (16.7%)

Percentages exceeded 100.0% as multiple concerns were expressed.

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Ensure villas are built to withstand adverse weather conditions/events – (16.7%)
- No suggestion offered (83.3%)

Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response. Of these respondents, 4.3% of individuals confirmed that they depended on the proposed site while 95.7% stated that they did not depend on the site.

When asked further what aspect of the proposed site was used 100.0% of these respondents indicated that they used the sea, and further indicated that the area was used for fishing.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Approximately sixty-two percent (61.7%) of respondents indicated that the project would not affect their life in any way, while 10.6% were not sure if the project would affect their life. Of the 27.7% of persons anticipating some effect on their lives, 2.2% anticipated a negative impact while 25.5% anticipated a positive impact from the project (Figure 6-7).

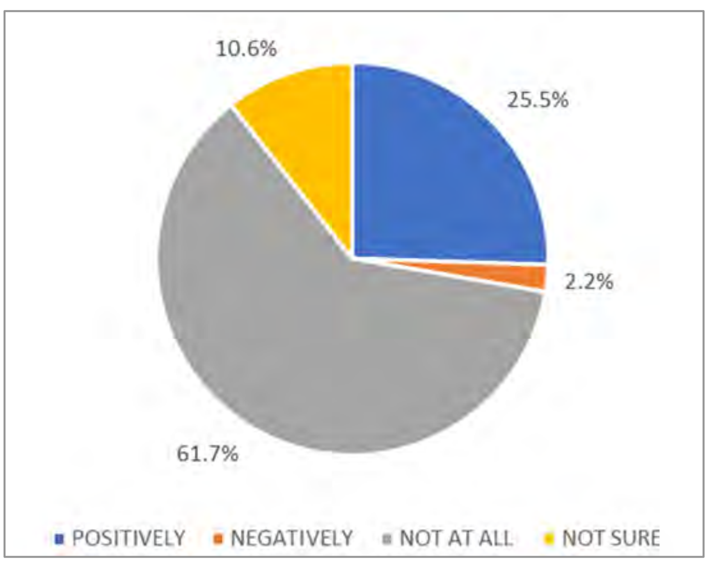


Figure 6-7 **Percentage of respondents and the potential impact of the project on respondents lives/livelihood (Johnson Town)**

For those anticipating some positive effect, they anticipated:

- Employment opportunity (83.3%)
- Increased opportunity to generate income (25.0%)

Percentages exceeded 100.0% as some respondents anticipated multiple positive impacts.

For those anticipating a negative effect, they anticipated increased fugitive dust in ambient air (100.0%). When asked about possible suggestions to mitigate/address the anticipated negative impact, none of the respondents (0.0%) offered any suggestion.

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately eleven percent (10.6%) stated that they were unsure if there would be an impact while 21.3% of individuals interviewed indicated that the project would not have any impact on the community. Approximately sixty-eight (68.1%) percent of respondents anticipated that the project would impact their community. Of these respondents, 61.7% of interviewees anticipated a positive effect, 4.3% anticipated a negative effect and 2.1% anticipated both positive and negative impacts on the community. For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (96.7%)
- There will be community/national development - (10.0%)
- Increased Tourist presence in the area – (3.3%)
- Infrastructure improvement – (3.3%)

Percentages exceeded 100.0% as multiple responses were offered.

For those anticipating a negative effect on the community, the following were stated:

- Reduced water supply - (66.7%)
- Increased crime/Influx of criminal elements into the community - (33.3%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered by respondents:

- Upgrade the existing NWC water supply (Logwood facility) – (33.4%)
- Provide more water trucks – (33.3%)
- No suggestions (33.3%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Approximately fifty-one percent (51.1%) of respondents stated that the project would not have an impact on the environment, while 34.0% stated that they were unsure if there would be any impact. Just under fifteen percent (14.9%) of interviewees anticipated an impact to the environment. Of these respondents, just under thirteen percent (12.8%) anticipated a negative effect while 2.1% anticipated a positive effect on the environment. For those anticipating a positive effect on the environment, community development was stated (100.0%).

It should be noted that those anticipating a positive impact on the environment were anticipating an impact on the physical environment. For those anticipating a negative effect on the environment, the following were stated:

- Loss of fish sanctuary - (50.0%)
- Damage to coral reef – (50.0%)
- Pollution (air/dust/water) to include motor vehicle emissions – (33.3%)
- Loss of marine wildlife - (16.7%)
- Loss of vegetation – (16.7%)
- Overall ecosystem damage - (16.7%)

Percentages exceeded 100.0% as multiple responses were offered.

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Wet the site regularly (during construction) – (16.7%)
- Replant trees to replace lost vegetation – (16.7%)
- Implement measures to mitigate against ecosystem damage - (16.7%)
- Encourage mask wearing as a personal protective measure to minimise dust impacts – (16.7%)

Some respondents (33.2%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.3.2 Brissette & Riley Road

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 83.8% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 16.2% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Fifty-five percent (55.0%) of those interviewed stated that they were aware of the project while 45.0% stated that they were not aware Of the 55.0% of interviewees confirming awareness of the proposed project, 2.3% stated that awareness of the project was via the television medium and 97.7% stated "word of mouth' as the medium by which they were made aware of the project.

When asked about awareness of the project's details. 86.4% of survey respondents indicated that they were not aware of the project details while 13.6% confirmed awareness of the project of details. Regarding awareness of specific details, of the 13.6% of respondents confirming awareness of the project details:

- 50.0% stated that they knew of the proposal to construct 16 overwater villas, while 50.0% stated that they were not aware of this detail.
- 100.0% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 33.3% stated that they were aware of the project including modifying a section of the existing beach, while 66.7% stated that they had no previous knowledge of this detail.

Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Five percent (5.0%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 90.0% of persons stated that there were no problems/issues. Five percent (5.0%) of respondents also indicated that there have been problems/issues with the existing hotel (Figure 6-8) Of this 5.0%, the following problems were highlighted:

- Smell of sewage effluent in the ambient air – (25.0%)
- Inadequate signs on approach to and outside the hotel – (25.0%)
- Hotel not employing local (Lucea and environs) residents – (25.0%)
- Flooding on the hotel property – (25.0%)

In response to whether the highlighted issues were resolved, 50.0% (of the 5.0% confirming problems with the existing hotel) stated that the issues were not resolved, 25.0% stated that the issues were resolved, while 25.0% expressed uncertainty.

As it regarded problems at the proposed Phase 2 project site, 82.5% of survey respondents indicated that there have not been any issues, while 17.5% stated that they did not know of any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 5.0% of those interviewed expressed uncertainty while, 80.0% of interviewees indicated that they did not have any concern while 15.0% indicated that they had concerns with the project as proposed (Figure 6-8).

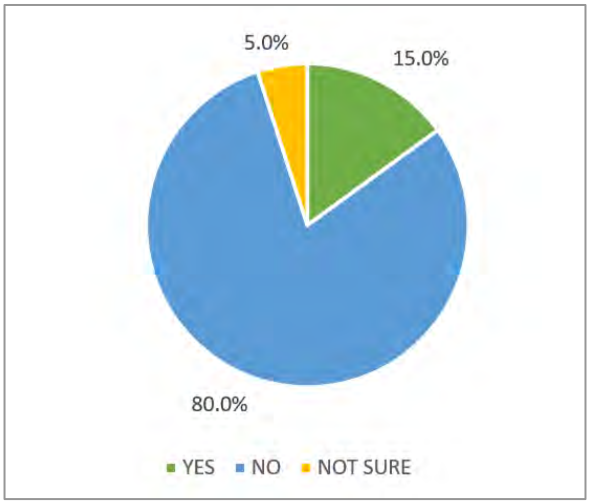


Figure 6-8 **Percentage of respondents indicating if there are general concerns about the proposed project (Brissette & Riley Road)**

Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems)- (58.3%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (41.7%)
- Loss of beach access (8.3%)
- Increased traffic congestion (in Lucea) – (8.3%)
- Whether competent workers will be employed for project implementation – (8.3%)

Percentages exceeded 100.0% as some respondents expressed multiple concerns.

When asked about possible suggestions to address highlighted concerns, the following were put forward - Fiesta Jamaica Limited should:

- Employ local (Lucea and environs) workers – (41.7%)
- Upgrade the existing NWC water supply (Logwood facility) – (16.7%)
- Find and alternative source (and not use Logwood) for potable water supply - (8.3%) (Desalination and the Great River Treatment facility in St James were suggested)
- Host a job fair to ensure equal employment opportunities – (8.3%)
- Create additional water catchment – (8.3%)
- Engage Chinese contractors – (8.3%)
- No suggestion offered – (8.4%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 3.8% expressed uncertainty, 92.4% stated that they had no concerns, while 3.8% indicated that they were concerned about a section of the beach being modified.

Concerns highlighted were:

- Loss of marine life - (33.4%)
- Possible damage to the coral reef – (33.3%)
- Pollution of the ocean – (33.3%)

Despite expressing concern none (0.0%) of the respondents offered suggestions to address the highlighted issues.

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately fifty-eight percent (57.5%) of respondents stated that they knew what the term meant while 42.5% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 7.4% expressed uncertainty, 88.8% stated that they had no concerns, while 3.8% indicated that they were concerned about suites being built over water.

Concerns expressed were:

- Damage to coral reef and/or sea floor – (66.7%)
- Will the villas be able to withstand adverse weather conditions/events – (33.3%)

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Not build the overwater suites – (33.3%)
- No suggestion offered (66.7%)

Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response. Of these respondents, 6.2% of individuals confirmed that they depended on the proposed site while 93.8% stated that they did not depend on the site.

When asked further what aspect of the proposed site was used 40.0% of these respondents indicated that they used the sea, 40.0% stated the beach and 20.0% stated that land was used. Additionally, 40.0%

of these survey participants indicated that the area was used for fishing. A similar 40.0% stated that the area was used for recreation/swimming while 20.0% indicated farming.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Just over fifty-seven percent (57.4%) of respondents indicated that the project would not affect their life in any way, while 10.0% were not sure if the project would affect their life. Of the 32.6% of persons anticipating some effect on their lives, 3.8% anticipated a negative impact while 23.8% anticipated a positive impact from the project (Figure 6-9).

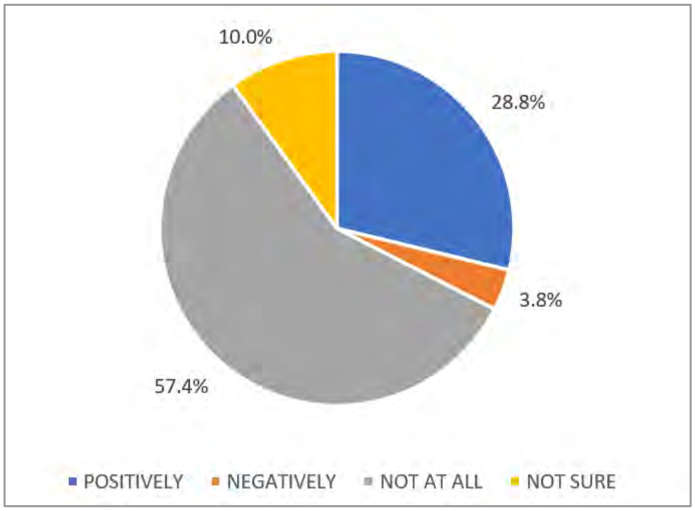


Figure 6-9 **Percentage of respondents and the potential impact of the project on respondents lives/livelihood (Brissette & Riley Road)**

For those anticipating some positive effect, they anticipated:

- Employment opportunity (78.3%)
- Increased opportunity to generate income (17.4%)
- Improved infrastructure – (8.7%)
- Increased Tourist presence in the area – (4.3%)
- Property appreciation (4.3%)

Percentages exceeded 100.0% as some respondents anticipated multiple positive impacts.

For those anticipating a negative effect, they anticipated:

- Increased traffic congestion (33.4%)
- Loss of fishing area (33.3%)
- Loss of beach access – (33.3%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered:

- Allow access for fishing - (33.4%)
- Allow beach access - (33.3%)
- No suggestion offered - (33.3%)

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately fourteen percent (13.7%) stated that they were unsure if there would be an impact while 22.5% of individuals interviewed indicated that the project would not have any impact on the community. Approximately sixty-four (63.8%) percent of respondents anticipated that the project would impact their community. Of these respondents, 52.5% of interviewees anticipated a positive effect, 8.8% anticipated a negative effect and 2.5% anticipated both positive and negative impacts on the community.

For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (86.4%)
- There will be community/national development - (15.9%)
- Increased Tourist presence in the area – (13.6%)
- Infrastructure improvement – (2.3%)
- Property appreciation - (2.3%)

Percentages exceeded 100.0% as multiple responses were offered.

For those anticipating a negative effect on the community, the following were stated:

- Reduced water supply - (55.6%)
- Increased crime/Influx of criminal elements into the community - (11.1%)
- Increased traffic congestion - (11.1%)
- Foul sewage odour in ambient air - (11.1%)
- Loss of fishing area - (11.1%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered by respondents:

- The hotel should establish/find an independent potable water source - (22.2%)
- Upgrade the existing NWC water supply (Logwood facility) – (11.1%)
- Provide more water trucks – (11.1%)
- Employ local (community) persons (11.1%)

- No suggestions (44.5%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Approximately fifty-nine percent (58.7%) of respondents stated that the project would not have an impact on the environment, while 22.5% stated that they were unsure if there would be any impact. Just under nineteen percent (18.8%) of interviewees anticipated an impact to the environment. Of these respondents, just over sixteen percent (16.3%) anticipated a negative effect while 2.5% anticipated a positive effect on the environment. For those anticipating a positive effect on the environment, infrastructure upgrades were stated (100.0%). It should be noted that those anticipating a positive impact on the environment were anticipating an impact on the physical environment. For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (38.5%)
- Loss of marine wildlife - (23.1%)
- Loss of vegetation – (15.4%)
- Improper discharge of sewage effluent into the ocean (15.4%)
- Damage to coral reef – (7.7%)
- Loss of fish sanctuary - (7.7%)
- Overall ecosystem damage - (7.7%)
- Loss of beach access – (7.7%)

Percentages exceeded 100.0% as multiple responses were offered.

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Wet the site regularly (during construction) – (23.1%)
- Replant trees to replace lost vegetation – (7.7%)

Some respondents (69.2%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.3.3 Elgin Town & Kew

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 80.6% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 19.4% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Approximately forty-five percent (45.2%) of those interviewed stated that they were aware of the project while 54.8% stated that they were not aware.

Of the 45.2% of interviewees confirming awareness of the proposed project, 2.4% stated that awareness of the project was via the television medium, 2.4% also stated newspaper, and 97.6% stated "word of mouth' as the medium by which they were made aware of the project. Percentages exceeded 100.0% as some respondents indicated that they were made aware of the project through multiple media.

When asked about awareness of the project's details. 95.2% of survey respondents indicated that they were not aware of the project details while 4.8% confirmed awareness of the project of details. Regarding awareness of specific details, of the 4.8% of respondents confirming awareness of the project details:

- 50.0% stated that they knew of the proposal to construct 16 overwater villas, while 50.0% stated that they were not aware of this detail.
- 100.0% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 50.0% stated that they were aware of the project including modifying a section of the existing beach, while 50.0% stated that they had no previous knowledge of this detail.

Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Just under twelve percent (11.8%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 84.9% of persons stated that there were no problems/issues. Approximately three percent (3.3%) of respondents indicated that there have been problems/issues with the existing hotel. Of this 3.3%, the following problems were highlighted:

- Smell of sewage effluent in the ambient air – (66.7%)
- Increased crime and violence during construction – (33.3%)

In response to whether the highlighted issues were resolved, 66.7% (of the 3.3% confirming problems with the existing hotel) stated that the issues were not resolved, 33.3% stated that the issues were resolved.

As it regarded problems at the proposed Phase 2 project site, 76.3% of survey respondents indicated that there have not been any issues, while 23.7% stated that they did not know of any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 3.2% of those interviewed expressed uncertainty while, 81.7% of interviewees indicated that they did not have any concern while 15.1% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems)- (28.6%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (21.4%)
- Possible pollution from sewage effluent – (14.3%)
- Loss of beach access (7.2%)
- Increased crime (influx of criminal elements) - (7.2%)
- Increased motor vehicle collisions caused by lack of adequate parking on the hotel property – (7.1%)
- Possible relocation – (7.1%)
- Possible beach erosion of neighbouring beach (in the vicinity of the molasses storage tanks) – (7.1%)

When asked about possible suggestions to address highlighted concerns, the following suggestions were put forward -Fiesta Jamaica Limited should:

- Employ local (Lucea and environs) workers – (14.3%)
- Properly manage sewage treatment plant – (14.3%)
- Upgrade the existing NWC water supply (Logwood facility) – (7.1%)
- Erect/install appropriate traffic (directional) signs and/or speed bumps – (7.1%)
- Provide an area for locals to access the beach – (7.1%)
- Employ water conservation practices – (7.1%)
- Provide a suitable location for persons who may face relocation – (7.1%)
- No suggestion offered – (35.9%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 4.3% expressed uncertainty, 92.5% stated that they had no concerns, while 3.2% indicated that they were concerned about a section of the beach being modified. Concerns highlighted were:

- Loss of marine life - (33.3%)
- Damage to the beach and coastline – (33.3%)
- Possible beach erosion of neighbouring beach (in the vicinity of the molasses storage tanks) - (33.3%)
- Loss of beach access - (33.3%)

Percentages exceeded 100.0% as multiple concerns were expressed.

Suggestions put forward to address highlighted concerns were - Fiesta Jamaica Limited should:

- Ensure that beach modification design does not alter the natural water pattern (movement) – (33.4%)
- Monitor the beach area adjacent to the molasses storage tanks area – (33.3%)
- No suggestion offered (33.3%)

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately fifty-one percent (50.5%) of respondents stated that they knew what the term meant while 49.5% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 9.7% expressed uncertainty, 84.9% stated that they had no concerns, while 5.4% indicated that they were concerned about suites being built over water. Concerns expressed were:

- Improper solid waste disposal from the over water suites (during operation) - (40.0%)
- Loss of Marine Life – (40.0%)
- Damage to coral reef and/or sea floor – (20.0%)
- Will the villas be able to withstand adverse weather conditions/events – (20.0%)

Percentages exceeded 100.0% as multiple concerns were expressed.

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Construct an artificial reef – (20.0%)
- Establish an environmental monitoring and oversight team - (20.0%)
- Use less harmful chemicals (during construction and/or operation) – (20.0%)
- No suggestion offered (40.0%)

Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response. Of these respondents, 1.1% of individuals confirmed that they depended on the proposed site while 98.9% stated that they did not depend on the site. When asked further what aspect of the proposed site was used all (100.0%) respondents indicated that the beach was used and further indicated that the area was used for recreation/swimming.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Just over sixty-three percent (63.4%) of respondents indicated that the project would not affect their life in any way, while 8.6% were not sure if the project would affect their life. Of the 28.0% of persons anticipating some effect on their lives, 1.1% anticipated a negative impact while 26.9% anticipated a positive impact from the project (Figure 6-10).

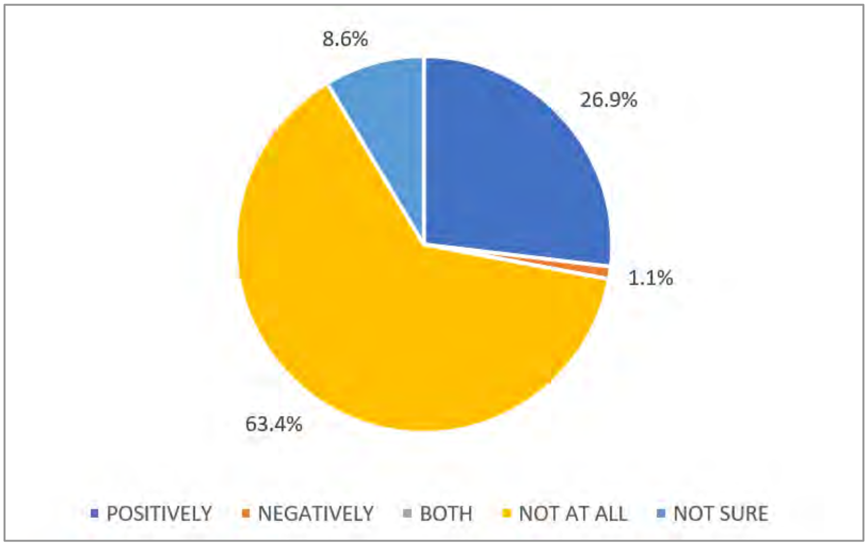


Figure 6-10 **Percentage of respondents and the potential impact of the project on respondents lives/livelihood (Elgin Town and Kew)**

For those anticipating some positive effect, they anticipated:

- Employment opportunity (88.0%)
- Increased opportunity to generate income (8.0%)
- Increased Tourist presence in the area – (8.0%)

Percentages exceeded 100.0% as some respondents anticipated multiple positive impacts.

For those anticipating a negative effect, they anticipated increased fugitive dust in ambient air (100.0%). When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestion was offered -wet the area frequently during construction (100.0%).

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately five percent (5.3%) stated that they were unsure if there would be an impact while 17.2% of individuals interviewed indicated that the project would not have any impact on the community. Approximately seventy-eight (77.5%) percent of respondents anticipated that the project would impact their community. Of these respondents, 75.3% of interviewees anticipated a positive effect, and 2.2% anticipated both positive and negative impacts on the community. No one (0.0%) anticipated only a negative effect.

For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (94.4%)
- There will be community/national development - (18.1%)
- Increased Tourist presence in the area – (4.2%)
- Infrastructure improvement – (1.4%)

Percentages exceeded 100.0% as multiple responses were offered.

For those anticipating a negative effect on the community, the following were stated:

- Increased crime/Influx of criminal elements into the community - (50.0%)
- Increased traffic congestion - (50.0%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered by respondents:

- Employ traffic wardens – (50.0%)
- No suggestions (50.0%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Approximately sixty-two percent (62.4%) of respondents stated that the project would not have an impact on the environment, while 20.4% stated that they were unsure if there would be any impact. Just over seventeen percent (17.2%) of interviewees anticipated a negative impact to the environment. No one (0.0%) interviewed anticipated a positive impact on the environment. For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (43.8%)
- Loss of marine wildlife - (25.0%)
- Improper discharge of sewage effluent into the ocean (18.8%)
- Loss of vegetation – (6.2%)
- Overall ecosystem damage - (6.2%)

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Wet the site regularly (during construction) – (25.0%)
- Ensure pollution prevention measures are in place (6.3%)
- Replant trees to replace lost vegetation – (6.3%)
- Implement measures to mitigate against ecosystem damage - (6.3%)

Some respondents (56.1%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.3.4 Malcolm Heights & Lucea

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 69.0% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 31.0% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Approximately thirty-eight percent (37.9%) of those interviewed stated that they were aware of the project while 62.1% stated that they were not aware. Of the 37.9% of interviewees confirming awareness of the proposed project, all (100.0%) stated "word of mouth' as the medium by which they were made aware.

When asked about awareness of the project's details. 95.5% of survey respondents indicated that they were not aware of the project details while 4.5% confirmed awareness of the project of details. Regarding awareness of specific details, of the 4.5% of respondents confirming awareness of the project details:

- 100.0% stated that they knew of the proposal to construct 16 overwater villas.
- 100.0% stated that they were not aware the development would include seventeen buildings comprising 948 rooms.
- 100.0% stated that they were not aware of the project including modifying a section of the existing beach.

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Approximately sixteen percent (15.5%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 79.3% of persons stated that there were no problems/issues. Just over five percent (5.2%) of respondents indicated that there have been problems/issues with the existing hotel. Of this 5.2%, the following problems were highlighted:

- Smell of sewage effluent in the ambient air – (66.7%)
- Inadequate signs on approach to and outside the hotel – (8.7%)
- Operations have caused reduced water supply to surrounding communities – (33.3%)

In response to whether the highlighted issues were resolved,33.3% (of the 5.2% confirming problems with the existing hotel) stated that the issues were not resolved, 66.7% stated that the issues were resolved. As it regarded problems at the proposed Phase 2 project site, 82.8% of survey respondents indicated that there have not been any issues, while 17.2% stated that they did not know of any issues at the proposed site.

Concerns

Regarding respondents having any general concerns pertaining to the proposed development project, 8.6% of those interviewed expressed uncertainty while, 67.3% of interviewees indicated that they did not have any concern while 24.1% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems)- (28.6%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (28.6%)
- Loss of beach access (14.3%)
- Loss of Livelihood for fisherfolk – (14.3%)
- Loss of marine wildlife – (7.1%)
- The proposed hotel expansion will not improve community development – (7.1%)
- Destruction of Coral Reef (7.1%)

Percentages exceeded 100.0% as some respondents expressed multiple concerns.

When asked about possible suggestions to address highlighted concerns, the following suggestions were put forward - Fiesta Jamaica Limited should:

- Employ local (Lucea and environs) workers – (28.6%)
- Find and alternative source (and not use Logwood) for potable water supply - (14.3%) (Desalination and the Great River Treatment facility in St James were suggested)
- Host a job fair to ensure equal employment opportunities – (7.1%)
- Provide an area for locals to access the beach – (7.1%)
- Create and artificial reef – (7.1%)
- No suggestion offered – (42.9%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 12.1% expressed uncertainty, 81.0% stated that they had no concerns, while 6.9% indicated that they were concerned about a section of the beach being modified.

Concerns highlighted were:

- Loss of marine life - (25.0%)
- Damage to the beach and coastline – (25.0%)
- Damage to Lucea Harbour – (25.0%)
- Possible damage to the coral reef – (25.0%)

Suggestions put forward to address highlighted concerns were - Fiesta Jamaica Limited should:

- Allow free movement along the section of shoreline/beach – (50.0%)
- Provide additional design detail information – (25.0%)
- No suggestion offered (25.0%)

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately fifty-seven percent (56.9%) of respondents stated that they knew what the term meant while 43.1% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 13.8% expressed uncertainty, 74.1% stated that they had no concerns, while 12.1% indicated that they were concerned about suites being built over water. Concerns expressed were:

- Damage to coral reef and/or sea floor – (28.6%)
- Will the villas be able to withstand adverse weather conditions/events – (28.6%)
- Loss of fishing area – (28.6%)
- Pollution of the sea (during construction) – (14.2%)

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Ensure villas are built to withstand adverse weather conditions/events – (14.3%)
- Construct an artificial reef – (14.3%)
- Compensate for medical expenses caused by pollution to the sea – (14.3%)
- Allow fisherfolk to access the fishing area – (14.3%)
- Establish a marine life protected area (sanctuary) – (14.3%)
- No suggestion offered (42.8%)

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response. Of these respondents, 1.7% of individuals confirmed that they depended on the proposed site while 98.3% stated that they did not depend on the site . When asked further what aspect of the proposed site was,100.0% stated the beach and further indicated that the area was used for recreation/swimming.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Just under seventy-one percent (70.7%) of respondents indicated that the project would not affect their life in any way, while 8.6% were not sure if the project would affect their life. Of the 20.4% of persons anticipating some effect on their lives, 5.2% anticipated a negative impact while

15.5% anticipated a positive impact from the project. For those anticipating some positive effect, they anticipated:

- Employment opportunity (88.9%)
- Increased opportunity to generate income (11.1%)

For those anticipating a negative effect, they anticipated:

- Reduced water supply – (66.7%)
- Increased traffic congestion (33.3%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered:

- The hotel should establish/find an independent potable water source - (33.3%)
- No suggestion offered - (66.7%)

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately ten percent (10.3%) stated that they were unsure if there would be an impact while 19.0% of individuals interviewed indicated that the project would not have any impact on the community. Approximately seventy-one (70.7%) percent of respondents anticipated that the project would impact their community. Of these respondents, 63.8% of interviewees anticipated a positive effect, 5.2% anticipated a negative effect and 1.7% anticipated both positive and negative impacts on the community (Figure 6-11).

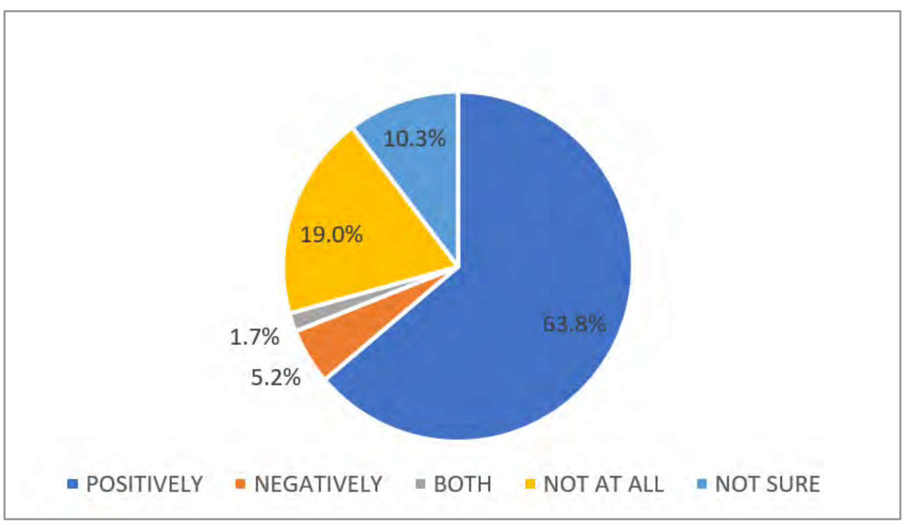


Figure 6-11 **Percentage of respondents and the potential impact of the project on the community (Malcolm Heights and Lucea)**

For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (92.1%)
- There will be community/national development - (10.5%)
- Increased Tourist presence in the area – (7.9%)
- Infrastructure improvement – (5.3%)
- Increased income opportunity - (2.6%)
- Economic Growth – (2.6%)

Percentages exceeded 100.0% as multiple responses were offered.

For those anticipating a negative effect on the community, the following were stated:

- Reduced water supply - (75.0%)
- Increased traffic congestion - (25.0%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered by respondents:

- The hotel should establish/find an independent potable water source - (75.0%)
- No suggestions (25.0%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Fifty percent (50.0%) of respondents stated that the project would not have an impact on the environment, while 32.8% stated that they were unsure if there would be any impact. Just over seventeen percent (17.2%) of interviewees anticipated an impact to the environment. Of these respondents, approximately fourteen percent (13.8%) anticipated a negative effect while 3.4% anticipated a positive effect on the environment. For those anticipating a positive effect on the environment, the following were stated:

- Infrastructure upgrades (50.0%)
- Community Development (50.0%)

It should be noted that those anticipating a positive impact on the environment were anticipating an impact on the physical environment.

For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (25.0%)
- Loss of marine wildlife - (25.0%)

- Improper discharge of sewage effluent into the ocean (25.0%)
- Damage to coral reef – (12.5%)
- Loss of fish sanctuary - (12.5%)
- Overall ecosystem damage - (12.5%)
- Loss of beach access – (12.5%)

Percentages exceeded 100.0% as multiple responses were offered.

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Ensure pollution prevention measures are in place (25.0%)
- Preserve a section of the site in its undisturbed state – (12.5%)
- Create an artificial reef – (12.5%)

Some respondents (50.0%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.3.5 Haughton Court

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 75.0% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 25.0% stated that they had not heard of that company name. As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Approximately fifty-four percent (53.6%) of those interviewed stated that they were aware of the project while 46.4% stated that they were not aware. Of the 53.6% of interviewees confirming awareness of the proposed project, all (100.0%) respondents indicated that they were made aware of the project via social media.

When asked about awareness of the project's details. 93.3% of survey respondents indicated that they were not aware of the project details while 6.7% confirmed awareness of the project of details. Regarding awareness of specific details, of the 6.7% of respondents confirming awareness of the project details:

- 100.0% stated that they knew of the proposal to construct 16 overwater villas.
- 100.0% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 100.0% stated that they were aware of the project including modifying a section of the existing beach.

Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Just over fourteen percent (14.2%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 67.9% of persons stated that there were no problems/issues. Approximately eighteen percent (17.9%) of respondents indicated that there have been problems/issues with the existing hotel. Of this 17.9%, the following problems were highlighted:

- Smell of sewage effluent in the ambient air – (60.0%)
- Loss of recreational space – (20.0%)
- Union busting – (20.0%)

In response to whether the highlighted issues were resolved, 80.0% (of the 17.9% confirming problems with the existing hotel) stated that the issues were not resolved, 20.0% stated that the issues were resolved. As it regarded problems at the proposed Phase 2 project site, 67.9% of survey respondents indicated that there have not been any issues, while 32.1% stated that they did not know of any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 3.6% of those interviewed expressed uncertainty while, 57.1% of interviewees indicated that they did not have any concern while 39.3% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems)- (54.5%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (9.1%)
- Possible pollution from sewage effluent – (18.2%)
- Increased crime (influx of criminal elements) - (18.2%)
- Loss of Livelihood for fisherfolk – (9.1%)
- Increase in fugitive dust (dust pollution) – (9.1%)

Percentages exceeded 100.0% as some respondents expressed multiple concerns.

When asked about possible suggestions to address highlighted concerns, the following suggestions were put forward - Fiesta Jamaica Limited should:

- Find and alternative source (and not use Logwood) for potable water supply - (18.2%) (Desalination and the Great River Treatment facility in St James were suggested)
- Properly manage sewage treatment plant – (9.1%)
- Wet the site regularly – (9.1%)

- Cover trucks carrying construction material – (9.1%)
- No suggestion offered – (54.5%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 7.1% expressed uncertainty, 85.8% stated that they had no concerns, while 7.1% indicated that they were concerned about a section of the beach being modified. Concerns highlighted were:

- Damage to the beach and coastline – (50.0%)
- Pollution of the ocean – (50.0%)

Suggestions put forward to address highlighted concerns were - Fiesta Jamaica Limited should:

- Implement measures to mitigate potential damage to the ecosystem (50.0%)
- No suggestion offered (50.0%)

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Fifty percent (53.9%) of respondents stated that they knew what the term meant while 50.0% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 3.6% expressed uncertainty, 75.0% stated that they had no concerns, while 21.4% indicated that they were concerned about suites being built over water. Concerns expressed were:

- Damage to coral reef and/or sea floor – (33.1%)
- Will the villas be able to withstand adverse weather conditions/events – (16.7%)
- Improper solid waste disposal from the over water suites (during operation) (33.3%)
- Damage to Lucea Harbour – (16.7%)
- Pollution of the sea (during construction) – (16.7%)

Percentages exceeded 100.0% as multiple concerns were expressed.

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Construct adequate sewer treatment plant – (33.3%)
- Ensure villas are built to withstand adverse weather conditions/events – (16.7%)
- Ensure that villas do not impede access the boat/ship channel and pier – (16.7%)
- No suggestion offered (33.3%)

Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response and further stated that they did not depend on the site.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Approximately ninety-three percent (92.9%) of respondents indicated that the project would not affect their life in any way, while 7.1% anticipated a positive impact from the project. For those anticipating some positive effect, they anticipated:

- Employment opportunity (50.0%)
- Increased opportunity to generate income (50.0%)

No negative impact was anticipated.

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately seven percent (7.1%) stated that they were unsure if there would be an impact while 10.7% of individuals interviewed indicated that the project would not have any impact on the community. Approximately eighty-two (82.2%) percent of interviewees anticipated a positive effect on the community. For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (91.3%)
- There will be community/national development - (8.7%)
- Increased Tourist presence in the area – (8.7%)
- Infrastructure improvement – (3.4%)
- Increased income opportunity - (8.7%)

Percentages exceeded 100.0% as multiple responses were offered.

No negative impact was anticipated.

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Approximately forty-three percent (42.9%) of respondents stated that the project would not have an impact on the environment, while 28.6% stated that they were unsure if there would be any impact. Approximately twenty-nine percent (28.5%) of interviewees anticipated an impact to the environment. Of these respondents, just over twenty-one percent (21.4%) anticipated a negative effect while 7.1% anticipated a positive effect on the environment (Figure 6-12).

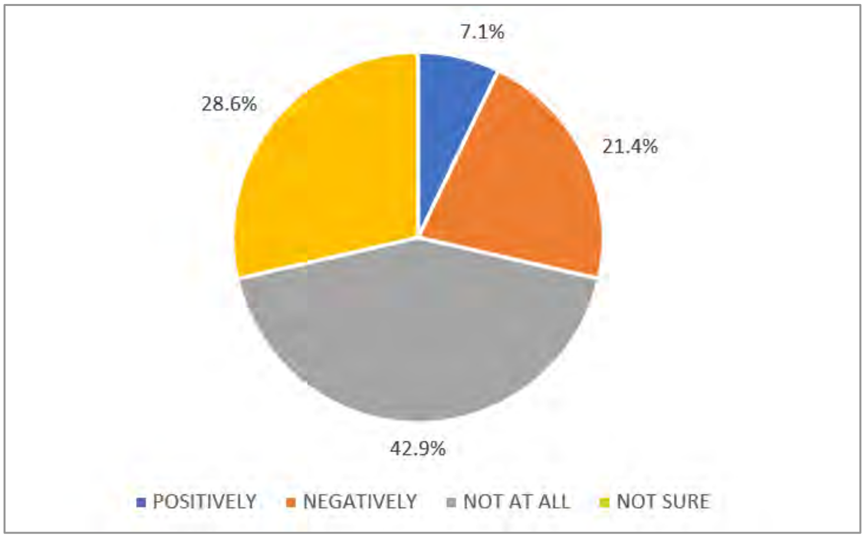


Figure 6-12 **Percentage of respondents and the potential impact of the project on the environment (Haughton Court)**

For those anticipating a positive effect on the environment, the following were stated:

- Infrastructure upgrades (100.0%)
- Community Development (50.0%)

Percentages exceeded 100.0% as some respondents offered multiple responses.

It should be noted that those anticipating a positive impact on the environment were anticipating an impact on the physical environment. For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (33.3%)
- Loss of marine wildlife - (33.3%)
- Improper discharge of sewage effluent into the ocean (33.3%)
- Damage to coral reef – (16.7%)

Percentages exceeded 100.0% as multiple responses were offered.

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Ensure pollution prevention measures are in place (16.7%)
- The government environmental regulatory agency (NEPA) should be engaged to monitor and give project oversight (16.7%)

Some respondents (66.6%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.3.6 Haughton Gardens and Prosper

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 71.9% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 28.1% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Twenty-five percent (25.0%) of those interviewed stated that they were aware of the project while 75.0% stated that they were not aware. Of the 25.0% of interviewees confirming awareness of the proposed project, all (100.0%) stated "word of mouth' as the medium by which they were made aware of the project.

When asked about awareness of the project's details. 87.5% of survey respondents indicated that they were not aware of the project details while 12.5% confirmed awareness of the project of details. Regarding awareness of specific details, of the 12.5% of respondents confirming awareness of the project details:

- 100.0% stated that they knew of the proposal to construct 16 overwater villas.
- 100.0% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 100.0% stated that they were not aware of the project including modifying a section of the existing beach.

Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Just under nineteen percent (18.8%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 78.1% of persons stated that there were no problems/issues. Approximately three percent (3.1%) of respondents indicated that there have been problems/issues with the existing hotel. Of this 3.1%, the following problem was highlighted - Smell of sewage effluent in the ambient air – (100.0%).

In response to whether the highlighted issues were resolved, 100.0% (of the 3.1% confirming problems with the existing hotel) stated that the issues were not resolved.

As it regarded problems at the proposed Phase 2 project site, 81.2% of survey respondents indicated that there have not been any issues, while 18.8% stated that they did not know of any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 3.1% of those interviewed expressed uncertainty while, 81.3% of interviewees indicated that they did not have any concern while 15.6% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- The demand on the local water supply system will be increased (worsening water supply problems)- (60.0%)
- Whether locals (residents of Lucea and environs) will have equal employment opportunities – (20.0%)
- Loss of marine wildlife – (20.0%)

When asked about possible suggestions to address highlighted concerns, the following suggestions were put forward - Fiesta Jamaica Limited should:

- Find and alternative source (and not use Logwood) for potable water supply - (20.0%) (Desalination and the Great River Treatment facility in St James were suggested)
- Host a job fair to ensure equal employment opportunities – (20.0%)
- Create and artificial reef – (20.0%)
- Use water trucks to supply the hotel – (20.0%)
- No suggestion offered – (20.0%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 6.2% expressed uncertainty, 93.8% stated that they had no concerns, while no one (0.0%) indicated that they were concerned about a section of the beach being modified.

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately forty-four percent (43.8%) of respondents stated that they knew what the term meant while 56.3% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 6.3% expressed uncertainty, 90.6% stated that they had no concerns, while 3.1% indicated that they were concerned about suites being built over water. Concern expressed was loss of marine life (100.0%). However, no suggestion was offered to address the concern.

Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response and further stated that they did not depend on the site.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Approximately fifty-nine percent (59.4%) of respondents indicated that the project would not affect their life in any way, while 12.5% were not sure if the project would affect their life. Of the 28.1% of persons anticipating some effect on their lives, 3.1% anticipated a negative impact while 25.0% anticipated a positive impact from the project (Figure 6-13).

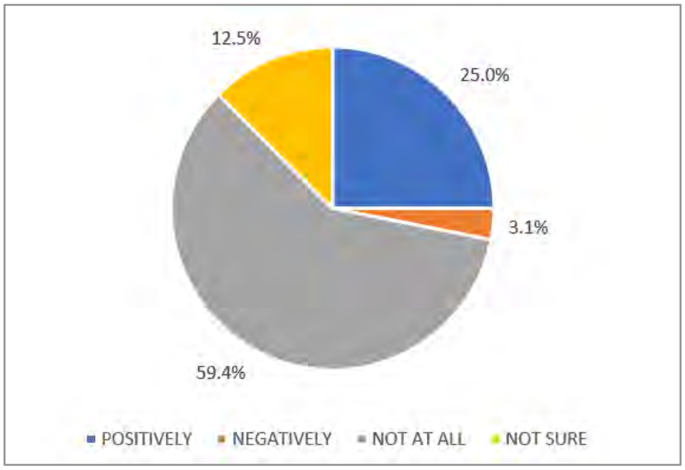


Figure 6-13 **Percentage of respondents and the potential impact of the project on respondents lives/livelihood (Haughton Gardens and Prosper)**

For those anticipating some positive effect, they anticipated:

- Employment opportunity (87.5%)
- Increased Tourist presence in the area – (12.5%)

For those anticipating a negative effect, they anticipated increased traffic congestion (100.0%).

When asked about possible suggestions to mitigate/address the anticipated negative impact, no suggestion was offered.

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Approximately thirteen percent (12.5%) stated that they were unsure if there would be an impact while 3.1% of individuals interviewed indicated that the project would not have any impact on the community. Approximately eighty-four (84.4%) percent of respondents anticipated that the project would impact their community. Of these respondents, 68.8% of interviewees anticipated a positive effect, 12.5% anticipated a negative effect and 3.1% anticipated both positive and negative impacts on the community.

For those interviewees anticipating a positive effect on the community, the following were stated:

- Employment opportunities will be created - (78.3%)

- There will be community/national development - (21.7%)
- Increased Tourist presence in the area – (4.3%)
- Infrastructure improvement – (13.0%)
- Increased income opportunity - (4.3%)
- Economic Growth – (4.3%)

Percentages exceeded 100.0% as multiple responses were offered.

For those anticipating a negative effect on the community, the following were stated:

- Reduced water supply - (60.0%)
- Increased crime/Influx of criminal elements into the community - (20.0%)
- Increased traffic congestion - (20.0%)

When asked about possible suggestions to mitigate/address the anticipated negative impact, the following suggestions were offered by respondents:

- The hotel should establish/find an independent potable water source - (20.0%)
- Upgrade the hotel entrance by improving the roadway and installing additional signs – (20.0%)
- No suggestions (60.0%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Fifty percent (50.0%) of respondents stated that the project would not have an impact on the environment, while 31.2% stated that they were unsure if there would be any impact. Approximately nineteen percent (18.8%) of interviewees anticipated a negative effect while no one (0.0%o anticipated a positive effect on the environment.

For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (33.2%)
- Loss of marine wildlife - (16.7%)
- Improper discharge of sewage effluent into the ocean (16.7%)
- Damage to coral reef – (16.7%)
- Loss of vegetation – (16.7%)

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees:

- Wet the site regularly (during construction) – (33.2%)
- Ensure pollution prevention measures are in place (16.7%)

- Replant trees to replace lost vegetation – (16.7%)
- Preserve a section of the site in its undisturbed state – (16.7%)

Some respondents (16.7%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.2.3.7 Pointe and Oceanpointe

Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all interviewees (100.0%) offered a response. Of these persons 60.0% indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 40.0% stated that they had not heard of that company name.

As it pertained to respondents' awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Twenty percent (20.0%) of those interviewed stated that they were aware of the project while 80.0% stated that they were not aware.

Of the 20.0% of interviewees confirming awareness of the proposed project, 100.0% stated "word of mouth' as the medium by which they were made aware of the project.

When asked about awareness of the project's details. 100.0% of survey respondents indicated that they were not aware of the project details.

Concerns

Pertaining to problems/issues with the existing hotel, all interviewees (100.0%) offered a response. Eighty percent (80.0%) of persons stated that there were no problems/issues. While 20.0% of respondents indicated that there have been problems/issues with the existing hotel.

Of this 20.0%, the following problems were highlighted:

- Operations have caused reduced water supply to surrounding communities – (100.0%)
- Increased crime and violence during construction – (100.0%)
- Negative impact on the ecosystem – (100.0%)

Percentages exceeded 100.0% as some respondents stated multiple problems with the existing hotel.

In response to whether the highlighted issues were resolved, 100.0% (of the 20.0% confirming problems with the existing hotel) stated that the issues were not resolved.

As it regarded problems at the proposed Phase 2 project site, 100.0% of survey respondents indicated that there have not been any issues at the proposed site.

Regarding respondents having any general concerns pertaining to the proposed development project, 80.0% of interviewees indicated that they did not have any concern while 20.0% indicated that they had concerns with the project as proposed. Concerns highlighted pertained to the following:

- Increased traffic congestion (in Lucea) – (100.0%)
- Increase in fugitive dust (dust pollution) – (100.0%)

Percentages exceeded 100.0% as some respondents expressed multiple concerns.

When asked about possible suggestions to address highlighted concerns, no suggestions were offered.

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewees offered a response. Of these individuals, 80.0% stated that they had no concerns, while 20.0% expressed uncertainty regarding a section of the beach being modified.

On the issue of respondents knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Eighty percent (80.0%) of respondents stated that they knew what the term meant while 20.0% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 80.0% stated that they had no concerns, while 20.0% expressed uncertainty about suites being built over water.

Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all persons interviewed (100.0%) offered a response and all (100.0%) stated that they did not depend on the site.

On the issue of whether respondents thought the project would affect their life 100.0% of interviewees offered a response. Forty percent (40.0%) of respondents indicated that the project would not affect their life in any way, while 20.0% were not sure if the project would affect their life. Of the 40.0% of persons anticipating some effect on their lives, 20.0% anticipated a negative impact while 20.0% also anticipated a positive impact from the project. For those anticipating some positive effect, they anticipated employment opportunities (100.0%). For those anticipating a negative effect, they anticipated increased competition for Airbnb Business (100.0%).

When asked about possible suggestions to mitigate/address the anticipated negative impact, no suggestion was offered.

Regarding whether respondents thought the project would affect their community 100.0% of interviewees offered a response. Twenty percent (20.0%) stated that they were unsure if there would be an impact. Eighty (80.0%) percent of respondents anticipated that the project would impact their community. Of these respondents, 60.0% of interviewees anticipated a positive effect, and 20.0% anticipated both positive and negative impacts on the community

For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (75.0%)
- Increased Tourist presence in the area – (25.0%)

For those anticipating a negative effect on the community, the following was stated- increased crime/Influx of criminal elements into the community (100.0%). When asked about possible suggestions to mitigate/address the anticipated negative impact, and increase security presence in the area was suggested (100.0%)

As it pertained to whether respondents thought the project would affect the environment, 100.0% of persons interviewed offered a response. Twenty percent (20.0%) of respondents stated that the project would not have an impact on the environment, while 20.0% stated that they were unsure if there would be any impact. Sixty percent (60.0%) of interviewees anticipated an impact to the environment. Of these respondents, forty percent (40.0%) anticipated a negative effect while 20.0% anticipated a positive effect on the environment. For those anticipating a positive effect on the environment, the following was stated: infrastructure upgrades (100.0%). It should be noted that those anticipating a positive impact on the environment were anticipating an impact on the physical environment.

For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (50.0%)
- Loss of vegetation – (50.0%)

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, the following suggestions were offered by interviewees - do not develop the property (50.0%). Some respondents (50.0%) offered no suggestion regarding how the anticipated negative impact could be addressed.

6.3 FISHERS

6.3.1 Cohort Description

Questionnaires specifically aimed at fisher folk were administered at the Lucea Fishing Beach. Fishers were interviewed on May 14 and 15, 2024. Thirteen persons were identified as fishers. All persons (100%) interviewed were males and also resided in the general Lucea area. Specific communities were Lucea (46.2%), Haughton Court (15.3%), Brissette (7.7%) and Prosper (30.8%).

Of the thirteen (13) respondents age cohort distribution was as follows; 30.8% were age 35-44 years. 30.8% were age 45-54 years, 30.8% were age 55-64% while 7.6% were 65 years of age or older. No one (0.0%) interviewed was age thirty-four years or younger.

6.3.2 Responses

6.3.2.1 Fishing Methods and Catch

All persons (100.0%) confirmed that they were involved in the fishing industry. Approximately eighty-five percent (84.6%) of fishers indicated that they sold their fish catch directly to customers, while 15.4% indicated that they did not sell their fish directly. No fish vendors or fish scalers/cleaners were encountered. This was attributed mainly to the fact that the Lucea Fishing Beach is a relatively small fishing beach and does not lend itself to providing a viable source of employment for someone to engage in fish vending or fish scaling as a stable means to generate income.

Regarding affiliation with recognised organisations:

- 84.6% of interviewed fishers indicated that they were registered with the National Fisheries Authority. Approximately sixteen percent (15.4%) of fishers were not registered.
- 76.9% of fishers interviewed indicated that they were members of the Lucea Fishers Association. Just over twenty-three percent (23.1%) of fishers were not members of the Association.

In response to what was used for fishing, it was realised during the survey exercise that the fishers used multiple tools. Approximately eighty-five percent (84.6%) of fishers used lines, 7.7% used spears, 46.2% used nets and 53.8% used fish pots, while 46.2% indicated that a canoe with an engine was used. Percentages exceeded 100.0% as fishers indicated that multiple tools were used for fishing.

When fishers were asked where they docked and launched their vessel, 69.2% stated that they docked at the Lucea Fishing Beach, 15.4% stated Dolphin Bank, 7.7% indicated Lances Bay, a similar 7.7% stated Pointe and 7.7% indicated Dolphin Cove. Percentages exceeded 100.0% as some fishers docked their canoes in multiple areas.

In relation to where persons fished, 30.8% of respondents indicated that they fished in nearshore areas, 30.8% stated that the fished in Deep Sea within a distance of between 1.6 km and 8.0 km from shore, while 53.8% stated that the fished in Deep Sea at a distance greater than 8.0 km from shore. Percentages exceeded 100.0% as multiple responses were offered. It should be noted that fisherfolk fished at different distances from shore based on the types of fish they wanted to harvest or based on prevailing weather conditions. In general, fisherfolk fished in waters extending west to Negril and eastwards to Montego Bay and also at the Pedro Cays. Areas named were Dolphin Bank, dolphin Point, Dry Ridge, Bucknor, Lances Bay and Sandy Bay, .

When fishers were asked how many times per week they went fishing, all interviewees (100.0%) offered a response. Approximately eight percent (7.7%) stated twice weekly, 15.4% three times per week, 7.7% indicated four times weekly, while 38.5% indicated five times per week. The remaining 30.7% of respondents stated that they went fishing more than five times each week.

As it pertained to the average pound catch of fish harvested on each fishing event, 7.7% of fishers stated that they caught/harvested less than ten pounds of fish, while 30.7% indicated that their catch was on average between eleven and twenty pounds. Approximately fifteen percent (15.4%) stated that catch ranged between twenty-one and fifty pounds, while 23.1% harvested between fifty-one and one hundred pounds and 23.1% indicated that average catch for each fishing event exceeded one hundred pounds.

In general, the fishers encountered, have been fishing for between eighteen and more than thirty years. Approximately eight percent (7.7%) of individuals stated that they have been fishers for between eighteen and twenty-four years, 30.8% stated that they had been engaged in fishing for between twenty-five and thirty years while 61.5% have been fishers for more than thirty years.

On the issue of whether there was an observed change in the earnings from/size/type of fish harvested or sold, all fishers (100.0%) responded. Approximately eighty-five percent (84.6%) of fishers indicated that there was an observed change while 15.4% stated that no change was noticed. Just under seventy three percent (72.7%) of fishers indicated a decrease and 27.3% stated an increase. When asked about the possible reason for the noticed change, the following were stated:

- Observed Decrease
    - Fish migration due to pollution – 63.6%
    - Lost/Damaged Fish pots – (9.1%)
    - Noise from jet skis operated by Palladium – (9.1%)
- Observed Increase
    - Increased cost per pound of fish – (18.2%)
    - Increased Customers – (18.2%)

Percentages exceeded 100.0% as multiple reasons for observed changes were put forward by fishers.

6.3.2.2 Livelihood and Education

On the issue of whether fishing was the main source of employment, all (100.0%) fishers interviewed indicated that they pursued fishing on a full-time basis and were not otherwise employed. When asked if other members of the household were fishers, 53.8% stated that no other household member was a fisher, while 46.2% of interviewed fishers confirmed that another household member was a fisher.

As it pertained to the highest level of education completed, 38.5% of interviewed fishers stated primary/all age as the highest level of education completed and 61.5% indicated that they completed high school.

As it pertained to the average weekly income derived from fish sales, 100.0% of interviewees offered a response. Approximately sixty-two percent (61.5%) indicated average weekly income from fish sales was in excess of $10,000.00, 23.1% stated weekly income ranged between $8,001.00 and $10,000.00 while 15.4% declined to offer a response.

6.3.2.3 Perception and Awareness

On the issue of respondents' awareness of a company named Fiesta Jamaica Limited, all fishers interviewed (100.0%) offered a response. Approximately ninety-two percent (92.3%) indicated that they heard of Fiesta Jamaica Limited (Fiesta) while 7.7% stated that they had not heard of that company name. As it pertained to awareness of the proposal by Fiesta Jamaica Limited to commence Phase 2 of its Hotel in Lucea Hanover, all (100.0%) participants responded. Approximately eighty-five percent (84.6%) of fishers interviewed stated that they were aware of the project while 15.4% stated that they were not aware.

Of the 84.6% of interviewees confirming awareness of the proposed project, 100.0% stated "word of mouth' as the medium by which they were made aware of the project, while 9.1% stated community meeting. Percentages exceeded 100.0% as some respondents indicated that they were made aware of the project through multiple media.

When asked about awareness of the project's details. 90.9% of fishers indicated that they were not aware of the project details while 9.1% confirmed awareness of the project of details. Regarding awareness of specific details, of the 9.1% of respondents confirming awareness of the project details:

- 100.0% stated that they knew of the proposal to construct 16 overwater villas.
- 100.0% stated that they knew the development would include seventeen buildings comprising 948 rooms.
- 100.0% stated that they were aware of the project including modifying a section of the existing beach.

6.3.2.4 Concerns

Pertaining to problems/issues with the existing hotel, all fishers interviewed (100.0%) offered a response. Just under eight percent (7.6%) of interviewees stated that they were unaware of the site having problems/issues in the past, while 46.2% of persons stated that there were no problems/issues. A similar 46.2% of fishers indicated that there have been problems/issues with the existing hotel. Of this 46.2%, the following problems were highlighted:

- Loss of fishing area – (33.2%)
- Smell of sewage effluent in the ambient air – (16.7%)
- Palladium does not purchase fish from local fishers – (16.7%)
- Improper solid waste disposal in the sea – (16.7%)
- Negative impact on the ecosystem – (16.7%)

In response to whether the highlighted issues were resolved, 33.3% (of the 46.2% confirming problems with the existing hotel) stated that the issues were not resolved, 50.0% stated that the issues were resolved, while 16.7% expressed uncertainty.

As it regarded problems at the proposed Phase 2 project site, 69.2% of survey respondents indicated that there have not been any issues, while 30.8% stated that there have been problems/issues at the proposed site. The following problems were highlighted:

- Improper solid waste disposal in the sea – (50.0%)
- No access to the fishing area – (25.0%)
- Not stated – (25.0%)

Regarding respondents having any general concerns pertaining to the proposed development project, 7.7% of fishers interviewed expressed uncertainty while 76.9% indicated that they did not have any concern while 15.4% indicated that they had concerns with the project as proposed (Figure 6-14).

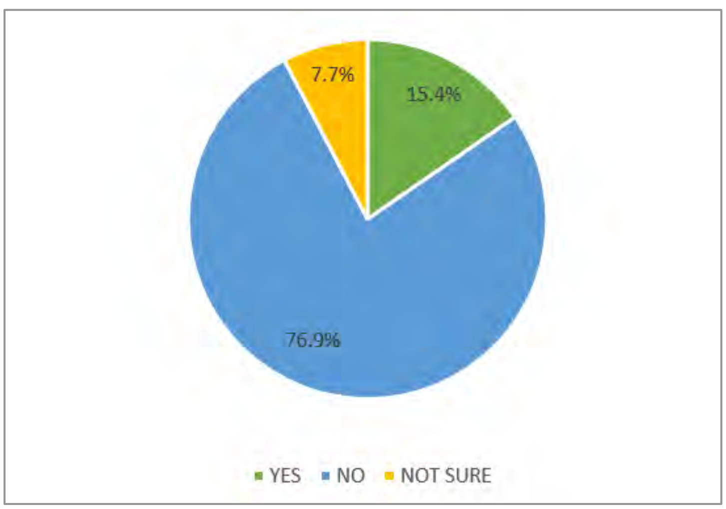


Figure 6-14 Percentage of fishers indicating if there are general concerns about the proposed project

Concerns highlighted pertained to the following:

- Loss of Livelihood for fisherfolk – (50.0%)
- Loss of marine wildlife – (50.0%)

When asked about possible suggestions to address highlighted concerns, the following suggestions were put forward - Fiesta Jamaica Limited should:

- Create an alternative income opportunity for fishers (e.g. boat rides for hotel guests) – (50.0%)
- No suggestion offered – (28.8%)

When asked if there were specific concerns regarding a section of the beach being modified, 100.0% of interviewed fishers offered a response. Of these individuals, 7.7% expressed uncertainty, 84.6% stated that they had no concerns, while 7.7% indicated that they were concerned about a section of the beach being modified. Concerns highlighted were:

- Loss of beach access - (100.0%)
- Whether natural or artificial sand would be used in the beach modification – (100.0%)

Percentages exceeded 100.0% as multiple concerns were expressed.

Suggestions put forward to address highlighted concerns were -that Fiesta Jamaica Limited should ensure that natural sand is used in beach modification (100.0%).

On the issue of fishers knowing what an overwater suite/villa was, all interviewees (100.0%) offered a response. Approximately sixty-nine percent (69.2%) of respondents stated that they knew what the term meant while 30.8% indicated that they did not know what an overwater suite/villa was.

In response to whether there were specific concerns relating to suites/villas being built over water, all (100.0%) survey participants offered a response. Of these respondents, 7.7% expressed uncertainty, 61.5% stated that they had no concerns, while 30.8% indicated that they were concerned about suites being built over water. Concerns expressed were:

- Loss of Marine Life – (50.0%)
- Improper solid waste disposal from the over water suites (during operation) (25.0%)
- Loss of fishing area – (25.0%)
- Will the villas be able to withstand adverse weather conditions/events – (25.0%)

Percentages exceeded 100.0% as multiple concerns were expressed.

To address highlighted concerns interviewees suggested that Fiesta Jamaica Limited should:

- Ensure villas are built to withstand adverse weather conditions/events – (25.0%)
- No suggestion offered (25.0%)

6.3.2.5 Site Use and Potential Impacts

In response to whether there was dependence on/use of the proposed site (land, beach or sea) for any type of activity, all fishers interviewed (100.0%) offered a response. Of these respondents, 7.7% of individuals confirmed that they depended on the proposed site while 92.3% stated that they did not depend on the site.

When asked further what aspect of the proposed site was used 100.0% (of the 7.7%) stated that land was used and further indicated that the area was used for boat repairs (100.0%).

On the issue of whether fishers thought the project would affect their life 100.0% of interviewees offered a response. Just under fifty-four percent (53.8%) of respondents indicated that the project would not affect their life in any way, while 30.8% anticipated a positive impact and 15.4% anticipated a negative impact (Figure 6-15).

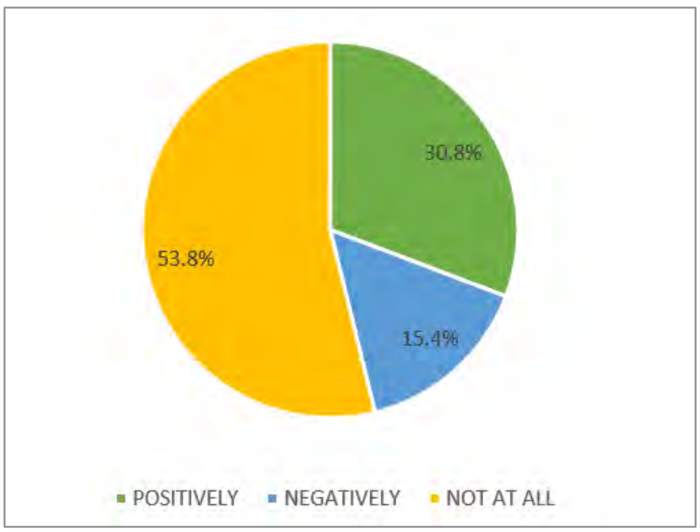


Figure 6-15 Percentage of fishers and the potential impact of the project on respondents lives/livelihood

For those anticipating some positive effect, they anticipated:

- Employment opportunity (50.0%)
- Increased opportunity to generate income (50.0%)
- Improved infrastructure – (25.0%)

Percentages exceeded 100.0% as some respondents anticipated multiple positive impacts.

For those anticipating a negative effect, they anticipated loss of fishing area (100.0%). When asked about possible suggestions to mitigate/address the anticipated negative impact, no suggestion was offered (100.0%).

Regarding whether fishers thought the project would affect their community 100.0% of interviewees offered a response. Approximately twenty-three percent (23.1%) stated that they were unsure if there would be an impact while 7.7% of individuals interviewed indicated that the project would not have any impact on the community. Approximately sixty-nine (69.2%) percent of respondents anticipated a positive effect. None of the fishers interviewed (0.0%) anticipated a negative effect on the community. For those interviewees anticipating a positive effect on the community, the following were stated:

- employment opportunities will be created - (89.9%)
- Increased income opportunity - (22.2%)
- Increased Tourist presence in the area – (11.1%)
- Percentages exceeded 100.0% as multiple responses were offered.

As it pertained to whether fishers thought the project would affect the environment, 100.0% of persons interviewed offered a response. Approximately thirty-nine percent (38.5%) of respondents stated that the project would not have an impact on the environment, while 46.1% stated that they were unsure if there would be any impact. Just over fifteen percent (15.4%) of interviewees anticipated a negative effect while no one interviewed (0.0%) anticipated a positive effect on the environment.

For those anticipating a negative effect on the environment, the following were stated:

- Pollution (air/dust/water) to include motor vehicle emissions – (50.0%)
- Loss of marine wildlife - (50.0%)

When asked about possible suggestions to mitigate/address the anticipated negative impact on the environment, no suggestions were offered by fishers interviewed.

6.4 OTHER STAKEHOLDERS

6.4.1 National Fisheries Authority

The National Fisheries Authority (NFA) is a key stakeholder engaged from the start of the EIA process. This engagement aimed to obtain relevant and up-to-date information and to gain insights regarding the fishing industry, sanctuaries in the area, and potential impacts. Two preliminary virtual meetings were arranged with NFA to address these matters:

- Capture Fisheries Division (May 24,2024): This introductory meeting described the main purpose and features of the project. Information was gathered about the Lucea Fish Sanctuary, including its partners and envisioned structure. Documents prepared for the establishment of the sanctuary were highlighted, and it was recommended to consult with the local fisheries extension officers for further details.

- Fisheries Extension Officers and Lucea Fish Sanctuary Manager (June 10, 2024): This meeting also introduced the proposed project and the sanctuary partner management structure. Requests were made for information on any biological surveys conducted in the area, draft sanctuary plans, zoning details, and recommended activities.

Following these meetings and information requests to NFA, statistical data on fisheries, geospatial information on fish sanctuaries, and various supporting reports and documents were received. This information has been incorporated and referenced in the relevant sections of the EIA.

NFA provided no objection or specific concerns.

6.4.2 Lucea Fishers Association

A meeting was held with members of the Lucea Fishers Association on July 16, 2024, where the proposed project was presented to them, and they were given the opportunity to field questions and to express their concerns.

In general, they were supportive of the proposed development and expressed the believe that this development is necessary for the advancement of the area and the development of the country. They however had the following questions and expressed the following concerns:

1. There is a space between the land and the overwater rooms, how far out will the extension go from the land and the sea?
2. Which channel will be affected, Bamboo beach channel or the main channel?
3. Will the reef be affected throughout the channel?
4. How the harbour is set up, will the boats be able to move freely through the construction without hindrance to reach inside the reef?
5. The sanctuary area was initially marked out when there was no Phase 2 planned. Now that Phase 2, which includes over-water rooms, is being developed, will there be a need to expand the sanctuary area, or will the current space be sufficient? Will the sanctuary area be extended as part of the Phase 2 development?
6. The main breeding ground, for pink parrot, lobster and octopus (sea cat) is from the pier going back to Grand Palladium Phase 1 to the northeast. Will the development of the overwater rooms impact this?
7. This is a main fish breeding area; will fishers be able to still enter the area?
8. Will there be a restocking of the lobster and crustacean in the Sanctuary since the proposed development will have an impact in the breeding ground?
9. What material will be used for creating the beaches in Phase 2? The use of manufactured sand or limestone for beach nourishment in Phase 1 created milky water, affecting the local fish population. This resulted in reduced fish catch as the fish migrated and the sediment also caused damage the reef.

10. Will there be an exclusion zone around the overwater rooms (bungalows)?
11. Will there be monitoring for sediments, water quality, seagrass and corals during the construction of the proposed project?

6.4.3 Lucea Fish Sanctuary

The Lucea Fish Sanctuary (LFA) have had a couple of meetings with Grand Palladium and have no major concerns, provided Grand Palladium fully complies with the recommendations and requirements. They further request that CL Environmental be contracted to monitor the project throughout the construction phase and provide periodic reports to the protected area management team and the fishing community.

LFA expressed a willingness and desire to continue working with Grand Palladium on this project and the long term management of the sanctuary.

6.4.4 Caribbean Molasses Company (Jamaica) Limited - Cane Point Pier

Project information was presented on July 12, 2024, to the General Manager, Spirits Pool Association Caribbean Molasses Company Jamaica Ltd (CMC).

The pier is used to ship molasses using J20 freighters with a draft of 9 – 12 m and a length of 150 m and beam of 50 m. Molasses is shipped typically 3 times per year nut at present no shipment is taking place as pier is in a state of disrepair, and the harbour is in the needs of dredging. The CMC is currently exploring ways of rehabilitating the pier.

Two concerns were raised;

1. During the loading process the odour of molasses drifting over towards the proposed project maybe unpleasant to some guests,
2. If CMC partners with an aggregate company, this aggregate will pose a major dust nuisance to the guests of Grand Palladium's new expansion.

6.5 INDEX OF STAKEHOLDER QUESTIONS AND CONCERNS

Table 6-1 summarises the questions, comments and concerns voiced by stakeholders throughout the public participation process. For each concern, a summarised response from CL Environmental is provided, based on information collated and assessed within this EIA. Section numbers are included in the table for easy referencing; these sections provide detailed information specific to each concern and recommended mitigation measures for any potentially negative impact.

Table 6-1 Index of questions and concerns voiced by stakeholder and responses from CL Environmental for each

Stakeholder	No.	Question or comment	Response	Report Section
Community	1	Demand on the local water supply system will be increased (worsening water supply problems).	Phase 2 will not directly impact water supply. The new hotel complex will source its drinking water from a Reverse Osmosis (RO) seawater desalination plant located in the industrial area, alleviating any potential pressure on the existing community water supply.	7.3.4.2
	2	Possible pollution from sewage effluent.	The existing wastewater treatment plant, currently servicing Phase I, has a capacity of 1,500 m^3/day. In response to the expansion of the hotel complex, the existing treatment plant is required to double its capacity from 1,500 m^3/day to 3,000 m^3/day to handle the increased daily volume. Further, the expansion of the wastewater treatment plant and the modification of the treatment process will address the odour issue and consistently provide effluent that meets NEPA standards. Specifically, the replacement of the sludge dehydration system to provide timely removal of dried sludge will reduce the odour emissions from the wastewater treatment plant.	7.3.4.3
	3	Whether locals (residents of Lucea and environs) will have equal employment opportunities? Whether competent workers will be employed for project implementation?	At its peak, the workforce at the construction site is expected to reach approximately 1,500 skilled labourers, with numbers fluctuating between 700 and 1,500 throughout the construction phase. This is anticipated to generate around 2,660 to 5,700 indirect and induced job opportunities. Once operational, the hotel aims to employ approximately 3,500 individuals, split between 1,600 jobs in Phase I and 1,900 in Phase II. This substantial workforce is projected to generate about 5,800 indirect jobs and 2,200 induced jobs. The hotel's operational phase will include comprehensive training programs for new employees, aimed at enhancing skills and expertise in the hospitality sector.	7.2.3.1 and 7.3.4.1
	4	Loss of beach access.	Public beaches will remain accessible. The proposed project has no impact on these beaches.	
	5	Increased crime (influx of criminal elements).	The proponent will work with the Municipal Corporation (Parish Council) and police to conduct background checks during employment drives, in order to reduce the possibility of hiring persons with criminal backgrounds.	
	6	Increased motor vehicle collisions caused by lack of adequate parking on the hotel property.	The development will provide a total of 325 parking spaces. Additionally, there is a designated area for a temporary bus stop. Employee parking spaces are situated in the staff quarters area. A Traffic Impact Assessment was undertaken to specifically address potential traffic management issues.	4.2.5 7.2.3.5 and 7.3.4.6
	7	Increased traffic congestion (in Lucea).	A Traffic Impact Assessment was undertaken to specifically address potential traffic management issues that may be potentially caused by the proposed project.	7.2.3.5 and 7.3.4.6
	8	Loss of livelihood for fisherfolk. Loss of fishing area.	Based on the observed spatial fishing patterns, designating the waters in front of the Grand Palladium hotel as a protected area would have minimal impact on fishers' incomes. The establishment of the Lucea Fish Sanctuary has the potential to increase the fish stock in the area, hence increasing fisher's catch and benefiting the local fishing industry.	7.3.4.9
	9	Destruction of/ damage to sea floor and marine ecosystems, e.g. coral reef. Loss of marine wildlife.	Benthic habitats and the associated biota may be potentially negatively impacted by the proposed project. Reef and seagrass communities, along with corals and other sessile organisms such as sponges, gorgonians, fanworms, and urchins living on the pavement near the impact area, are expected to return to normal conditions. Pilings and boulders will provide ecological volume both on the seafloor and in the water column. These hard structures will offer a substrate for colonization, which should change in composition over time. Fish may benefit from the presence of pilings, boulders, and shaded areas, which will act as Fish Aggregation Devices (FADs). This area may also be more managed, offering fish some protection from overfishing. Mitigation measures are recommended to reduce this potential impact.	7.2.2.2 and 7.3.3.1
	10	Increase in fugitive dust (dust pollution).	Site preparation involves various activities such as excavation, land clearing (including digging, loading, and removal of materials by trucks), and the storage of raw materials like sand and marl. These activities may potentially have a dual direct negative impact on air quality. Mitigation measures are recommended to reduce this potential impact.	7.2.1.4
	11	Possible relocation.	Relocation will not be required.	
	12	The proposed hotel expansion will not improve community development.	The hotel's operational phase will include comprehensive training programs for new employees, aimed at enhancing skills and expertise in the hospitality sector. This investment in training is anticipated to yield long-term benefits by improving employability and expanding career opportunities both within and beyond the hospitality industry.	7.2.3.1 and 7.3.4.1
	13	Damage to the beach and coastline. Possible beach erosion of neighbouring beach (in the vicinity of the molasses storage tanks).	Analysis of beach stability from 2004 to 2023 revealed that the beach is highly dynamic, with significant fluctuations in its profile. Breakwaters mitigate sediment transport, ensuring shoreline stability even during winter swells. The modelled erosion suggests	7.3.2.1

Stakeholder	No.	Question or comment	Response	Report Section
			sediment movement beyond the hotel swimming area, predominantly during peak swell conditions, with stabilization of the groyne being crucial to prevent further erosion.	
	14	Pollution/ damage of the ocean, e.g. Lucea Harbour.	The construction of the hotel and overwater villas may have several potential impacts to water quality. Natural hydrodynamic forces, such as wave action and currents, can exacerbate the spread of sediments and pollutants; these forces can transport silt and other particulates from the construction site downstream, affecting a larger area than just the immediate vicinity of the project. Simulation results during hotel operation indicate a complete flushing time of 8 hours for the north beach and 12 hours for the south beach. This suggests that in the event of actual contamination, beach closure would be necessary for approximately 8 to 12 hours (about half a day). Mitigation measures are recommended to reduce the potential impacts.	7.2.1.1 and 7.3.1.2
	15	Will modification influence/change natural water pattern (movement)?	Yes, changes will occur as a result of the proposed coastal project works. Wave-induced currents are crucial for coastal dynamics and sediment transport, with structures influencing current velocities and directions. Adjusting the gap between the proposed breakwaters is essential to manage sediment accumulation, increased flow, rip current formation, swimmer safety, and sand erosion. Mitigation measures are recommended to reduce the potential impacts.	7.3.1.4
Fisherfolk	16	Improper solid waste disposal from the over water suites (during operation), in the sea.	The operation of the hotel development has the potential to significantly increase solid waste generation and improper disposal can lead to pollution of the local marine environment. Mitigation measures are recommended to reduce the potential impacts.	7.3.4.4
	17	Will the villas be able to withstand adverse weather conditions/events.	The villas were designed based on severe modelled events. Specifically, the 1 in 50-year hurricane conditions under the RCP 8.5 50-year horizon was simulated. The proposed configuration reduced wave heights behind the structures to 0.5-1.0m, compared to 0.9-1.4m under current conditions, but the submerged structures' effectiveness during hurricanes is limited by static surge water levels. Despite these limitations, the structures maintain beach stability under normal conditions and have minimal impact on storm surge. Critical buildings, particularly along the North beach, should be elevated above this level to mitigate flood risks.	7.3.2.1 and 7.3.2.2
	18	No access to/ loss of fishing area. Loss of Livelihood for fisherfolk.	Based on the observed spatial fishing patterns, designating the waters in front of the Grand Palladium hotel as a protected area would have minimal impact on fishers' incomes. The establishment of the Lucea Fish Sanctuary has the potential to increase the fish stock in the area, hence increasing fisher's catch and benefiting the local fishing industry.	7.3.4.9
	19	Loss of marine wildlife.	Benthic habitats and the associated biota may be potentially negatively impacted by the proposed project. Reef and seagrass communities, along with corals and other sessile organisms such as sponges, gorgonians, fanworms, and urchins living on the pavement near the impact area, are expected to return to normal conditions. Pilings and boulders will provide ecological volume both on the seafloor and in the water column. These hard structures will offer a substrate for colonization, which should change in composition over time. Fish may benefit from the presence of pilings, boulders, and shaded areas, which will act as Fish Aggregation Devices (FADs). This area may also be more managed, offering fish some protection from overfishing. Mitigation measures are recommended to reduce this potential impact.	7.2.2.2 and 7.3.3.1
	20	Loss of beach access.	Public beaches will remain accessible. The proposed project has no impact on these beaches.	
	21	Whether natural or artificial sand would be used in the beach modification?	Interventions are necessary to expand the beach and address cliff stability. Sand will be sourced from either manufactured, dredged or imported sources.	4.2.4 and 4.4.3
Lucea Fishers Association	22	There is a space between the land and the overwater rooms, how far out will the extension go from the land and the sea?	The property's total sea frontage measures 2,607.46 meters, with the overwater bungalows accounting for a length of 252.41 meters. The proposed overwater rooms and connected boardwalks are situated between 5 to and 60 metres from the coastline.	4.2.3
	23	Which channel will be affected, Bamboo Beach channel or the main channel?	Both channels will be accessible; however, access to the Bamboo Beach channel may potentially be limited. Mitigation measures are recommended to reduce the potential impacts to maritime traffic.	7.2.3.6 and 7.3.4.7
	24	Will the reef be affected throughout the channel?	No, the reef will not be affected. Section 7.2.2.2 shows the impact area, which does not encompass the reef in question.	7.2.2.2
	25	How the harbour is set up, will the boats be able to move freely through the construction without hindrance to reach inside the reef?	Construction activities have the potential to negatively impact maritime activities within the project area, due to increased maritime traffic, machinery, and equipment.	7.2.3.6 and 7.3.4.7

Stakeholder	No.	Question or comment	Response	Report Section
			Mitigation measures are recommended to reduce the potential impacts.	
	26	The sanctuary area was initially marked out when there was no Phase 2 planned. Now that Phase 2, which includes over-water rooms, is being developed, will there be a need to expand the sanctuary area, or will the current space be sufficient? Will the sanctuary area be extended as part of the Phase 2 development?	This is a decision that will have to be addressed by the relevant authorities. Reef and seagrass communities, along with corals and other sessile organisms such as sponges, gorgonians, fanworms, and urchins living on the pavement near the impact area, are expected to return to normal conditions. Pilings and boulders will provide ecological volume both on the seafloor and in the water column. These hard structures will offer a substrate for colonization, which should change in composition over time. Fish may benefit from the presence of pilings, boulders, and shaded areas, which will act as Fish Aggregation Devices (FADs). This area may also be more managed, offering fish some protection from overfishing.	7.3.4.9, 7.2.2.2 and 7.3.3.1
	27	The main breeding ground, for pink parrot, lobster and octopus (sea cat) is from the pier going back to Grand Palladium Phase 1 to the northeast. Will the development of the overwater rooms impact this?	Section 7.2.2.2 shows the impact area, which does not encompass the reef. Benthic habitats and the associated biota within the project impact area may be potentially impacted by the proposed project. Reef and seagrass communities, along with corals and other sessile organisms such as sponges, gorgonians, fanworms, and urchins living on the pavement near the impact area, are expected to return to normal conditions. Pilings and boulders will provide ecological volume both on the seafloor and in the water column. These hard structures will offer a substrate for colonization, which should change in composition over time. Fish may benefit from the presence of pilings, boulders, and shaded areas, which will act as Fish Aggregation Devices (FADs). This area may also be more managed, offering fish some protection from overfishing. Mitigation measures are recommended to reduce any potential impacts.	7.2.2.2 and 7.3.3.1
	28	This is a main fish breeding area; will fishers be able to still enter the area?	It is designated as a fish sanctuary, which prohibits fishing. However, based on the observed spatial fishing patterns, designating the waters in front of the Grand Palladium hotel as a protected area would have minimal impact on fishers' incomes. The establishment of the Lucea Fish Sanctuary has the potential to increase the fish stock in the area, hence increasing fisher's catch and benefiting the local fishing industry.	7.3.4.9
	29	Will there be a restocking of the lobster and crustacean in the Sanctuary since the proposed development will have an impact in the breeding ground?	This is outside the scope of this project and will have to be addressed by the management of the Lucea Fish Sanctuary.	
	30	What material will be used for creating the beaches in Phase 2? The use of manufactured sand or limestone for beach nourishment in Phase 1 created milky water, affecting the local fish population. This resulted in reduced fish catch as the fish migrated and the sediment also caused damage the reef.	Sand will be sourced from either manufactured, dredged or imported sources. The construction of the hotel and overwater villas may have several potential impacts to water quality. Mitigation measures are recommended to reduce the potential impacts.	4.2.4 and 4.4.3 7.2.1.1 and 7.3.1.2
	31	Will there be an exclusion zone around the overwater rooms (bungalows)?	Exclusion zones are recommended, in particular around the swimming areas to prevent boasting accidents.	7.2.3.6 and 7.3.4.7
	32	Will there be monitoring for sediments, water quality, seagrass and corals during the construction of the proposed project?	Yes, construction monitoring will be conducted, and details of the monitoring plan are provided in section 9.2.	9.2
Caribbean Molasses Company Jamaica Ltd.	33	During the loading process the odour of molasses drifting over towards the proposed project maybe unpleasant to some guests.	To address the strong odour from a port that ships molasses, the following measures may be implemented: Odor Neutralizers and Masking Agents: • Use odour-neutralizing agents that chemically react with odour molecules to eliminate them. Odor-masking agents can also be used to cover up unpleasant smells, although neutralizers are generally more effective. Regular Cleaning and Maintenance: • Implement a rigorous cleaning and maintenance schedule for storage tanks, pipes, and handling equipment to prevent molasses residues from accumulating and decomposing, which can cause strong odours. Leak Detection and Repair: • Regularly inspect storage tanks, pipelines, and handling systems for leaks or spills and repair them promptly to prevent molasses from being exposed to the air. Controlled Ventilation:	

Stakeholder	No.	Question or comment	Response	Report Section
			• Ensure proper ventilation in storage and handling areas to prevent the buildup of odours. Controlled ventilation systems can help direct odours away from sensitive areas and towards treatment systems. Odor-Controlled Delivery Systems: • Use closed-loop systems for transferring molasses from storage to ships to minimize exposure to air. Loading and Unloading Times: • Schedule loading and unloading operations during times when the impact on nearby communities will be minimized, such as early morning or late evening when fewer people are present. Limit Exposure Time: • Reduce the amount of time molasses is exposed to the air during handling and transfer operations by using efficient and rapid processing techniques. Community Engagement and Communication: • Inform the local community about odour control measures in place and provide a channel for residents to report odour issues. Engage with the community to build trust and demonstrate a commitment to mitigating odours.	
	34	If CMC partners with an aggregate company, this aggregate will pose a major dust nuisance to the guests of Grand Palladium's new expansion.	To address the potential dust nuisance, the following measures may be implemented: Water Sprays and Misting Systems: • Use water sprays or misting systems to dampen aggregate piles and roadways, reducing the amount of dust that becomes airborne. Windbreaks and Barriers: • Erect physical barriers such as windbreaks or enclosures around storage piles and processing areas to minimize wind-induced dust dispersal. Dust Suppressants: • Apply chemical dust suppressants on aggregate piles, roadways, and work areas. These can include binding agents that form a crust on the surface, preventing dust from being lifted by the wind. Enclosed Conveyors and Transfer Points: • Enclose conveyors, transfer points, and material handling systems to contain dust. Use dust extraction and filtration systems to capture and remove dust from these enclosed areas. Regular Maintenance and Housekeeping: • Conduct regular maintenance and housekeeping activities to keep the port area clean. Remove dust accumulations from surfaces and equipment. Monitoring and Reporting: • Implement a dust monitoring program to measure dust levels at various locations within and around the port. Use this data to identify problem areas and adjust control measures as needed. Community Engagement and Communication: • Engage with the local community to inform them about dust control measures in place and provide a channel for reporting dust-related issues. Minimize Material Drop Heights: • Reduce the height from which materials are dropped during loading and unloading to decrease the amount of dust generated. Optimize Material Handling: • Schedule material handling operations during periods of low wind speeds to minimize dust dispersal. Covering Materials: • Cover aggregate piles with tarpaulins or similar materials when not in use to prevent wind erosion.	

7.0 IDENTIFICATION OF POTENTIAL IMPACTS AND RECOMMENDED MITIGATION

7.1 IMPACT MATRICES

Impact matrices were developed for both the site preparation/construction and operational phases of the proposed project. Each impact was assessed based on specific criteria, categorized into Physical, Biological, and Human/Social groups (Ogola, 2007). The criteria used for the assessment are described below, with ranking techniques outlined in Table 7-4:

- **Direction**: This describes the nature of the potential impact, which can be positive, negative, or indicate no impact (none).
- **Duration**: Environmental impacts have a temporal dimension and need to be considered over different phases of the project cycle.
- **Magnitude**: This measures the severity of each potential impact, indicating whether it is irreversible or reversible and estimating the potential rate of recovery. An impact's magnitude cannot be considered high if it can be successfully mitigated.
- **Extent**: This determines the spatial extent or zone of influence of the impact. An impact can be site-specific and limited to the project area, regional, extending beyond the local area, or national, affecting resources on a national scale and potentially being trans-boundary (international).

Additional factors considered during the impact analysis include the consultants' experience, documented impacts from similar projects, data collected, analysis of the proposed project's processes, information generated from models, concerns raised by stakeholders in social surveys, and discussions among the EIA study team. These considerations ensure a comprehensive and thorough assessment of potential environmental impacts.

Table 7-1 Ranking criteria utilised for duration, magnitude and extent of each potential impact

DURATION	**None (N) –** No temporal effect	**Short (S) -** Impacts lasting 0 – 10 years before recovery occurs. Impact does not persist after the activity ends.	**Medium (M) -** Impacts lasting 10 - 20 years before signs of recovery. Impacts on biological populations are not inter-generational.	**Long (L) -** Impacts are persistent and lasting over 20 years. Impacts on biological populations are over several recruitment cycles or generations of those populations.
MAGNITUDE	**None (N) -** No measurable change in availability of resources or function of systems. No measurable effect on people.	**Small (S) -** Changes in form and/or ecosystem function and/or a resource. The system maintains the ability to support ecosystem/ resource functions with only minor changes in community value and no overall loss/gain and is reversible. Only a small fraction of the local community is affected.	**Medium (M) -** Changes in form and/or ecosystem function and/or a resource. The system's ability to support ecosystem/ resource functions and economic benefit is affected but not lost and is reversible. Only a moderate fraction of the local community is affected.	**Large (L) -** Changes in form and/or ecosystem function and/or a resource. The system's ability to support ecosystem/resource functions and economic benefit is highly affected and irreversible. A large fraction of the local community is affected.
EXTENT	**None –** No spatial effect	**Local (L) -** Isolated effects within project site and its locality.	**Regional (R) –** Extended beyond local area/borders or offsite dispersion pathways.	**National (N)** - Widespread effect affecting the nation (and/or transboundary/international)

Table 7-2 Impact matrix for Site Clearance and Construction Phase

CATEGORY Environmental Receptor		IMPACT	DIRECT/ INDIRECT		DIRECTION			DURATION	MAGNITUDE	EXTENT
			DIRECT	INDIRECT	POSITIVE	NONE	NEGATIVE			
Physical	***Water Quality***	Increased levels of suspended solids from raw materials stored on-site, heightened turbidity and sedimentation from runoff, and potential contamination from leaks and spills of fuels, lubricants, and hazardous substances.	X				X	S	M	L
		Runoff from site, use of boulders for coastal structures, and construction activities for overwater villas and beach works can increase water turbidity and sedimentation. Natural hydrodynamic forces can further spread sediments and pollutants.	X				X	S	M	L
	Benthic Sediment	Disturbance during coastal construction activities can lead to sediment displacement, increased turbidity, and the release of pollutants trapped in the sediment,	X				X	S	M	L
	Noise	Use of heavy equipment significantly increase noise levels, impacting the noise climate and potentially affecting nearby residents, wildlife, and the overall soundscape.	X				X	S	S	L
	Air Quality	Emissions from construction equipment and transportation, as well as fugitive dust emissions, potentially affect local air quality, health, and vegetation.	X				X	S	S	L
Biological	***Terrestrial Flora and Fauna***	Vegetation clearance may lead to a reduction in local biodiversity, affecting ecological balance and leading to habitat loss.	X				X	L	M	L
		Loss of ecosystem services	X				X	L	S	L
		Potential relocation of endemics, such as Morass Royal (*Roystonea princeps*) and Broom Thatch (*Thrinax parviflora*).	X				X	S	S	L
		Fauna may experience temporary displacement and some habitat loss.	X				X	M	S	L
		Loss of roosting/nesting sites for Brown Pelicans (*Pelecanus occidentalis*).	X				X	M	S	L
	Benthic Habitats	Habitats and their resident biota could potentially be affected.	X				X	L	M	L
		Loss of ecosystem services.	X				X	L	M	L
	Seagrass Communities	Approximately 12,630.46 m² of seagrass may be impacted, with 1,758.43 m² within the buffer area and 10,872.03 m² directly affected.	X				X	L	M	L
		Loss of carbon sequestration (stored and ability to sequester additional carbon).	X				X	L	M	L
	Coral Communities	Marine construction activities may result in colony loss (for corals which cannot be relocated)	X				X	L	M	L
	Fish and Invertebrates	Construction activities can displace fish and invertebrates through habitat destruction.	X				X	S	M	L
	Intertidal Communities	Minimally impact the low-diversity, low-abundance rocky shore and intertidal communities, with species expected to recolonize post-construction and new structures potentially offering additional substrates for colonization.	X				X	S	S	L
	Sea Turtles	Site preparation and construction activities may temporarily displace sea turtles that use the area for foraging and nesting, with potential impacts including barriers like silt screens limiting access, increased noise from construction, and nighttime lighting.	X				X	S	S	L
Socioeconomic / Cultural	***Employment***	The construction site will employ about 1,500 skilled labourers, fluctuating between 700 and 1,500 throughout the phase, potentially creating 2,660 to 5,700 indirect and induced jobs.	X	X	X			S	M	N
	Wastewater	Improper disposal of wastewater at the construction campsite could harm water quality, potentially impacting aquatic ecosystems and human health.	X				X	S	S	L
	Solid Waste	Increased generation of solid waste. Improper disposal of this waste poses risks such as environmental pollution, habitat degradation, and visual blight, while also attracting vermin and threatening the health of workers and nearby communities.	X				X	S	S	L
	Health and Safety	Construction activities pose various risks, including potential accidental injuries and exposure to fugitive dust.	X				X	S	S	L

CATEGORY Environmental Receptor		IMPACT	DIRECT/ INDIRECT		DIRECTION			DURATION	MAGNITUDE	EXTENT
			DIRECT	INDIRECT	POSITIVE	NONE	NEGATIVE			
	Vehicular Traffic	Proposed road design accommodates construction traffic without significantly affecting the overall level of service (LOS) on the main road, while the service entrance may experience occasional delays averaging LOS C.	X				X	S	S	L
	Maritime Traffic	Construction activities for the project could disrupt fishing and maritime activities through increased vessel traffic, equipment deployment, and potential accidents, affecting local fishing operations, recreational boating, and other maritime activities.	X				X	S	S	L
	Aesthetics	Construction activities may temporarily reduce the area's aesthetic appeal, primarily due to visual intrusion from machinery, equipment, and temporary structures, as well as dust and debris accumulation, noise, light pollution, and alterations to natural features like vegetation and landform.	X				X	S	M	L
	Cultural and Heritage	No substantial evidence of Taino occupation was found; the JNHT determined that the site's cultural heritage does not warrant in situ preservation.	X			X		N/A	N/A	N/A

Table 7-3 Impact matrix for Operational Phase

CATEGORY Environmental Receptor		IMPACT	DIRECT/ INDIRECT		DIRECTION			DURATION	MAGNITUDE	EXTENT
			DIRECT	INDIRECT	POSITIVE	NONE	NEGATIVE			
Physical	***Drainage***	Improved drainage systems, such as the proposal of swales, open channels, and a Retention Buried Pond system to effectively manage surface water while minimizing discharge impacts on the coastline.	X		X			L	M	L
	Water Quality	Proposed drainage concept emphasizes the flushing capacity of the beach layout, maintaining/ improving water quality.	X		X			L	M	L
	Wave Climate	Localized wave energy reduction of approximately 40% around the proposed structures.	X		X			L	M	L
	Currents and Sediments	The influence of structures alters current directions, causing sediment accumulation on southern groynes and increased flow through gaps.	X			X		N/A	N/A	N/A
Natural Hazards	***Swell Events***	Breakwaters effectively reduce wave heights by 50%, crucial for shoreline protection against erosion.	X		X			L	M	L
	Hurricane Waves	Reduction in wave heights in the sheltered area behind structures.	X		X			L	M	L
Biological	***Reef and Seagrass Communities***	Hard structures (pilings and boulders) provide ecological volume (FADs, additional habitat and colonization surfaces).	X		X			X	M	L
	Sea Turtles	Operational activities, obstructions and lighting may impact turtle nesting and foraging activity.	X				X	L	M	L
		Protection from poachers and predators.	X		X			L	M	L
Socioeconomic / Cultural	***Employment***	Significant opportunity for job creation in Lucea (approximately 3,500 direct jobs split between Phase I and Phase II, along with 5,800 indirect and 2,200 induced jobs).	X	X	X			L	L	N
	Water Supply	Phase 2 of the hotel complex will not directly affect the local water supply as it will source drinking water from a Reverse Osmosis seawater desalination plant located in the industrial area, separate from the community supply.	X			X		N/A	N/A	N/A
	Wastewater	The existing wastewater treatment plant, currently servicing Phase I, must double its capacity from 1,500 m³/day to 3,000 m³/day to accommodate the increased volume.	X			X		N/A	N/A	N/A
	Solid Waste	The hotel's operational activities are expected to increase solid waste generation significantly, potentially leading to environmental pollution, aesthetic degradation, and wildlife harm, particularly if waste enters marine environments near coastal areas.	X				X	L	M	L
	Vehicular Traffic	Significant traffic increases during the hotel's operational phase, primarily due to expanded guest and staff requirements, affecting both the guest and staff entrances.	X				X	L	M	L
	Maritime Traffic	The introduction of overwater rooms and coastal structures poses potential disruptions to maritime activities, including obstruction of navigational paths and increased risks of collisions, particularly in low visibility conditions like night or adverse weather.	X				X	L	S	L
	Tourism	Poised to enhance the country's tourism offering by attracting more visitors and boosting local tourism revenue.	X		X			L	L	N

7.2 SITE CLEARANCE AND CONSTRUCTION

7.2.1 Physical

7.2.1.1 Water Quality

Impact

The construction of the hotel and overwater villas may have several potential impacts to water quality.

LAND-BASED CONSTRUCTION

- The use of raw materials, such as marl, stored on-site or in staging areas, can significantly increase the levels of suspended solids in ground and surface water. During heavy rainfall, runoff from these materials can lead to higher turbidity and sedimentation in nearby rivers, streams, and coastal areas. This sedimentation can smother benthic habitats, reducing light penetration and affecting the photosynthesis of seagrasses and corals.
- The storage and handling of fuels, lubricants, and hazardous substances present additional risks. Construction equipment requires regular maintenance and operation, during which hydraulic fluids, oils, and other chemicals may leak. These substances can seep into the soil and contaminate groundwater, eventually making their way into surface water bodies. Such contamination can degrade water quality, posing threats to both benthic life and human health.

COASTAL CONSTRUCTION

- Coastal works such as dredging, temporary success roads, pile driving, has the potential to impact the marine environment.
- The use of heavy machinery and equipment on or near the water has the potential to result in spills of fuels, oils, and other chemicals. These pollutants have the potential to spread quickly in the marine environment which further has the potential to impact a wide range of organisms, from plankton to larger fish and marine mammals.

Natural hydrodynamic forces, such as wave action and currents, can exacerbate the spread of sediments and pollutants; these forces can transport silt and other particulates from the construction site downstream, affecting a larger area than just the immediate vicinity of the project.

Primary Recommended Mitigation

i. Erosion and Sediment Control:
    a. During construction, the project site should include sediment control measures such as turbidity barriers/silt screens and should be erected around the entire work area to prevent the dispersion of sediments and contaminants throughout the water column. These should be placed so as to reduce/contain the resultant sediment plume during the activities. Construction activities should only continue when these barriers are fully

operational, that is; placed correctly; calm to moderate sea conditions; without damage. These barriers are particularly important when operations occur near or may influence sensitive ecosystems and species such as coral reefs and seagrass beds and or filter feeding organisms and fish. It may be necessary to have multiple layers of sediment barriers around work areas

b. Erosion Control Mats: Use erosion control mats and geotextiles on exposed soil to reduce erosion.
c. Conduct sediment dispersal calculation rates on coral reefs and seagrass beds within 200 meters of the proposed villas and other marine works and at control stations, on a monthly basis, for comparison to background levels. Pre-construction sedimentation rates should therefore also be conducted and used as a baseline for comparison.
d. All activities should be limited to the minimal working area, and as such reducing the extent of the footprint. No activities and or placement of anchors or materials should be done placed outside the approved area.

ii. Stormwater Management:
   a. Retention Ponds: Construct retention ponds or sediment basins to capture and treat stormwater runoff before it enters water bodies.
   b. Drainage Systems: Design and implement efficient drainage systems to direct stormwater away from vulnerable areas and into treatment facilities.

iii. Proper Storage and Handling of Hazardous Materials:
   a. Raw Materials:
      i. Designate a central area for the storage of raw materials.
      ii. Area should be lined in order to prevent the leakage of chemicals into the sediment.
      iii. Stockpile fine grained materials (sand, marl, etc.) away from drainage channels and low berms should be placed around the piles, which themselves should be covered with tarpaulin to prevent erosion.
      iv. Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne.
   b. Hazardous Substances:
      i. Storage of fuels and oils, and hazardous substances should be in clearly marked containers (tanks/drums etc.) indicating the type and quantity being stored.
      ii. Containers should be surrounded by bunds to contain the volume being stored in case of accidental spillage.
      iii. Equipment should be stored on impermeable hard stands surrounded by berms to contain any accidental surface runoff.
      iv. Vehicle refuelling facilities must be situated on impermeable surfaces served by an oil trap, run-off collection system. Sediment basins and oil water separators should be constructed to intercept storm water before it is discharged.

v. Refuelling of boats should only be done at anchor out at sea if the sea conditions are calm, otherwise, all refuelling should be done when docked at land. Appropriate refuelling equipment (such as funnels) and techniques should always be used.

c. Transport:
   i. In terms of transporting equipment, utilise the paths of the planned roadways rather than creating temporary pathways just for equipment access.
   ii. Raw materials such as marl and sand should be adequately covered within the trucks to prevent any escaping into the air and along the roadway.

d. Spill Response Plan:
   i. Develop and implement a spill response plan, including spill kits and training for workers to handle and clean up spills promptly and effectively.
   ii. Appropriate minor spill response equipment (for containment and clean- up) will kept on site, including oil absorbent pads and disposal bags.

e. Construction Equipment Maintenance:
   i. Regular Inspections: Conduct regular inspections and maintenance of construction equipment to prevent leaks and ensure optimal functioning.
   ii. Designated Maintenance Areas: Perform equipment maintenance in designated areas with proper containment measures to prevent contamination of soil and water.

iv. Natural Environment

a. Relocation of sensitive species should be done if; they are suitable for relocation (that is suitable substrate, health and over all viability), those species fall within the potential impact area; and if mobile invertebrates are in or around the potential impact area. Sensitive organisms and systems in and outside the impact area include; hard and soft corals, sponges, seagrass and mobile invertebrates such as urchins, sea cucumbers, starfish and conch. Detailed Seagrass and Coral Mitigation Plans must be prepared for approval by NEPA.

b. Alternative mitigations should be proposed when relocation is unlikely to be successful.

c. Where possible, as little of the natural environment should be relocated or removed. Habitat fragmentation and species displacement should be temporary, with the placement of silt screens, construction materials and equipment as well as general human activity in the area.

d. Structures placed on the seafloor may cause habitat fragmentation and displace some species, however they may also serve to add ecological volume, providing substrate for organisms to settle and colonize and eventually may serve some ecosystem functions.

e. Any temporary floating structures and /or vessels should be placed in areas with less sensitive species where possible. Floating structures anchored or moored over seagrass beds or coral.

v. Monitoring and Compliance:
   a. Weekly monitoring of water quality parameters such as temperature, salinity, pH, Dissolved Oxygen, light irradiance, turbidity and Total Suspended Solids (TSS) in and around the project area should be conducted during construction for the first 3 months of construction. Monitoring can be conducted fortnightly thereafter.
   b. Adaptive management, including stoppage of works during adverse weather conditions and using monitoring data to adapt and refine mitigation measures as needed to address any emerging issues promptly.

7.2.1.2 Benthic Sediment

Impact

Marine works, such as dredging, construction, or other activities that disturb the seabed, can resuspend sediments. This resuspension can have several potential impacts on marine life, including seagrass, fish, coral and other organisms.

Recommended Mitigation

See Primary Recommended Mitigation under section 7.2.1.1.

7.2.1.3 Noise

Impact

TERRESTRIAL

The construction activities for the hotel and coastal works will involve site clearance using heavy equipment such as bulldozers, backhoes, and jackhammers. These activities and the equipment required have the potential to have a negative impact on the noise climate of the area.

Construction noise has the potential to lead to short-term impacts that vary in duration and magnitude. The noise levels produced during construction are influenced by several factors, including the scale of the project, the specific phase of construction, the condition and maintenance of the equipment, its operating cycles, and the number of pieces of equipment operating simultaneously. To understand the potential construction noise impacts that may arise from the project, typical noise levels associated with various types of construction equipment are identified in Table 7-4. The use of this equipment will inevitably increase noise levels in the vicinity of the construction site, potentially affecting nearby residents, wildlife, and the overall soundscape.

Table 7-4 Typical construction equipment noise levels

Type of Equipment	Typical Sound Level at 50 ft. (dBA Leq.)
Dump Truck	88
Portable Air Compressor	81
Concrete Mixer (Truck)	85

Type of Equipment	Typical Sound Level at 50 ft. (dBA Leq.)
Jackhammer	88
Scraper	88
Bulldozer	87
Paver	89
Generator	76
Piledriver	101
Rock Drill	98
Pump	76
Pneumatic Tools	85
Backhoe	85

Adapted from - Route 101A Widening and Improvements, City of Nashua Hillsborough County, New Hampshire; McFarland-Johnson, Inc. May 30, 2007

UNDERWATER

Underwater noise generated by coastal construction activities, such as pile driving, dredging, and machinery operation, marine vessels, can cover a broad range of frequencies, typically from low-frequency rumblings to high-frequency impacts. These noises can have various detrimental effects on fish and other tropical nearshore species:

Frequency and Intensity

- Low-Frequency Noise: Low-frequency sounds (below 1 kHz) can travel long distances underwater and may disrupt the migration patterns and communication of marine species. Species that rely on low-frequency sounds for navigation, such as some fish and marine mammals, may experience disorientation or stress.
- High-Frequency Noise: High-frequency sounds (above 1 kHz) can cause physical damage to hearing structures in fish and other marine animals. This can affect their ability to detect predators, locate prey, and communicate.

Behavioural Changes

- Disruption of Communication: Many marine species use sound for communication and social interactions. Increased underwater noise can interfere with these vocalizations, affecting mating behaviours, territory establishment, and predator-prey interactions.
- Altered Feeding and Breeding: Noise pollution can cause fish and other species to alter their feeding habits and breeding behaviours. Increased noise levels can lead to reduced feeding efficiency and decreased reproductive success.

Stress and Physiological Effects

- Increased Stress Levels: Prolonged exposure to high noise levels can lead to chronic stress in marine animals, affecting their overall health and survival. Stress responses may include changes in hormone levels and immune function.

- Hearing Damage: High-intensity sounds can cause physical damage to the auditory organs of fish and other species, leading to temporary or permanent hearing loss. This can impair their ability to detect important environmental cues.

Habitat Displacement

- Avoidance Behaviour: Fish and other marine species may avoid areas with high noise levels, leading to habitat displacement. This can reduce their access to critical habitats for feeding, breeding, and shelter.

Impact on Coral Reefs

- Coral Health: Excessive noise can also affect coral reef ecosystems indirectly by altering the behaviours of key species such as herbivorous fish. Changes in fish behaviour can impact coral health and the overall balance of the reef ecosystem.

In summary, underwater noise from coastal construction can significantly impact the behaviour, health, and distribution of tropical nearshore species, affecting their communication, feeding, reproduction, and overall well-being.

Recommended Mitigation

Noise generated from site clearance activities should be managed to ensure that levels in residential areas do not exceed 55 dBA during daytime hours (7 am – 10 pm) and 50 dBA during nighttime hours (10 pm – 7 am). If baseline noise levels already exceed these thresholds, the construction noise should not increase baseline levels by more than 3 dBA.

Appropriate mitigation measures can be implemented to minimize the impact of construction noise and ensure a more acceptable noise climate for surrounding communities and minimizing the disturbance to daily activities. These possible measures include:

i. Scheduling and Planning:
    a. Restrict construction activities to regular working hours (7 am – 6 pm) to avoid disturbances during nighttime.
    b. Schedule particularly noisy activities during times when they will cause the least disruption, avoiding early mornings, late evenings, and weekends.
    c. Minimize engine idling when equipment is not in use to reduce unnecessary noise.
    d. Where possible, position noisy equipment and staging areas as far from sensitive receptors
    e. Restricting noisy activities like construction and seismic surveys during breeding and migration seasons
ii. Equipment Management:

a. Use equipment that has low noise emissions as stated by the manufacturers, and properly equip machinery with noise reduction devices, such as effective mufflers and silencers to reduce noise emissions. Newer models of construction equipment are typically designed to operate more quietly and should be considered.
b. Ensure equipment is maintained to prevent excessive noise from worn or faulty parts.

iii. Worker Protection and Training:
a. Construction workers operating noise-generating equipment should be provided with appropriate hearing protection. Workers handling equipment that produces continuous noise levels of 80 dBA or more for 8 hours or longer should use earmuffs. Those exposed to prolonged noise levels between 70 - 80 dBA should wear earplugs.
b. Train construction workers on the importance of noise control and encourage best practices to minimize noise generation.

iv. Monitoring and Compliance:
a. Conduct regular noise monitoring (monthly) at various points around the construction site to ensure compliance with noise standards.
b. Adhere to the 24-hour construction noise guidelines as stated in the environmental permit (usually 70 dBA or 75 dBA).

v. Community Engagement:
a. Provide advance notice to neighbouring businesses about upcoming noisy activities and expected durations.

7.2.1.4 Air Quality

Impact

Site preparation involves various activities such as excavation, land clearing (including digging, loading, and removal of materials by trucks), and the storage of raw materials like sand and marl. These activities may potentially have a dual direct negative impact on air quality:

- Air Pollution from Equipment and Transportation: The use of construction equipment and the transportation of materials generate emissions, contributing to air pollution. This includes the release of exhaust gases such as carbon monoxide, nitrogen oxides, and particulate matter, which can deteriorate local air quality.
- Fugitive Dust Emissions: Dust generated from construction areas and raw materials stored on-site or transported to the site can become airborne, creating fugitive dust. This dust can affect the health of construction workers and the resident population, causing respiratory issues and other health problems. Additionally, it can settle on and damage local vegetation, potentially disrupting the ecosystem.

Recommended Mitigation

Dust control mechanisms are proposed as part of the Phase 2 construction methodology (section 4.4.1.2). To supplement this, it is recommended:

i. Dust Control:
    a. Areas, including roads, should be dampened every 4-6 hours or within reason to prevent a dust nuisance and on hotter, more windy days, this frequency should be increased.
    b. Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne; this includes those being transported on trucks.
    c. Minimize cleared areas to those that are needed to be used.
    d. Ensure material stockpiles and construction debris are stored away from the roadway
ii. Equipment Emissions:
    a. Utilize construction machinery and vehicles that meet stringent emission standards.
    b. Ensure equipment is regularly maintained to operate efficiently with minimal emissions.
    c. Implement policies to reduce unnecessary idling of construction vehicles and machinery.
iii. Monitoring and Compliance:
    a. Implement a monthly air quality monitoring program to regularly assess the levels of particulate matter and other pollutants.
    b. Ensure all activities comply with local air quality regulations and standards.
iv. Worker Protection:
    a. Provide construction workers with appropriate Personal Protective Equipment (PPE), such as masks and N95 respirators, to protect against dust and emissions.
v. Community Engagement:
    a. Keep local business informed about construction activities and potential air quality impacts.
    b. Provide a contact point for concerns and complaints.

7.2.2 Biological

7.2.2.1 Terrestrial Flora and Fauna

Impact

The proposed project activities have the potential to significantly impact large and endemic trees within the project boundary. Locations of the endemic Morass Royal (*Roystonea princeps*) were recorded during the vegetation survey (Plate 7-1); both seedlings and large trees are shown in Figure 7-1 and GPS coordinates provided in Table 7-5. The removal or disturbance of these trees, such as Morass Royal (*Roystonea princeps*) and Broom Thatch (*Thrinax parviflora*), may not only reduce local biodiversity but also affect the ecological balance and habitat quality. The loss of large trees can lead to increased soil erosion, altered microclimates, and the disruption of native fauna that depend on these trees for shelter and food.

Despite being low in diversity and highly disturbed, areas such as open fields still serve as habitats for fauna, including birds and herpetofauna recorded during the survey. These animals will be temporarily displaced but are likely to return after the initial phases of the project. Of particular concern is the area identified as a roosting/nesting site for Brown Pelicans (*Pelecanus occidentalis*), which will be destroyed due to the essential land clearance required for development. This loss is unavoidable given the project's needs.

Table 7-5 Coordinates of potentially impacted Morass Royal seedling groupings and trees

Eastings	Northings	Eastings	Northings
628212.493710	700546.592374	627919.758977	700363.157312
628081.972861	700373.792056	628013.044330	700341.345876
628131.307806	700207.383901	628151.299579	700294.845801
628089.761566	700476.020269	628141.374842	700286.652861
628124.027514	700250.781641	628154.019527	700273.372536
628153.922108	700286.172190	628165.736744	700311.075739
628105.160780	700153.204436	628182.168535	700306.858849
627991.174463	700360.501841	628089.755012	700233.181598
628130.548348	700309.906034	628161.887607	700301.078414
628145.835096	700311.079889	628022.057076	700476.571931
627881.363406	700250.065096	627926.203319	700391.470035
628023.269797	700437.467417	628004.839401	700291.763215
627965.670977	700540.759353	627921.075932	700331.550503
628144.206287	700283.063966	628184.494565	700247.767749
628053.170211	700195.963497	628169.977707	700206.907653
628153.106261	700275.014468	627962.921753	700424.502381

Plate 7-1 Example of tagged endemic Morass Royal Palm (*Roystonea princeps*)

Recommended Mitigation

The proposed project plans include the reforestation of gardens and access roads using indigenous plant species. Further, it is proposed that any tree that must be removed during construction will be replaced through a comprehensive replanting effort. A detailed landscaping plan will be presented to the NEPA for review and approval. In addition to these efforts, the following are recommended:

i. In instances where possible, some of the larger trees (> 25cm) within the project area should be retained as part of the landscaping plans for the development. This will help to maintain some of the habitat for fauna within the areas.
ii. Establish protective zones around significant trees that cannot be moved to minimize disturbance.
iii. Endemic plant species identified and logged during the flora assessment should be relocated or placed in a nursery, prior to land clearance. If and when other endemic seedlings or trees are identified, whether Morass Royal (*Roystonea princeps)*, Broom Thatch (*Thrinax parviflora*) or other species, these should also be relocated.
iv. The planting of representative native tree species (including endemics) that were recorded during the flora assessment as a part of the landscaping when the development is completed, is being encouraged. This initiative will improve the flora diversity, as bolster the habitat for fauna.
v. The preservation of any active Brown Pelican (*Pelecanus occidentalis*) nests should be a priority. An experienced ecologist should be engaged by the developers to assess the roosting area a minimum of 1 month before land clearance in this zone. Weekly assessments should be done by the ecologist up to the commencement of land clearance of this space. The ecologist should ensure that all nests are clear (no eggs or hatchlings) before land clearance begins. The possibility of nest relocation should be explored by the ecologist just before the land clearance stage begins.

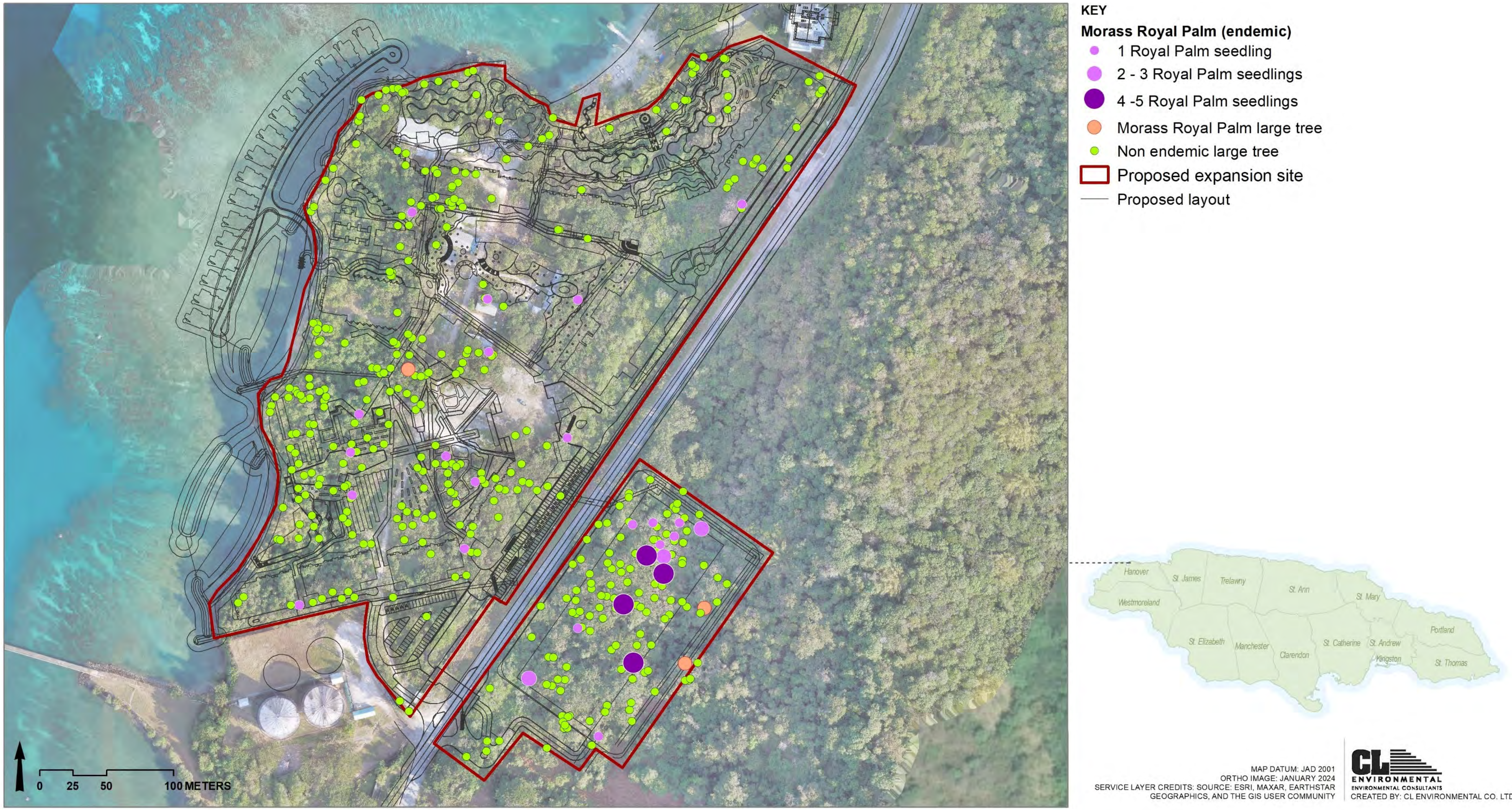


Figure 7-1 Impacted endemic Morass Royal (*Roystonea princeps*) seedlings and trees

7.2.2.2 Benthic Habitats

Impact

Benthic habitats and the associated biota may be potentially negatively impacted by the proposed project. Table 7-6 details the potentially impacted benthic habitats within the project footprint and buffer.

The potential loss of benthic habitats in the impact and buffer areas is expected to lead to a reduction in some ecosystem services, such as food security and carbon sequestration. Benthic environments, including seagrass beds and coral reefs, sustain marine life, supporting local fisheries, and sequestering atmospheric carbon. While there is the potential for permanent loss impacts may be permanent if these habitats undergo irreversible changes, others may be temporary as ecosystems gradually recover. The overall extent of these losses is anticipated to be relatively small. Figure 7-2 illustrates the potentially impacted habitats.

Details of the potentially impacted sensitive species (corals and seagrass) are given in subsequent sections.

Table 7-6 Potentially impacted benthic habitats within the project footprint and buffer

Habitat	Buffer	Impact	Total
Forereef	311.67	425.55	737.22
Intertidal rock	5.87	56.28	62.14
Patch reef	66.40	151.35	217.75
Pavement/rock/rubble	822.45	3199.21	4021.67
Sand/silt	38.97	1716.20	1755.18
Seagrass	3268.06	19917.65	23185.71
Total	**4513.43**	**25466.25**	**29979.67**

Recommended Mitigation

The surrounding benthic and intertidal community including seagrass, hard corals, fish, urchins and other invertebrates may be impacted by sedimentation and smothering, habitat fragmentation/loss, loss of suitable breeding, foraging and nursery grounds, increased water turbidity and suspended solids and species loss.

See Primary Recommended Mitigation under section 7.2.1.1.

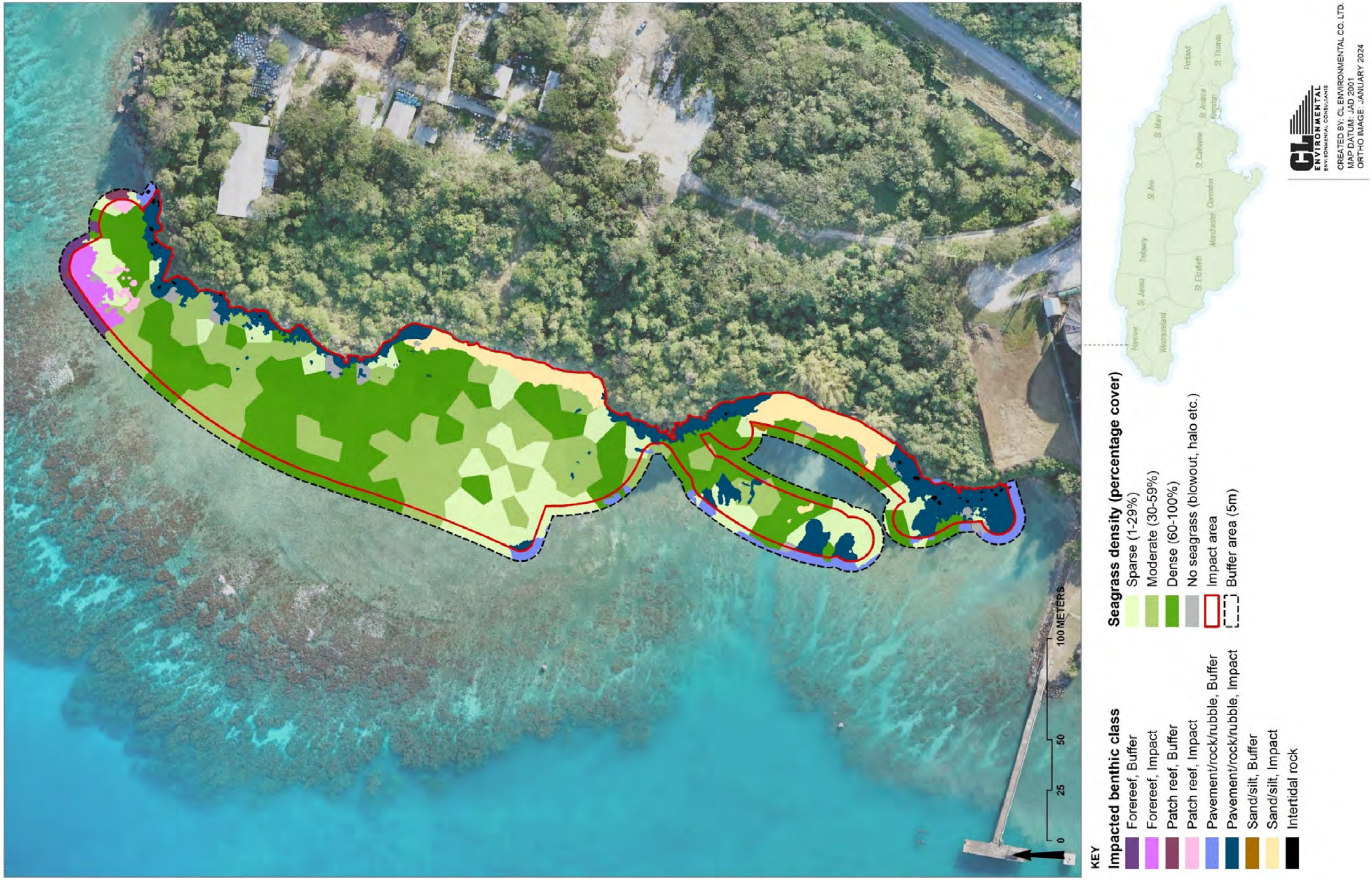


Figure 7-2 Impacted benthic habitats

7.2.2.3 Seagrass Communities

Impact

Sections of the project footprint lie within an expansive seagrass bed. A 5-meter buffer outside of the project footprint was applied to account for the active working area and accidental seagrass damage during construction.

Estimates for seagrass coverage were determined based on density/percentage cover, reflecting the amount of seagrass present relative to the total surveyed area. This approach acknowledges that the total area surveyed includes habitats where seagrass may be absent or present at low densities, thus explaining why the total surveyed area differs from the total area covered by seagrass. This method accounts for variability in seagrass distribution and density across different substrate types and environmental conditions within the study area.

Approximately 12,630.46m² of seagrass within the project footprint, including buffer areas, may be impacted. 1,758.43 m² is within the 5m buffer area and 10,872.03m² is in the direct impact area. Figure 7-3 shows the affected seagrass and its relocation suitability, and Table 7-7 provides a detailed breakdown.

Seagrass suitability was evaluated based on substrate composition, species composition, and density within the project area. Thalassia-dominated seagrass beds were identified as optimal candidates for relocation efforts due to their resilience and ecological importance. However, despite the prevalence of Thalassia in the project area, variations in seagrass density and substrate types were observed.

Areas characterized by pavement or very shallow, as well as very silty sediment, were deemed unsuitable for relocation. These conditions typically lack sufficient root structure and sediment stability required for successful transplantation. In locations where sediment depth and seagrass density were moderate, relocation suitability was considered suboptimal. Such areas may pose challenges in maintaining seagrass health during and after relocation efforts. Conversely, areas characterized by dense Thalassia cover and deep sand were identified as suitable for relocation. These areas provide favourable conditions for robust seagrass growth and establishment, facilitating successful relocation initiatives.

Table 7-7 Potential seagrass within the project footprint and buffer

Seagrass Suitability	Buffer (m²)	Impact (m²)	Total (m²)
Not ideal	515.49	3,405.86	**3,921.35**
Not suitable	278.19	2,563.76	**2,841.95**
Suitable	964.76	4,902.41	**5,867.17**
Total	**1,758.43**	**10,872.03**	**12,630.46**

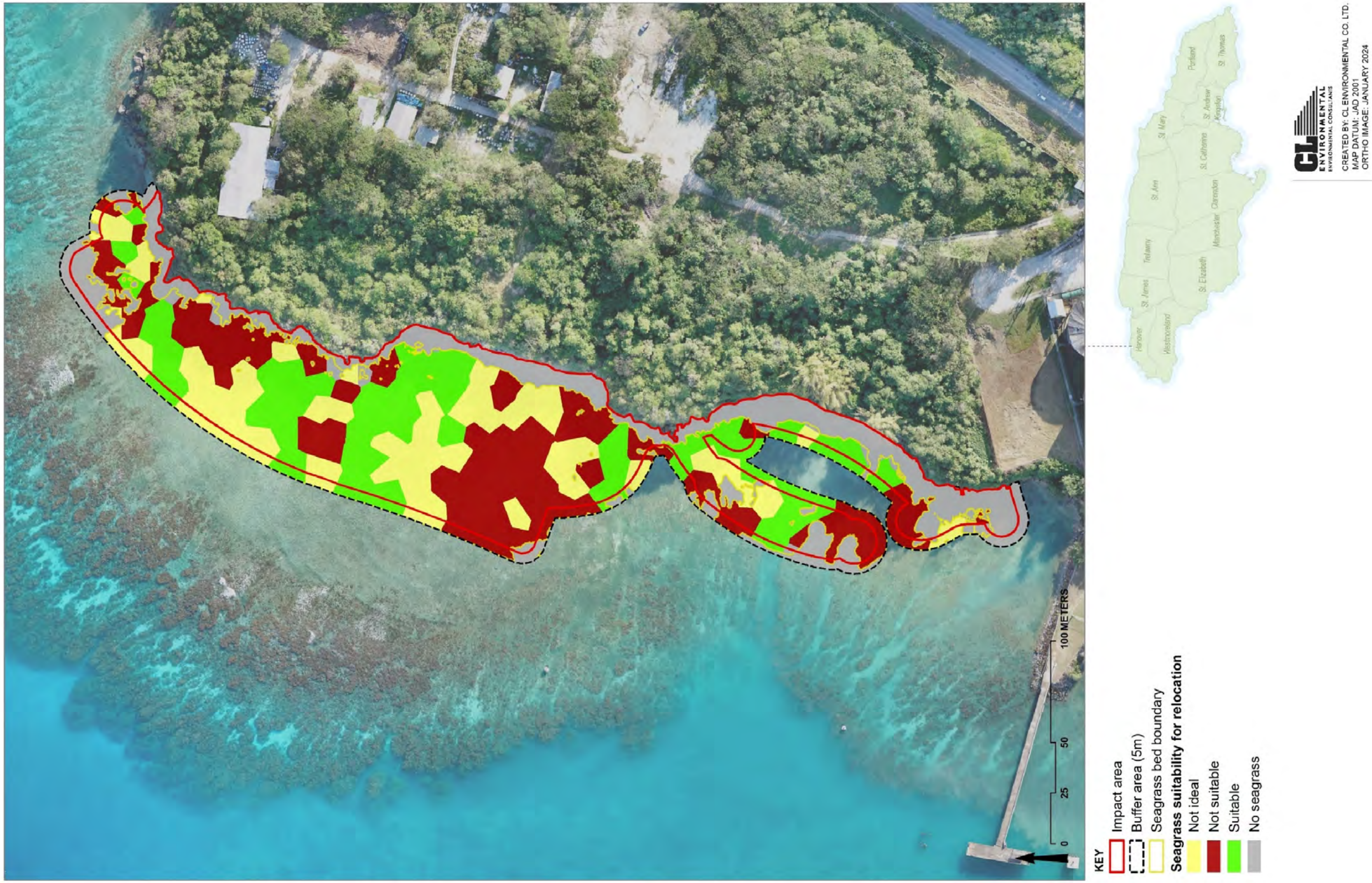


Figure 7-3 Impacted seagrass suitability

CARBON SEQUESTRATION AND STORAGE

As detailed in the baseline description of the seagrass beds, much of the seagrass habitat in question show sparsely distributed grass with a reduced root system (due to hard or rocky sediment) and shorter blade lengths. This is also shown in the variation in blue carbon values. Seagrasses found in sandier areas have greater carbon storage.

Researchers have repeatedly noted a positive correlation between sediment grain size and carbon content (Oreska M. P. J., 2017) (Röhr E., 2018) (Prentice C., 2020), with fine grained sediments having a greater available surface area, higher porosity (Dahl M., 2016), and more effectively binding organic carbon (Novak M., 2020).

The ability to store and sequester carbon varies within seagrass bed and substrate types. Based on the findings of the EIA, sections within the study area which possess sand, silty and muddy substrates are seen to store more soil carbon, than areas with firmer substrate such as rock and rubble which accumulate and store less soil carbon. Most of the stored soil carbon within the impact area can be found in silt and sandier arears which are also the areas to be relocated.

Carbon stored in the above and below ground biomass (roots and shoots) varies within the impact area. The ability to sequester and store more carbon is related to several environmental factors such as hydrodynamic activity and nutrient inputs. More sheltered areas of seagrass beds (reduced currents) in general have higher potential of carbon storage while areas with higher nutrient inputs such as run off and proximity to rivers, drains or gullies also have a higher potential for carbon storage.

According to (Fourqurean, 2012) (Kennedy, 210) (Lavery, 2013) and (Macreadie, 2019), carbon sequestration in seagrass beds can vary with substrate type. Seagrass beds are highly productive coastal ecosystems that play a significant role in carbon sequestration and storage. The substrate, or the type of sediment or soil in which seagrasses grow, can influence the carbon sequestration capacity of seagrass beds in several ways:

- Sediment Composition: The composition of the sediment can affect the availability of nutrients and organic matter, which are essential for seagrass growth and productivity. Different sediment types may vary in their organic carbon content, nutrient levels, and texture, which can influence the seagrass growth rate and, consequently, carbon sequestration.
- Particle Size and Porosity: The size and porosity of the sediment particles can affect water movement and nutrient exchange within the seagrass bed. Fine sediments with smaller particles tend to have higher organic carbon content and provide more favourable conditions for seagrass growth and carbon sequestration compared to coarse sediments.

Table 7-8 and Table 7-9 show the estimated carbon storage values of above and below ground biomass, soil carbon values within the impact and buffer areas.

Table 7-8 Estimated carbon stored in vegetative and soil seagrass components in the buffer area

Estimated carbon stored in Buffer Area (MgC)		
Seagrass Suitability	Vegetative	Soil
Not ideal	0.016	1.004
Not suitable	0.009	0.542
Suitable	0.030	1.879

Table 7-9 Estimated carbon stored in vegetative and soil seagrass components in the impact area

Estimated carbon stored in Impact Area (MgC)		
Seagrass Suitability	Vegetative	Soil
Not ideal	0.106	6.634
Not suitable	0.080	4.993
Suitable	0.153	9.548

The IPCC have set a default rate for seagrass carbon sequestration (0.43 t C ha-1 yr-1) and research by (Oreska M. P. J., 2020) supported this value for initial restoration up to 10 years, but further research is considered necessary to confirm that the rate is applicable globally.

SEAGRASS PRODUCTIVITY

Seagrasses present within the impact area will critically suffer from construction activities which result in increased sedimentation, shading, water quality degradation, hydrodynamic changes and biological interactions. The productivity of seagrass beds is typically dependent on the availability of light, wave activity, biodiversity and the presence of nutrients within the water column. Results of baseline assessments conducted within the study area indicate slight variances in seagrass productivity as they fluctuate around +/- 0.02 g/m^{2-14} between sites.

Seagrass productivity may be impacted by marine construction activities through direct physical disturbance such as mechanical damage from dredging, anchoring and the movement of heavy equipment which can physically damage or uproot seagrass beds. Sediment displacement can lead to the possible burying of seagrasses which will hinder their ability to photosynthesize. Shading from structures during the construction and operation process will also lead to the reduction of light available for continued productivity and may result in death of beds within these areas.

Water quality degradation such as increased turbidity, nutrient runoff and pollutant discharge will promote unfavourable conditions for seagrass growth. These may lead to an increase in competition for light which may be brought about by eutrophication, algal blooms and high turbidity. Where it is possible for pollutants to be discharged such as heavy metals and hydrocarbons, these toxins may be fatal to the existing ecosystem. Additionally, the disruption of sediment stability due to coastal construction may also change local hydrodynamics and result in altered water flow; this could result in the accumulation of pollutants within the impact and buffer areas which will negatively impact seagrass health. Increased erosion and sedimentation may also occur due to alterations in coastal morphology. Construction activities may lead to the long term disturbance of fauna within seagrass beds. Fish and invertebrate species graze within seagrass beds may be removed leading to the overgrowth of epiphytes on seagrass blades.

Recommended Mitigation

See Primary Mitigation in section 7.2.1.1.

- Habitat management and Restoration in the Lucea Sanctuary. This may include activities such as identifying within areas for habitat and or species restoration or rehabilitation, active removal of trash/litter and invasive species and implementing erosion control in seagrass beds.
- To offset the loss of blue carbon, and in collaboration with the Lucea Fish Sanctuary various carbon offset projects that specifically target blue carbon ecosystems will be implemented. These projects will focus on restoring and conserving seagrass beds, mangroves, and other vital habitats. Additionally, social outreach will include teaching and implementation of sustainable fishing and aquaculture practices to minimize habitat disruption and carbon release. This will be achieved with the active involvement of local communities and the sanctuary's management, ensuring that sustainable practices are adopted and maintained.
- Community engagement and citizen science initiatives in projects in and around the sanctuary

POTENTIAL SEAGRASS RELOCATIONAAREAS

Phase 1 of the hotel construction project included identifying potential sites for seagrass relocation. One of these identified sites was utilized for seagrass transplantation, and the seagrass continues to thrive at this relocation site as of the time of the survey (CL Envrionmental Co. Ltd., 2006). Location suitability was chosen based on the following criteria Physio-chem data, wave climate, bathymetry and currents including a hydrodynamic model (Figure 7-4).

Approximately 4,902.41m^2 of seagrass which has the potential to be impacted by the proposed project was found to be suitable for relocation (Table 7-10). Seagrasses located within the 5m buffer are potentially highly vulnerable that is they may be potentially damaged or removed. This area also represents an area that has the potential to recover post construction activities.

Table 7-10 Seagrass suitability within the project footprint and buffer

Seagrass Suitability	**Buffer (m^2)**	**Impact (m^2)**	**Total (m^2)**
Not ideal	515.49	3,405.86	**3,921.35**
Not suitable	278.19	2,563.76	**2,841.95**
Suitable	964.76	4,902.41	**5,867.17**
Total	**1,758.43**	**10,872.03**	**12,630.46**

Source: (CL Envrionmental Co. Ltd., 2006)

Figure 7-4 Ideal potential relocation areas

7.2.2.4 Coral Communities

Impact

Marine construction activities in shallow nearshore areas may lead to the loss of coral colonies across different habitats. The majority of the coral communities within the project area consist of various species encrusting on pavement and rocks. Due to their attachment to these substrates, successful relocation of these corals is improbable.

Table 7-11 and Figure 7-5 detail all potentially impacted coral colonies within the direct impact area and within a 5m buffer around the footprint. Most corals are between 10-20cm encrusting on pavement and large rocks. The dominant species was *Siderastrea siderea*. Encrusting colonies have an extensive, flattened growth form which makes it challenging to detach them without causing significant damage or shattering of the colony, reducing the likelihood of successful transplantation and survival.

Small colonies such as *Porites divaricata* can be easily relocated to areas outside the project footprint and do not require specialized coral relocation methods. These small colonies will be relocated prior to any works and during the sensitive species relocation exercise. These corals are free (not fixed to any substate) branching or massive colonies and found within seagrass areas or on small rocks and rubble.

It should be noted that *Porites divaricata* colonies are often partially buried in sand, with small sections of living tissue at the tips, it is therefore possible that a single colony may have been counted more than once.

Table 7-11 Potentially impacted coral colonies within the project footprint and buffer

Coral Size Class	Buffer Area	Impact Area
>20cm	0	49
10-20cm	48	390
5 - 9cm	0	74
Total	**48**	**513**

Table 7-12 Estimated number of potentially impacted coral colonies (less than 5cm) within the seagrass bed

Suitability	Buffer Area	Impact Area	Total
Suitable	4,267	26,381	30,648
Not Suitable	259	1,599	1,858
Total	**4,526**	**27,980**	**32,506**

Figure 7-5 Potential impacted coral colonies

Recommended Mitigation

See Primary Mitigation in Section 7.2.2.2. Additionally:

i. Coral nurseries should be established. These nurseries will support the cultivation and rehabilitation of various coral species, offering a scientifically grounded approach to preserving and restoring the impacted coral communities.
ii. Coral nurseries are structures or areas specifically designed to cultivate and propagate corals for restoration purposes. They offer several benefits in the conservation and restoration of coral reef ecosystems.:
iii. Coral Reef Restoration: Coral nurseries provide a means to propagate and grow coral fragments in controlled environments. This allows for the production of a large number of healthy coral colonies that can be used for reef restoration projects. By transplanting these nursery-grown corals onto degraded reefs, the nurseries contribute to the recovery and resilience of coral reef ecosystems. (Bayraktarov, n.d.).
iv. Genetic Diversity Preservation: Coral nurseries can enhance genetic diversity in restored reefs by cultivating and propagating multiple coral genotypes. By selecting diverse parent colonies and incorporating different genotypes, nurseries can contribute to the overall genetic health and resilience of coral populations. (Consortium, 2017)
v. Climate Change Resilience: Coral nurseries can assist in developing coral populations that are better adapted to changing environmental conditions, including ocean warming and acidification. By selecting and propagating coral genotypes that exhibit higher thermal tolerance or resilience, nurseries can help create reef communities better equipped to withstand climate stressors (Van Oppen, 2015)

7.2.2.5 Fish and Invertebrates

Impact

- Habitat Destruction: Direct removal or alteration of habitats can displace fish and invertebrates.
- Increased Sedimentation: Sediment plumes can reduce water clarity, affecting feeding and predator avoidance.
- Water Pollution: Release of pollutants can harm aquatic life and disrupt ecosystems.
- Noise and Vibrations: Construction noise can cause stress and disorientation, leading to displacement from critical habitats.
- Loss of Coral and Benthic Structures: Removal of these structures can decrease biodiversity and alter community dynamics.
- Temporary Exclusion of Predators: Construction activities might temporarily reduce predator populations, potentially benefiting prey species.
- Enhanced Monitoring and Management: Increased attention to environmental conditions during construction can lead to better long-term management practices.

Recommended Mitigation

See Primary Mitigation in Section 7.2.2.2 and Coral Mitigation in Section 7.2.2.4. Additionally:

i. Habitat Restoration: Mitigation efforts, such as coral nurseries and artificial reefs, can enhance habitat availability.

7.2.2.6 Intertidal Communities

Impact

The rocky shore and intertidal communities found within the project footprint may be impacted by the proposed development. Species diversity and abundance is in general low. The impact of the loss of species and habitat is expected to be low. Species present on the rocky shore and intertidal areas should recolonise suitable areas post-construction. Any permanent structures with intertidal areas should provide additional substrate for colonisation by some species.

Recommended Mitigation

See Primary Mitigation in Section 7.2.2.2. No additional recommendations.

7.2.2.7 Sea Turtles

Impact

Site preparation and construction activities may result in the temporary displacement of any sea turtles that utilize the general area for foraging and nesting. Displacement may occur as a result of; silt screens and other barriers and equipment being utilized, this may prevent/limit access to various habitats and pathways (fragmentation).

Nesting turtles maybe particularly sensitive to varying and increased noise (Wendy E.D Piniak, 2016). Studies carried show that turtle have auditory cues however the impact of noise on their ecology is not fully known.

Lighting used during any night-time construction activities has the potential to interfere with nesting and navigation of some species.

Recommended Mitigation

i. All staff and workers should be sensitized to all sensitive ecosystems and species in the area, in particular turtles. The site should be inspected daily for any signs of turtle activity. If a nest is suspected or found, all activity nearby should stop until an expert can determine if there is a nest and how to relocate the eggs.
ii. The stakeholders, proponents and the NEPA should develop clear lines of reporting and communication in the event that action needs to be taken.

iii. Silt screens should be used to prevent sedimentation but should be removed promptly along with any other construction debris and material upon completion.
iv. Night-time activities should be limited or avoided when possible. No lights should be pointed out to sea confusion and disorientation of turtles or any other species that maybe affected by lunar activity.
v. Fixtures in direct line-of-sight from the beach should be shielded down-light only fixtures or recessed fixtures having low wattage "bug" type bulbs and non-reflective interior surfaces.
vi. Fixtures mounted as low in elevation as possible through use of low-mounted wall fixtures, low bollards and ground level fixtures.
vii. Floodlights, up-lights or spotlights for decorative and accent purposes that are directly visible from the beach, or which indirectly or cumulatively illuminate the beach shall not be used.
viii. For high intensity lighting applications such as providing security and similar applications shielded low-pressure sodium vapour lamps and fixtures shall be used.

7.2.3 Socioeconomic and Cultural

7.2.3.1 Employment

Impact

At its peak, the workforce at the construction site is expected to reach approximately 1,500 skilled labourers, with numbers fluctuating between 700 and 1,500 throughout the construction phase. This is anticipated to generate around 2,660 to 5,700 indirect and induced job opportunities. This significant level of employment within the study area is likely to have a substantial positive impact on the local economy.

However, it is important to address potential inclusivity issues. Individuals with diverse sexual orientations and gender identities may face exclusion from these employment opportunities, preventing them from benefiting equally from the economic opportunities available to other community members.

Further, there is a potential for an influx of individuals seeking employment or business opportunities, which may also lead to challenges such as squatting.

Recommended Mitigation

i. Prioritize sourcing potential workers from nearby communities to strengthen community relations and support local economies. Fiesta Jamaica aims to prioritize local talent and labour for both the construction and operation of the hotel whenever feasible.
ii. Ensure that project-derived benefits are accessible to people of all genders, sexual orientations, and gender identities, fostering an inclusive environment where everyone can benefit equally from employment opportunities.

iii. Implement robust measures to prevent incidents of sexual and gender-based violence, including sexual harassment, exploitation, and abuse. Establish clear protocols for prompt and effective responses to any incidents of SGBV.
iv. Proactively identify and prevent risks and impacts related to gender, sexual orientation, and gender identity. When avoidance is not possible, mitigate and compensate for such impacts to ensure fairness and equality.
v. The project team will collaborate closely with the Hanover Municipal Cooperation to manage and mitigate the potential issues of squatting and influx of people.

By adopting these measures, the Developer can enhance community relations, promote inclusivity, and ensure that the benefits of the project are shared equitably among all community members.

7.2.3.2 Wastewater

Impact

For every construction site, there arises the requirement to furnish construction workers with showers and sanitary facilities. The disposal of wastewater produced at the construction campsite may pose an adverse impact on water quality if inadequately handling wastewater. A deterioration in water quality may subsequently adversely affect aquatic ecosystems and pose health hazards to humans.

Recommended Mitigation

i. Provision and maintenance of portable sanitary conveniences for the construction workers for control of sewage waste by a licenced contractor. A ratio of approximately 25 workers per chemical toilet should be used.
ii. Portable toilets should be located approximately 25 metres from the high water mark, away from the shoreline to avoid discharge into the marine environment in the event of accidental spillage.

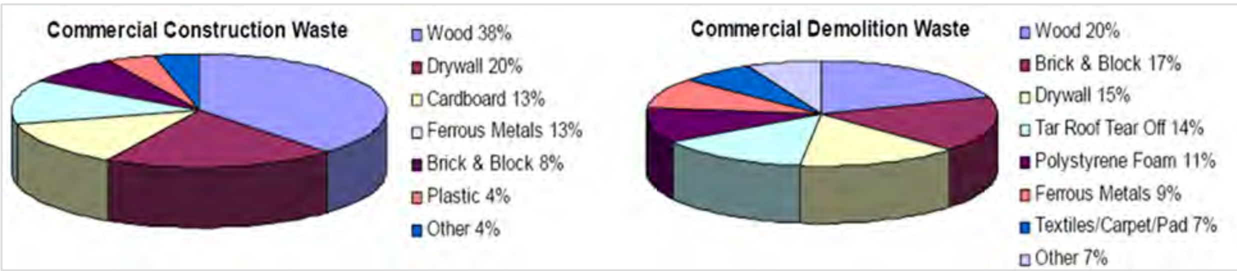
7.2.3.3 Solid Waste

Impact

During the construction phase of the proposed project, solid waste generation will occur mainly from construction activities, such as site clearance and excavation. Improper handling and disposal of this waste can lead to environmental pollution, habitat degradation, and unpleasant visual aesthetics. Furthermore, solid waste may attract vermin and pose health hazards to workers and nearby communities.

During the construction phase of the proposed project, solid waste generation will occur mainly from construction activities, such as site clearance and excavation. The USEPA estimates from surveys of non-residential construction that the average rate of solid waste generation is 22.95 Kg/square metre (or 1.6 to 8.5 lb/ft^2 (5.05 lb/ft^2)). With an estimated 113,311 m^2 (1,219,680 ft^2) of building floor area, then the estimated construction solid waste is 2,793.85 tonnes, comprised mainly of wood, blocks/bricks, cardboard, drywall, ferrous material and plastics. The operation of the hotel development will contribute to solid waste generation mainly as a result of activities of guests and staff. This will include food waste, packaging materials, paper, plastics, and other refuse.

Figure 7-6 and Table 7-13 shows the typical breakdown of this waste.



Source: "Construction and Demolition Waste Management Toolkit," WasteCap Wisconsin, June 2005

Figure 7-6 Composition of construction and demolition waste

Table 7-13 Estimated construction solid waste generation

BUILDING SIZE		**1,219,680 ft2**	**1,219,680 ft2**		
GENERATION RATE		**LOW 1.6 lb/ft²**	**HIGH 8.5 lb/ft²**		
MATERIAL	**COMPOSITION (%)**	**LBS**	**LBS**	**LOW TONNES**	**HIGH TONNES**
Wood	38	741,565.44	3,939,566.40	336.368	1786.956
Drywall	20	390,297.60	2,073,456.00	177.036	940.5031
Cardboard	13	253,693.44	1,347,746.40	115.073	611.327
Ferrous	13	253,693.44	1,347,746.40	115.073	611.327
Brick/Block	8	156,119.04	829,382.40	70.8143	376.2012
Plastic	4	78,059.52	414,691.20	35.4072	188.1006
Other	4	78,059.52	414,691.20	35.4072	188.1006
TOTAL	100	1,951,488.00	10,367,280.00	885.18	4702.52
AVERAGE		6,159,384.00		**2,793.85**	

Recommended Mitigation

i. Waste Management Plan:

   a. Develop a comprehensive waste management plan outlining procedures for waste segregation, recycling, and disposal. This should be approved by the National Environment and Planning Agency (NEPA) and the National Solid Waste Management Authority (NSWMA).

b. Assign responsibilities to personnel for waste management and designate waste collection points on-site.
c. Employees should be educated on impacts of solid waste and best practises.
d. Prioritize waste minimization by reducing packaging materials, reusing construction waste where feasible, and recycling materials such as metal, wood, and concrete.
e. Encourage contractors and suppliers to use eco-friendly packaging and materials that are recyclable or biodegradable.
f. Solid waste collection points and the number of staff assigned to collection and disposal should be increased with every stage of construction and changes to the number of workers present.

ii. Waste Segregation and Storage:
a. Skips and bins should be strategically placed within the campsite and construction site.
b. The skips and bins at the construction campsite should be adequately designed and covered to prevent access by vermin and minimise odour.
c. The skips and bins at both the construction campsite and construction site should be emptied regularly to prevent overfilling.
d. Disposal of the contents of the skips and bins should be done at an approved disposal site.
e. Establish separate bins or containers for different types of waste, including recyclables, hazardous materials, and non-recyclable waste.
f. Clearly label bins and provide training to workers on proper waste sorting and segregation practices.

iii. Hazardous Waste Handling:
a. Identify and properly handle hazardous materials such as paints, solvents, batteries, and chemicals according to regulatory requirements.
b. Store hazardous waste in designated areas with appropriate containment measures to prevent spills and leaks.

iv. Monitoring and Compliances:
a. Monitor waste generation, segregation, and disposal activities regularly to assess compliance with waste management objectives.
b. A ticketing system will be developed between both the Permittee and the Solid Waste Contractor to ensure effective management of waste and verification of disposal at the correct site.

7.2.3.4 Health and Safety

Impact

Construction activities have the potential for accidental injury, whether major or minor. For example, on land, construction works may entail workers being suspended at heights in the process and this has the potential for increased construction accidents. Fugitive dust has the potential to affect the health of construction workers. This may also include fire safety, safe access routes, clearly defined pedestrian pathways, electrical hazards, eye hazards and radiation hazards. In addition, disasters such as earthquakes, floods and hurricanes are real possibilities.

During the construction of coastal structures, a stockpile of armour stones will be created from which an excavator will retrieve and place stones in the various areas for structure construction. This activity has the potential for accidental injury.

The establishment of a construction site may cause a proliferation of "cook shops" (food vendors) to provide the construction workers with meals. Improper food preparation and the failure to practice proper hygiene can result in certain pathogens entering the food supply and cause food borne illness. Food borne illness often presents itself as flu likes symptoms such as nausea, vomiting, diarrhoea or fever. This will also have a negative visual effect on the proposed construction site.

Recommended Mitigation

Emergency response protocols are outlined in the proposed Phase 2 construction methodology (section 4.4.1.3). To supplement his, it is recommended:

GENERAL

i. Worker Protection:
    a. Provide comprehensive safety training and education programs for all construction workers, including hazard recognition, emergency response procedures, and proper use of personal protective equipment (PPE).
    b. If necessary, provision of lifelines, personal safety nets or safety belts and scaffolding.
    c. Ensure that workers wear PPE (hard hats, reflective vests, safety shoes, eye protection etc.)
    d. Where unavoidable, construction workers working in dusty areas should be provided and fitted with N95 respirators.

ii. Emergency Preparedness and Response Planning:
    a. Develop emergency response plans and procedures for handling accidents, injuries, fires, and other emergencies on-site. Designing and implementing an Emergency Response Plan (ERP) in the event of any emergency. This should include:
        - Hurricane
        - Earthquake
        - Flooding
        - Fire
        - Civil Unrest and Riots
        - Bomb Threats and Acts of Sabotage
        - Acts of Terrorism and Armed Attacks

- Petroleum and Hazardous Material Stockpiling
- Security and Safety Information
- Medical Emergency Information
- Technological Emergencies

a. Designate a qualified safety officer or supervisor responsible for emergencies and overseeing safety compliance and enforcement on-site. This person should be clearly identified to the construction workers.
b. Conduct regular safety inspections, audits, and reviews to identify areas for improvement and implement corrective actions as needed.
c. Site should be equipped with first aid kits and arrangement for a local nurse and/or doctor to be on call for the construction site.
d. Ensure that there is an ambulance and requisite staff onsite for any eventualities.
e. Make prior arrangements with staff at the Noel Holmes Hospital in Lucea and/or health centre to accommodate any eventualities.
f. Make prior arrangements with the Lucea police and fire stations to accommodate any eventualities.

iii. Hazardous Material Management:
a. Properly store, handle, and dispose of hazardous materials and chemicals used during construction, following regulatory requirements and best practices.
b. Material Safety Data Sheets (MSDS) should be stored onsite.

iv. Communication and Reporting:
a. Establish clear communication channels for reporting safety concerns, near misses, and incidents on-site.
b. Encourage open dialogue between workers, supervisors, and management to address safety issues promptly and effectively.

TRENCH EXCAVATION

i. A trench 1.2m or more in depth must have a means of egress (ladders/ stairways/ramps) and should be located at 8m intervals.
ii. Excavated materials must be stored 0.6m or more from the open trench (not to be measured from the crown of the spoil).
iii. Spoil should be placed so that the channels rainwater and other runoff water away from the excavation.
iv. Take precautions regarding tension cracks
   - Tension cracks usually form at a horizontal distance of 0.5 to 0.75 times the depth of the trench.

- Sliding or sloughing may occur as a result of tension cracks. [8]

VENDING AREAS

i. Provision of adequate supply of potable water.
ii. Monitoring of the various "cook shops" by public health authorities and the construction management team, to ensure proper hygiene is being followed.
iii. The provision of areas to adequately wash hands and utensils.
iv. Support the Hanover Municipal Corporation to ensure an orderly layout of vending areas.

MARINE

i. A safety officer, who is a competent swimmer and CPR trained, should be appointed.
ii. Spotters in the water will assist the heavy equipment in accurate placement of the armour units.
iii. The slopes and elevations of the armour layer will be demarcated with visual aids to guide the placement of boulders and to ensure they are properly interlocked.

7.2.3.5 Vehicular Traffic

Impact

A Traffic Impact Assessment (TIA) was conducted to evaluate current and future traffic conditions. During the construction phase, the introduction of construction vehicles is expected to slightly impact traffic, particularly at the service entrance. Traffic generation was estimated based on observations and previous studies. Approximately 10 trips are expected during peak hours, with five vehicles entering and five leaving to transport materials and spoils. Additionally, concrete trucks will transport concrete from the batching area to various locations around the site. The modelled scenario represents a worst-case peak hour, with 20 personal vehicles, 5 dump trucks, and 3 concrete trucks traveling to and from the proposed service entrance within an hour, simulating a foundation pour or similar major construction activity.

The proposed road alignment for the service entrance includes a right-turn lane with a queue lane (recommended to hold at least 5 trucks, approximately 40 meters) and a slip lane or wide shoulder to accommodate vehicles from Hanover. The simulated construction traffic load with this alignment should not impact the level of service (LOS) on the main road due to the relatively low construction traffic volumes and low priority for turning vehicles. The model indicates that the main road will maintain an LOS A, while the service and staff entrances will experience delays of up to 40 seconds, averaging an LOS C.

[8] Worker Health and Safety Guidelines as per OSHA #510 Construction Industry Standard 29 CFR Part 1926.

Figure 7-7 **Level of Service during Pm peak during construction scenario**

Recommended Mitigation

To mitigate traffic impacts, it is recommended that the batching plant be placed within or close to the construction footprint. Vans and personnel vehicles are expected to follow normal 9 am and 5 pm peaks and should have minimal impact on traffic flow.

To minimize the impact of increased traffic, it is highly recommended to discourage vehicles from crossing the main road from the service entrance to the proposed housing entrance. Alternatively, constructing an underpass to allow uninterrupted crossing between facilities should be prioritized. This issue is further complicated by the relatively short sight distance (~75 meters) to the adjoining corner. With vehicles traveling at the posted 50 km/h speed limit, the required stopping distance is 63 meters, which is acceptable. However, traffic camera analysis indicates that speeds often exceed 80 km/h, increasing the stopping distance to 129 meters, which far exceeds the available sight distance. This necessitates extensive traffic calming measures during the construction phase. To mitigate these, the following measures are recommended:

i. Improved road lighting to enhance visibility in low-light conditions along the corner.
ii. Appropriate traffic warning signs informing road users of the construction site entrance and instructing them to reduce speed. These signs should be placed at least 200 meters both westbound and eastbound from the site.
iii. Flagmen should be employed to control traffic and assist construction vehicles as they enter and exit the project site, particularly for heavy vehicles.
iv. Rumble strips to improve oncoming vehicle awareness.
v. Schedule all major heavy vehicle traffic during off-peak hours to reduce the impact on the main road.

7.2.3.6 Maritime Traffic

Impact

Construction activities for the project may negatively impact fishing and other maritime activities due to the presence of vessels, machinery, and equipment in the water. This increased maritime traffic and the use of construction equipment at sea can disrupt local fishing operations, recreational boating, and other maritime activities. Additionally, the potential for accidents rises with the presence of vessels and structures, posing risks to both construction workers and local maritime users.

Recommended Mitigation

i. Maritime Traffic Management:
   a. Clear Navigation Routes: Establish and clearly mark safe navigation routes for local fishers and recreational boaters to avoid construction areas.
   b. Exclusion/ Safety Zones: Establish safety exclusion zones around construction areas to prevent unauthorized access and reduce the risk of accidents. These zones should be clearly marked with buoys and warning signs to keep out other marine traffic and fishers from the work area and prevent potential accidents.
   c. Monitoring and Enforcement: Maritime patrols to monitor and enforce safety zones, ensuring compliance by all vessels operating in the area.
ii. Coordination with Local Maritime Users:
   a. Stakeholder Engagement: Engage with local fishing communities and maritime users early in the planning process to understand their needs and concerns. Provide regular updates and opportunities for feedback throughout the construction phase.
   b. Communication Protocols: Implement communication protocols to inform maritime users of construction schedules, locations, and potential hazards through local notices to mariners and regular updates.
   c. Compensation and Support: Consider compensation or support measures for local fishers and maritime businesses adversely affected by the construction activities.
iii. Environmental Protection:

a. Minimize Turbidity and Pollution: Use turbidity curtains and other measures to minimize sediment disturbance and water pollution during construction. Ensure all vessels and machinery are well-maintained to prevent leaks and spills.
b. Timing Restrictions: Schedule construction activities to avoid peak fishing seasons or sensitive periods for marine wildlife to reduce disruption to local ecosystems.

7.2.3.7 Aesthetics

Impact

Construction activities may decrease the aesthetic appeal of the area; however, this will be for a short-term period during construction. Negative impacts on the aesthetics include:

- Visual Intrusion: The presence of construction machinery, equipment, and temporary structures can significantly alter the visual landscape, making it less attractive.
- Dust and Debris: Dust, debris, and waste materials from construction activities can contribute to a visually unappealing environment. In particular, trucks leaving the construction site have the potential to deposit marl and mud onto the main road, making the main road aesthetically unappealing and in the process, affecting the conditions of other vehicles traversing the main road.
- Noise and Light Pollution: Construction noise and lighting can detract from the natural and serene ambiance of the area, particularly in residential or natural settings.
- Alteration of Natural Features: The removal of vegetation and changes to the natural landform during construction can permanently alter the visual character of the area.

Recommended Mitigation

i. Site Management:
   a. Erect temporary hoarding or fencing around the construction site to obscure unsightly machinery and activities.
   b. Maintain a clean construction site by regularly removing debris, waste materials, and dust. Implement dust control measures such as water spraying and covering stockpiles.
   c. An area of gravel should be placed on site (just before exiting onto the main road) to help remove mud/marl from truck wheels.
   d. A wheel wash area on site (just before exiting onto the main road) should be implemented to rid wheels of as much mud/marl as possible.
   e. Use directional lighting to focus light only where it is needed and minimize spillover into surrounding areas. Employ low-intensity, warm-coloured lighting to reduce glare and light pollution.

ii. Minimize Visual Intrusion:

a. Compact Site Layout: Organize the construction site to minimize the footprint and reduce visual intrusion. Place equipment and materials in less visible areas whenever possible.
b. Camouflage and Landscaping: Use temporary landscaping or plantings to soften the visual impact of the construction site. Employ natural colours and materials to blend temporary structures with the surrounding environment.

As mentioned, negative impacts to the aesthetics of the area are short-term and the proposed landscaping plan includes the reintroduction of plants and the creation of visually appealing green spaces.

7.2.3.8 Cultural and Heritage

Impact

The JNHT conducted an Archaeological Impact Assessment for the proposed Grand Palladium Resort, which aimed to identify historical and archaeological resources, evaluate their socio-economic significance in relation to the development project and forecast potential impacts. The study area, once inhabited by Jamaica's indigenous Taino population and later used as an 18th-century sugar plantation, revealed artifacts such as Taino ceramics and European pieces along the beach, possibly transported from nearby Taino sites. While no substantial evidence of Taino occupation was found in the study area, concrete foundations were identified, some reused for modern purposes like a dog kennel, while others served as dumping grounds for Grand Palladium Hotel and Spa refuse, including furniture and brick pavers.

The findings suggest potential long-term positive impacts on the Point community, environment, and economy from this development. With regard to the cultural heritage, JNHT concluded that based on the archaeological evidence available at the time, it is not significant enough to warrant in situ preservation and there is no objection to the proposed development.

Recommended Mitigation

Given the findings of the by the JNHT, it is recommended to implement a protocol to halt construction immediately if significant archaeological finds are discovered, allowing for proper assessment and documentation by the JNHT.

7.2.3.9 Community Relations

Impact

A significant majority of survey participants (section 6.0), approximately 69%, have resided in their community for over fifteen years, indicating a stable and established population. This long-term residency suggests strong community ties and a deep familiarity with local conditions and challenges. Just over 12% have lived in their community for ten to fifteen years, while 10% have resided for five to ten years, both groups likely contributing to the community's continuity and development. A smaller proportion, just over 7%, have lived in their community for one to five years, and 1.7% for less than a year, indicating a slower rate of new residents moving into the area.

The available housing data (section 5.4.3) suggests a diverse range of household sizes within the community, reflecting various family structures and living arrangements. The distribution of household sizes can have implications for local services and infrastructure, such as schools, healthcare facilities, and recreational spaces, which must cater to a wide demographic. Additionally, the stable population with a majority of long-term residents indicates a potential for strong community engagement and support networks, which are valuable assets for any community development or intervention programs.

Construction activities often cause inconveniences, health risks, and nuisances to stakeholders both on-site and in the surrounding area. The community has expressed several concerns regarding the construction of the new hotel, based on their experiences with the existing hotel (section 6.0). While the majority of respondents did not report issues with the current hotel, a small percentage did highlight specific problems. These included the smell of sewage effluent in the air, inadequate signage, reduced water supply to surrounding communities, sewage discharge into the ocean, limited staff parking, increased motor vehicle collisions, insufficient local employment, flooding on the hotel property, increased crime and violence during construction, loss of recreational space, negative impacts on the ecosystem, and union busting. Notably, most of these issues were reported as unresolved.

In relation to the proposed hotel development, a significant portion of respondents expressed concerns. These concerns include increased demand on the local water supply system, doubts about equal employment opportunities for locals, potential loss of beach access, possible pollution from sewage effluent, increased crime, inadequate parking leading to traffic issues, loss of livelihood for fisherfolk, increased traffic congestion, loss of marine wildlife, dust pollution, possible relocation, lack of community development benefits, employment of competent workers, beach erosion, and destruction of coral reefs.

Despite these concerns, many community members also see potential positive impacts from the new hotel project. They anticipate the creation of employment opportunities, community and national development, increased tourist presence, infrastructure improvements, increased income opportunities, economic growth, and property appreciation. However, there is also apprehension about negative impacts, such as reduced water supply, increased crime, traffic congestion, increased motor vehicle collisions, loss of fishing areas, and foul sewage odours. Overall, the community is divided, with some expecting positive outcomes and others worried about potential negative effects.

Recommended Mitigation

To establish and maintain a harmonious relationship with both internal and external stakeholders, the following measures are recommended:

i. Claims and Complaints Resolution Program:
   a. Objective: Create a system that allows for the timely response to complaints from residents and stakeholders who perceive they are affected or harmed by any aspect of the Project.
   b. Implementation: Establish clear channels for stakeholders to submit complaints and concerns, ensuring transparency and accessibility.

ii. Grievance Redress Mechanism (GRM):
   a. Comprehensive Reporting: Formulate a Grievance Redress Mechanism to address all complaints, including reports of GBV, SEA, and sexual orientation discrimination.
   b. Prompt Response: Ensure that all grievances are addressed promptly and effectively, with particular attention to sensitive issues such as GBV and SEA.
   c. Stakeholder Engagement: Regularly engage with stakeholders to inform them about the GRM and encourage the use of the mechanism to report any concerns.

LUCEA FISH SANCTUARY

Specific to the Lucea Fish Sanctuary, to ensure ongoing environmental stewardship and mitigate the impacts of the within the nearby fish sanctuary, a robust reporting mechanism will be established with the sanctuary management team. This mechanism aims to foster transparent communication and effective monitoring of the project's environmental footprint, particularly concerning marine ecosystems.

Regular environmental monitoring will be conducted, especially within the fish sanctuary. Each report will be compiled and submitted to the fish sanctuary management team.

7.3 OPERATION

7.3.1 Physical

7.3.1.1 Drainage

Impact

Design considerations for 1 in 25-year runoff events highlight critical areas such as the upper catchment and hotel property, guiding drainage optimization and management strategies. The upper catchment plan focuses on enhancing existing drainage paths, while at the hotel property, efforts are concentrated on managing runoff from various sources and directing it towards a central catchment area. Calculations indicate runoff values of 21.609 m^3/s for the roadway basin and 4.358 m^3/s for the hotel property during 1 in 25-year events. Consequently, a system featuring swales and open channels has been proposed to effectively manage surface runoff.

The project necessitates meticulous stormwater management due to paved areas and proximity to the coastline, aimed at minimizing discharge of solids and debris while maximizing natural purification processes. Drainage design integrates shallow elements to reduce visual impact and limits ocean discharge points to two, each equipped with flow lamination braking systems to uphold sustainability standards. Natural slopes are utilized to establish a Retention Buried Pond for collecting and filtering water into the subsoil, complemented by closely ducted pipes to direct rainwater. Stormwater drainage wells are strategically deployed where natural slopes are insufficient.

Recommended Mitigation

Implementing the following mitigation measures will enhance the resilience of the drainage infrastructure, minimize environmental impacts, and ensure sustainable management of stormwater within and around the project area:

i. Monitoring and Maintenance: Establish a comprehensive monitoring program to regularly assess the functionality and efficiency of the drainage system. This includes inspecting swales, open channels, and retention ponds to ensure they are free from obstructions and operating as designed.
ii. Training and Awareness: Conduct training sessions for maintenance staff and relevant stakeholders on the proper upkeep of drainage infrastructure. This ensures that personnel are equipped to identify and address any potential issues promptly.

7.3.1.2 Water Quality

Impact

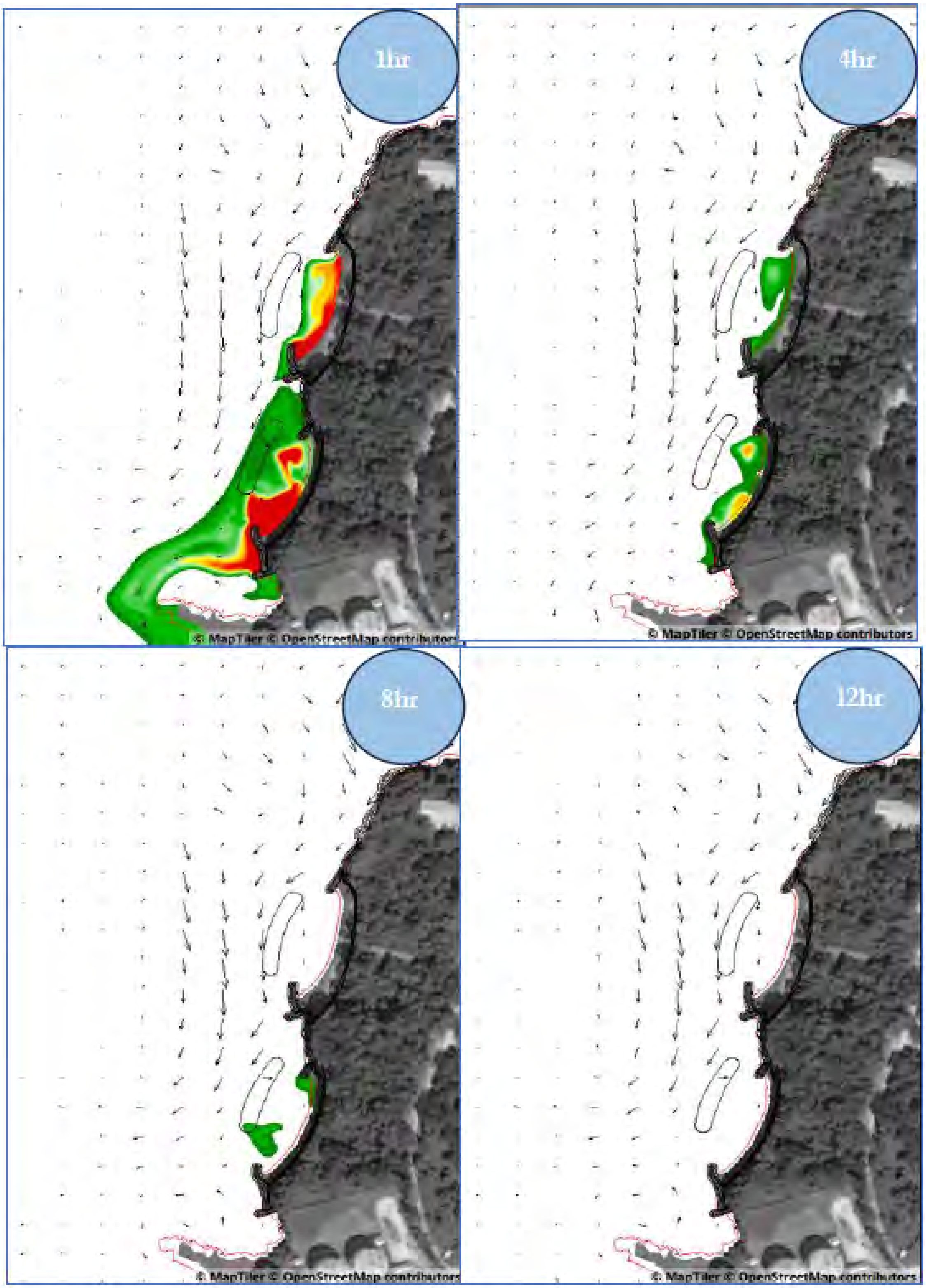
A critical aspect of the proposed drainage concept is the flushing capacity of the preferred beach layout, determining its ability to maintain acceptable water quality. Using the MIKE 21 model, specifically its transport module, this analysis was benchmarked against United States Environmental Protection Agency (USEPA) guidelines for marinas. These guidelines recommend achieving a 90% reduction in initial pollutant concentration within 24 hours for optimal water conditions within the cove. For bathing and swimming areas, contaminants are expected to be removed within 3-4 hours (Smith Warner International Limited, 2023).

To simulate a worst-case scenario for water quality, the model introduced a pollutant (initial concentration of 1 mg/l) during a rising neap tide (minimal water level fluctuations). Recognizing the influence of wave energy on current generation, a mean wave height of 0.9m (8s period) from the northeast (typical for the area) was applied. The pollutant's behaviour was assessed under two specific scenarios: typical operational conditions and periods of elevated rainfall (Smith Warner International Limited, 2023).

TYPICAL OPERATIONAL CONDITIONS

Under operational conditions, simulations explored beach contamination by various dissolved pollutants at 1mg/l concentration. According to observed current patterns, the simulated pollutant plume moved southward (Figure 7-8). It predominantly drifted from the north beach toward the south beach, further dispersing southward within each beach due to the prevailing current. This southward movement creates potential stagnant zones in the southern sections of both beaches, where larger particles may settle. These areas should be closely monitored during maintenance.

Simulation results indicate a complete flushing time of 8 hours for the north beach and 12 hours for the south beach. This suggests that in the event of actual contamination, beach closure would be necessary for approximately 8 to 12 hours (about half a day).



Source: (Smith Warner International Limited, 2023)

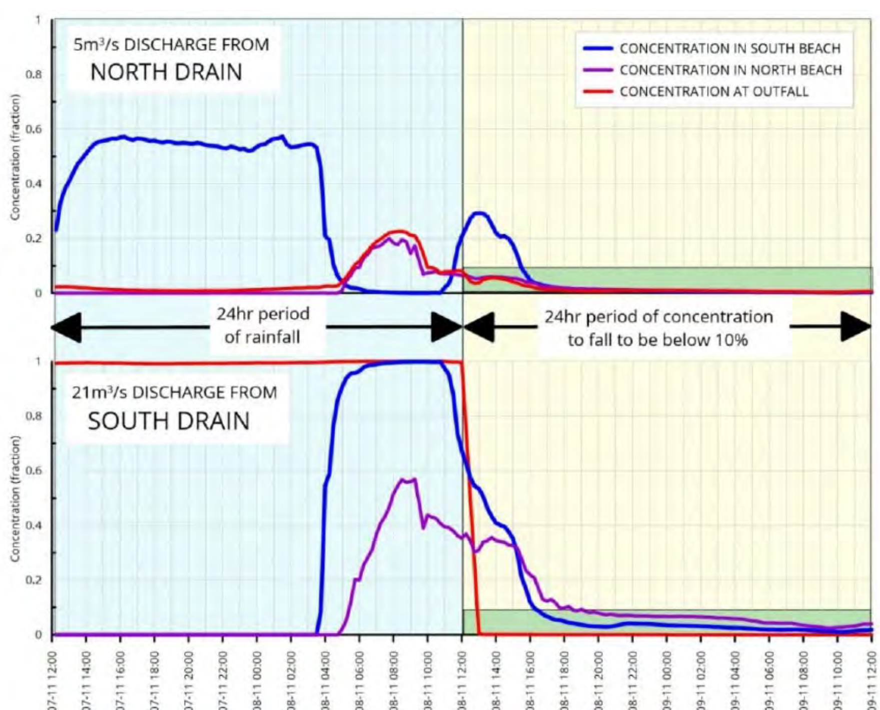
Figure 7-8 Dilution of the concentration from the initial release under operational conditions

PERIODS OF ELEVATED RAINFALL

Heavy rainfall events pose unique challenges for beach cleanliness due to drainage outfalls at the north and south ends. To understand the impact of stormwater runoff, the model simulated contaminant releases from these outfalls, examining: (1) the spread of polluted runoff plumes, and (2) potential beach downtime after significant rainfall, enabling proactive management strategies. The simulation involved two phases:

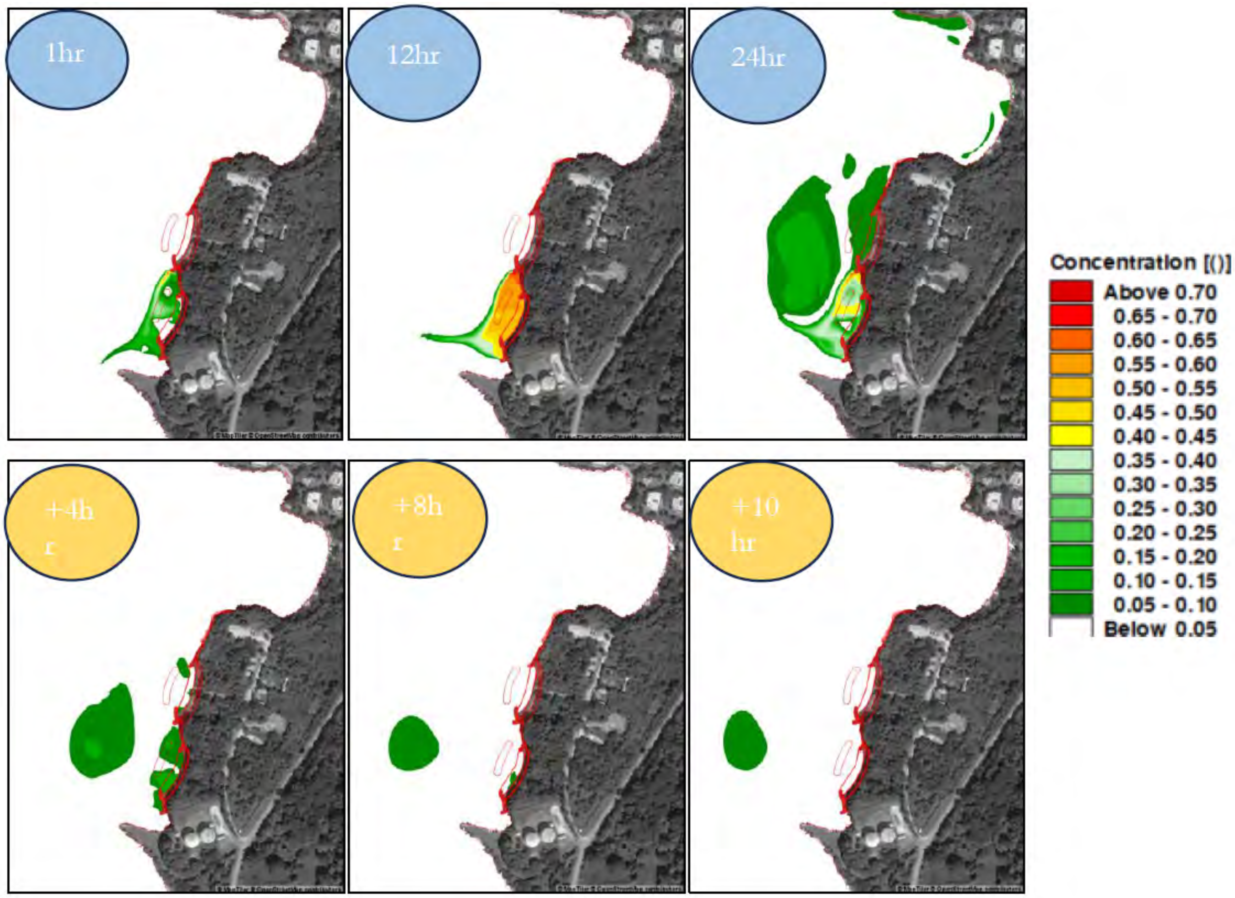
1. Release and Dispersion (0-24 hours): This phase observed the simultaneous spread of contaminants and initial flushing in beach areas. Continuous discharge from drains:
    a) North Drain: 5 m³/s for 24 hours (equivalent to a 1 in 25-year event on the property).
    b) South Drain: 21 m³/s for 24 hours (similar to a 1 in 25-year event).
2. Natural Recovery (24+ hours): Discharge from drains ceased. This phase observed the time required for the area to flush out after the pollution source was removed.

The assessment focused on a central point within the swimming areas, yielding promising results as contaminant concentrations dropped below 10% within less than 4 hours for all scenarios (Figure 7-9). Circulation patterns were visualized using 2D plots (Figure 7-10 and Figure 7-11). While flow patterns indicated a tendency towards the south, there was potential for recirculation entering the beaches, resulting in slower flush-out times. Full circulation and a reduction to 10% of the original concentration were achieved 8-19 hours after discharge ceased.



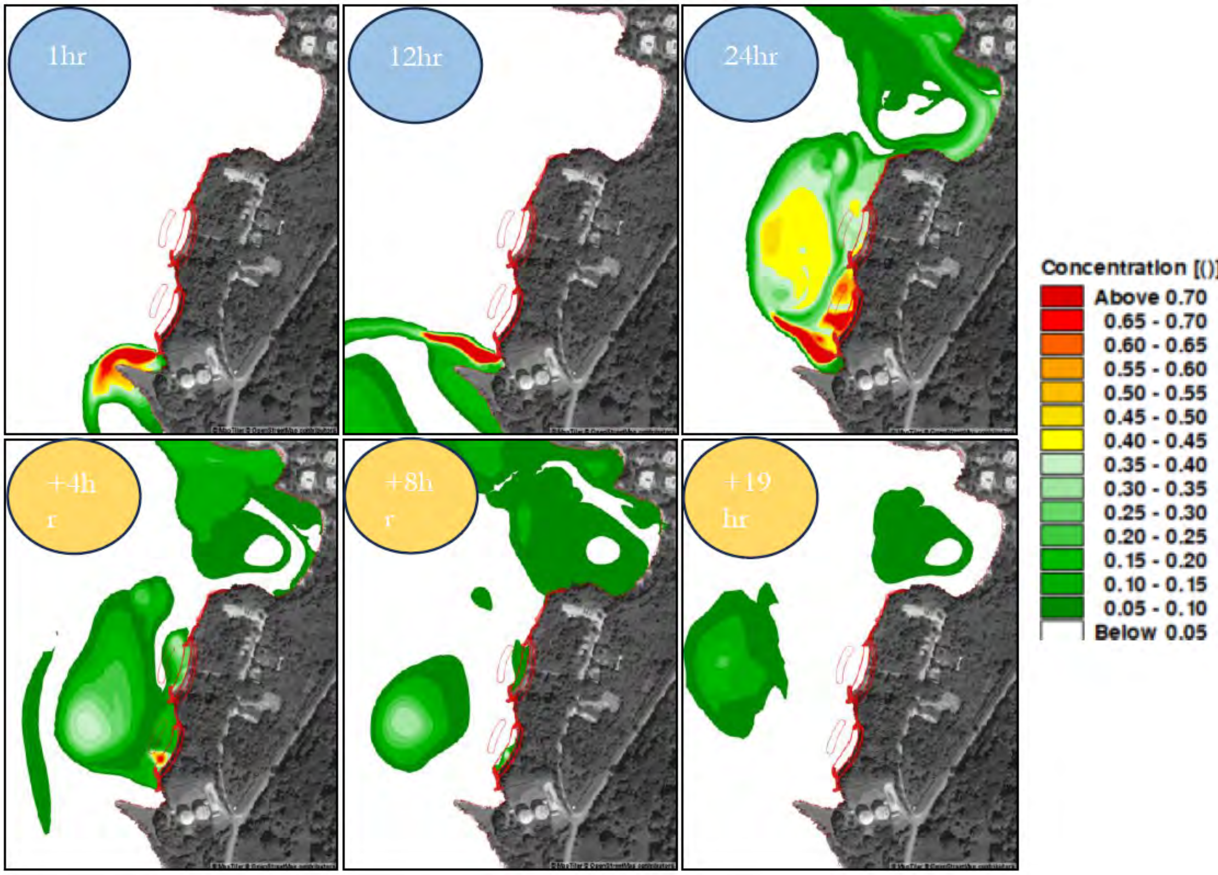
Source: (Smith Warner International Limited, 2023)

Figure 7-9 **Decline in contaminant concentration at both the North and South locations attributable to the discharge from the proposed outfalls**



Source: (Smith Warner International Limited, 2023)

Figure 7-10 Dilution of the concentration from the initial release from North Drainage Outfall



Source: (Smith Warner International Limited, 2023)

Figure 7-11 Decay of the concentration from the initial release from South Drainage Outfall

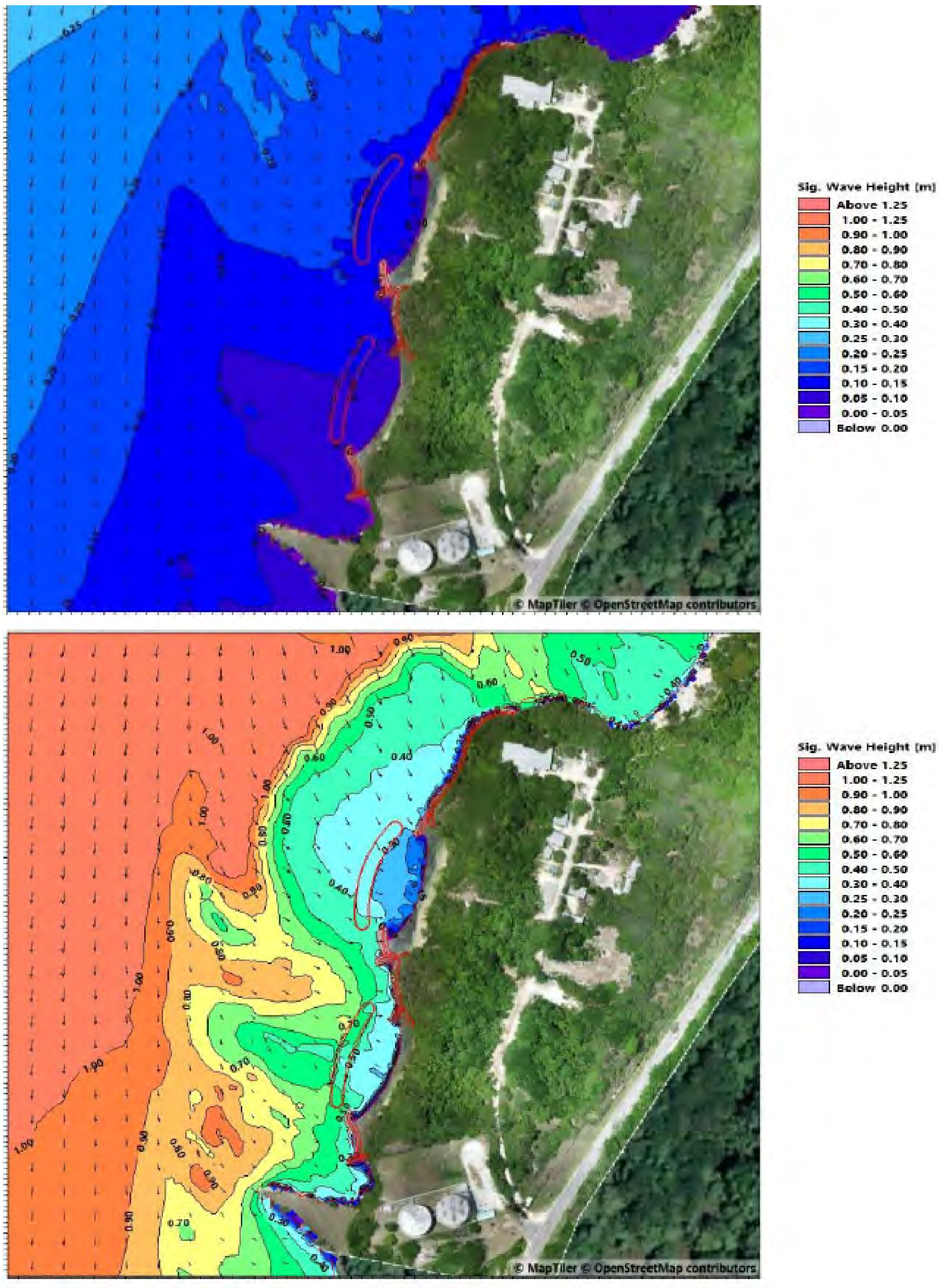
Recommended Mitigation

Similar to the assessment mentioned earlier, hotel management should anticipate approximately a day of downtime during such events. The prevailing southerly flow carried contaminants to the southern corners of the beaches, underscoring the importance of regular inspections.

7.3.1.3 Wave Climate

Impact

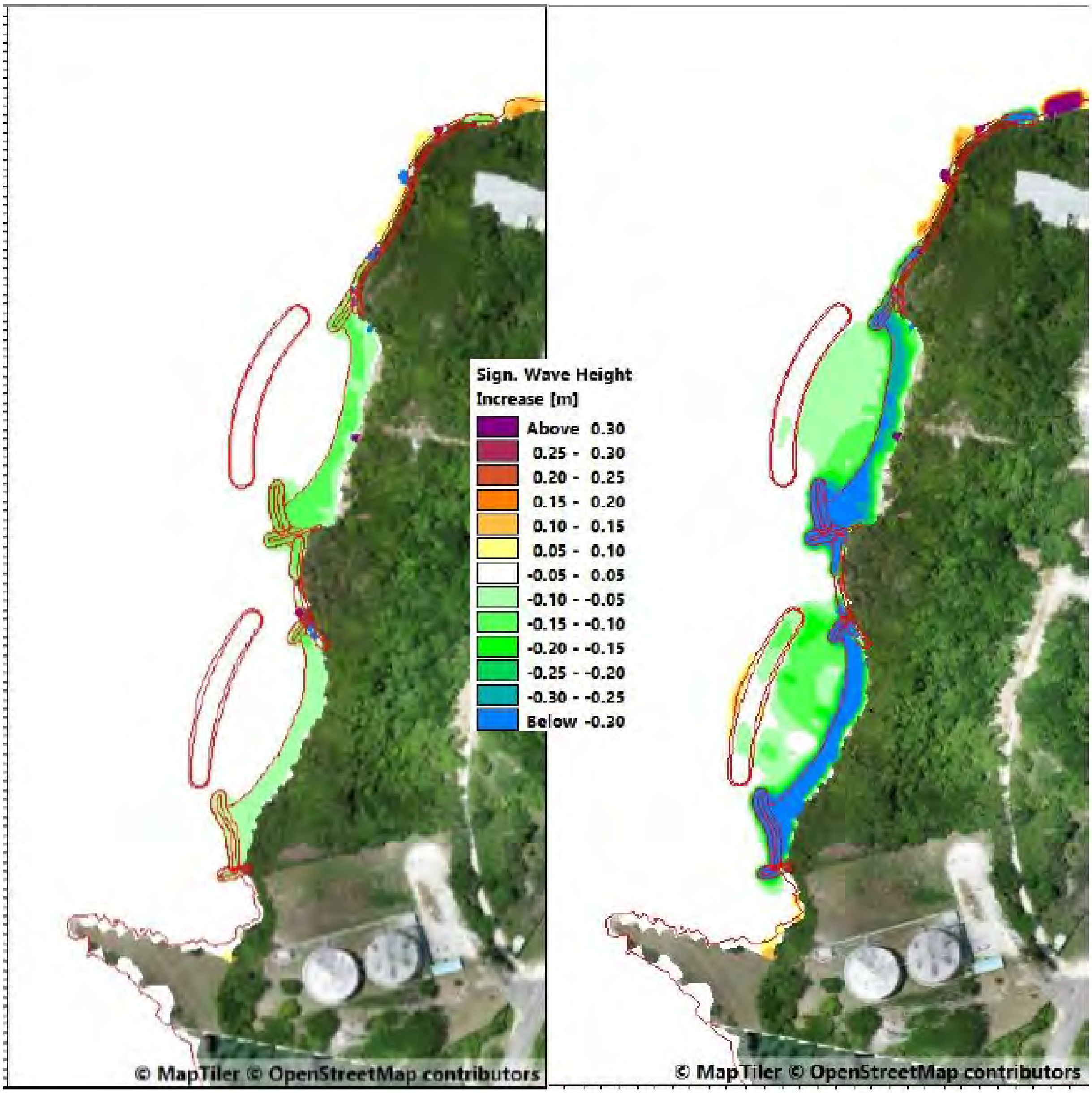
The spectral wave model simulations with the proposed coastal works indicate that the presence of the structures does not significantly influence average conditions. On average, wave heights in the area are less than 0.2m (Table 7-2). This is primarily due to the existing small average wave heights, attributed to the reef platform mentioned earlier. When waves pass over the submerged structures, their impact on the breaking process is limited. However, the structures demonstrate effectiveness in mitigating more extreme wave heights. Specifically, in this evaluation, attention was given to the 99th percentile, revealing that the breakwater reduces wave heights from 0.7m to 0.5m.



Source: (Smith Warner International Limited, 2023)

Figure 7-12 **Response of structure to day-to-day conditions (top: mean conditions and bottom: 99th percentile)**

The results show that breakwaters located at an elevation of -0.3m MSL reduce wave heights by 0.2-0.3m at the shoreline during the 99th percentile wave condition. This suggests that for more significant events statistically, the proposed shoreline could see a reduction in wave energy by approximately 40%. However, this wave energy reduction is localized around the structures and does not extend beyond the immediate area of interest. This observation indicates minimal impact on adjacent shorelines.



Source: (Smith Warner International Limited, 2023)

Figure 7-13 **Change in mean wave heights (left) and the 99th percentile (right) at the site with structures in place**

Recommended Mitigation

No mitigation required.

7.3.1.4 Currents and Sediments

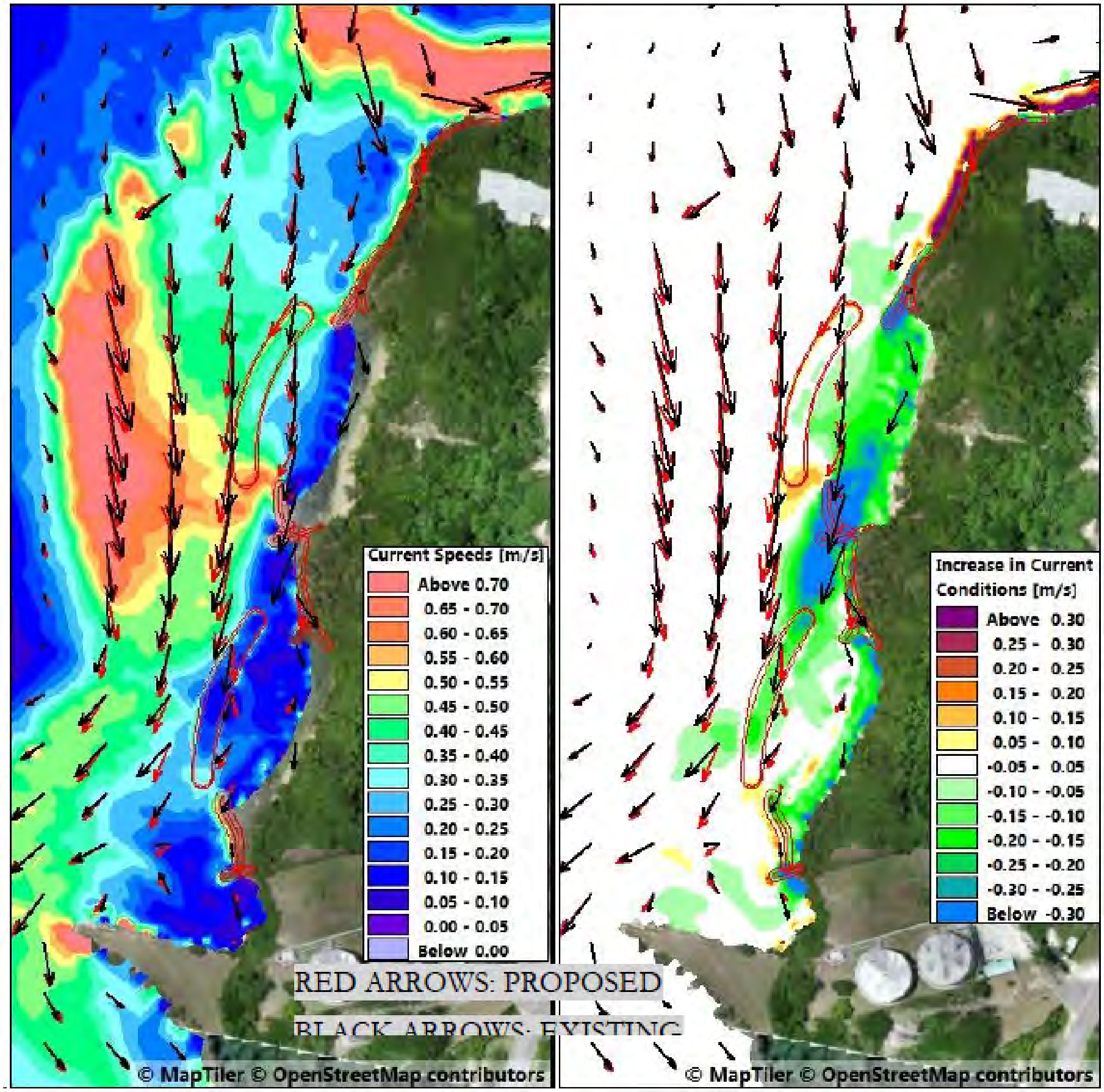
Impact

Wave-induced currents are crucial in shaping coastal dynamics and influencing sediment transport. Sediment flow in the area correlates directly with wave-driven currents. Figure 7-14 illustrates a decrease in current velocities along the existing shoreline, measuring between 0.15-0.2m/s during the 99th percentile scenario. Analysing current directions (indicated by red and black arrows in Figure 7-14), the influence of structures is evident, extending from the shoreline to just under 20m seaward of the breakwater. The prevailing flow remains north to south, entering the gap between the breakwater and the shoreline. However, southward progression leads to constriction between the southern ends of the breakwaters and groynes. This configuration is expected to result in: (1) sediment accumulation on the southern groynes, and (2) increased flow through the gap. The dominant current at the location of the central groyne/revetment observed in existing conditions is eliminated, reduced to less than 0.1m/s.

Nevertheless, at the constriction, there is a +0.20m/s change in current speed, along with a shift in direction illustrating flow through the gaps. The adjustment of this gap (to be addressed in the detailed engineering phase) is critical for the operational success of this measure. The presence of this gap can influence the formation of rip currents (affecting swimmer safety) and the erosion of sand (impacting maintenance nourishment). These aspects are further discussed in section 7.3.2.1.

Recommended Mitigation

i. Perform periodic assessments of beach profiles to evaluate the stability and morphological changes of the constructed beach over time, including shoreline erosion, sediment movement, and alterations in physical characteristics.
ii. Use the collected data to make informed decisions for adaptive management and potential enhancements based on observed performance.



Source: (Smith Warner International Limited, 2023)

Figure 7-14 **Wave-driven currents at the 99th percentile (left) and the difference between Existing and Proposed 99th Percentile (right) at the site with structures in place**

7.3.2 Natural Hazards

7.3.2.1 Swell Event

Impact

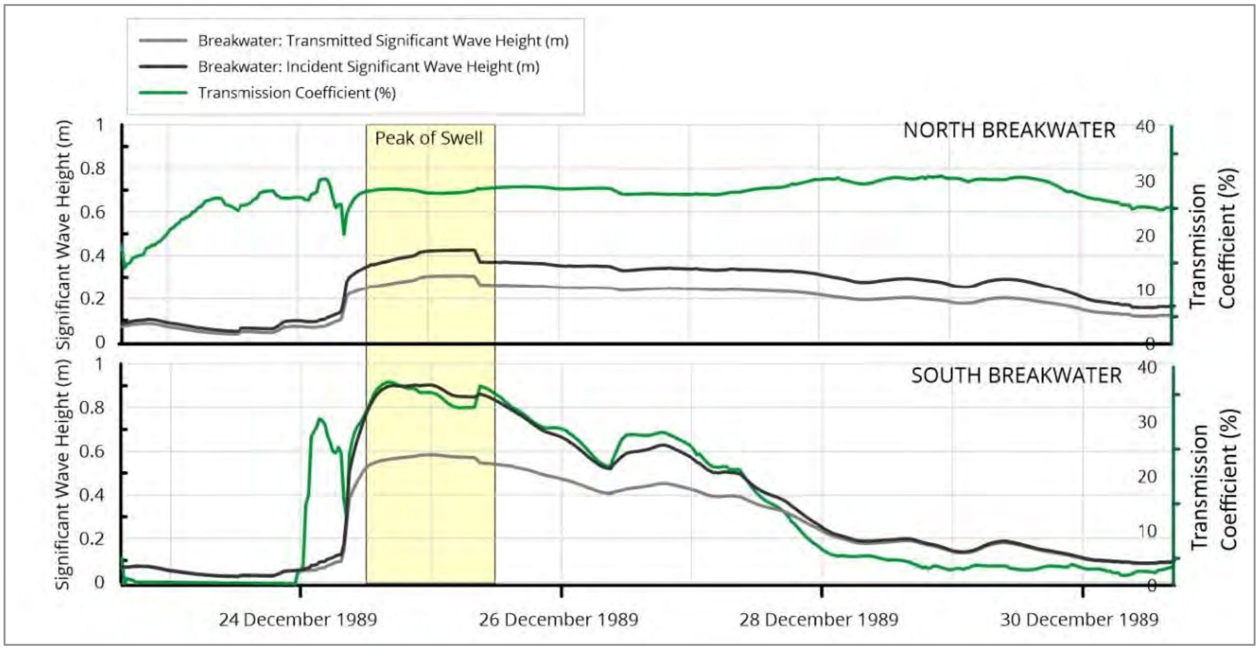
The assessment of swell wave climate aims to analyse potential shoreline impacts during significant events, particularly those occurring in the 'winter' months from November to March. Swell events, characterized by clear skies and elevated wave heights originating from distant wind fields like cold fronts, can alter wave directions and affect the equilibrium sand profile at the site. This assessment focuses on individual event responses without averaging effects, providing a detailed understanding of wave dynamics, currents, and sediment transport patterns in relation to coastal structures.

SIGNIFICANT WAVE HEIGHTS UNDER SWELL EVENTS

During a specific December swell event (5.3.2.4), deep-water wave heights peaked at 3m with a period of 9s, originating from the northwest. Using the proposed mesh model, simulations depicted waves approaching the shoreline from a north-westerly direction, with lower heights observed on the north beach compared to the south beach. As waves encountered the reef, heights decreased significantly before reaching the breakwaters, where a 50% reduction in wave heights was achieved despite varied effectiveness due to local conditions. Subsequent changes in wave direction towards the northeast further influenced offshore conditions, aligning closely with average regional wave patterns.

During the observed swell event, waves refracted around the headland northeast of the Phase 2 site, approaching the Phase 2 shoreline from the northwest. Despite changes in offshore wave direction, wave conditions at the Phase 2 site remained consistent. Waves reaching the north breakwater measured approximately 0.3m and were further reduced to around 0.1m upon reaching the breakwaters, while waves on the south beach approached 0.7m before diminishing to 0.1m in its lee.

The transmission coefficient, which quantifies the percentage of incident wave energy that passes through or over the breakwater, was analysed during this event. The north and south breakwaters exhibited maximum transmission coefficients of approximately 30% and 40%, respectively (Figure 7-15, green lines). These coefficients indicate the effectiveness of the breakwaters in reducing wave energy and protecting the shoreline from erosion.



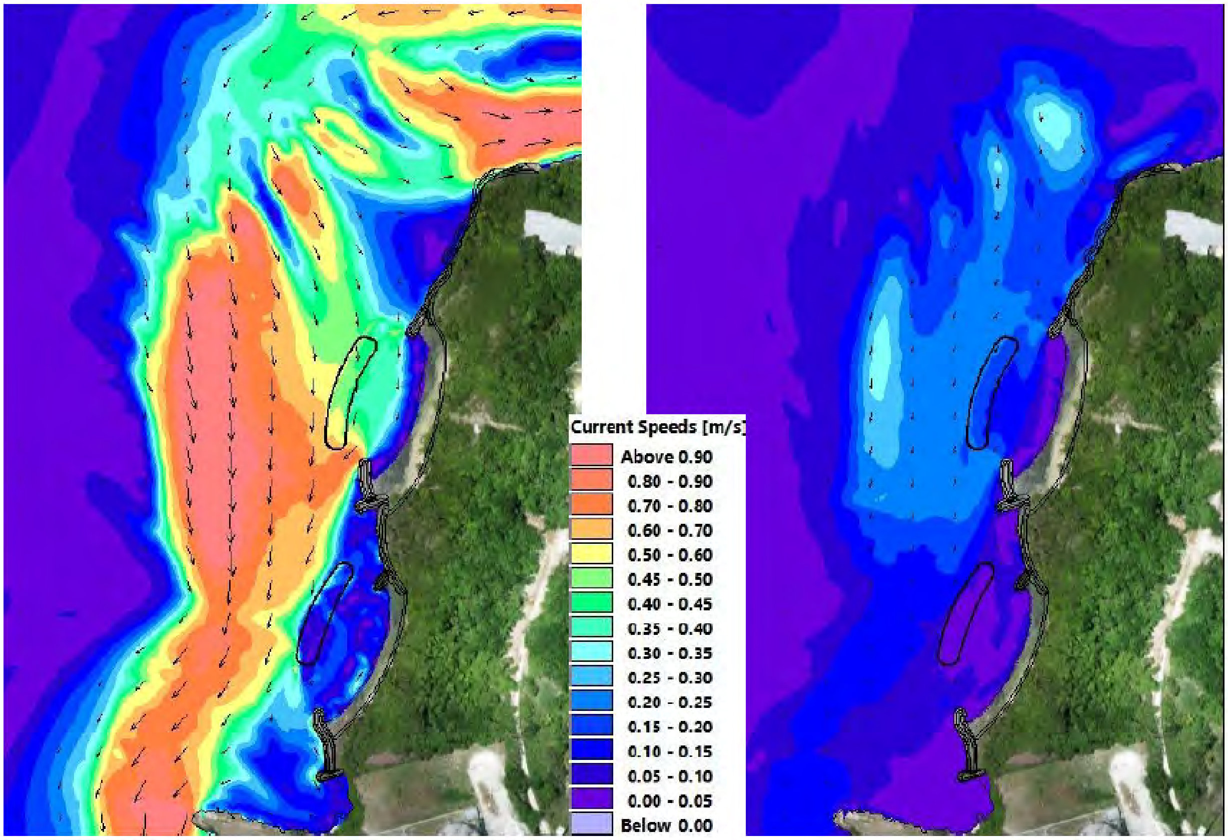
Source: (Smith Warner International Limited, 2023)

Figure 7-15 Transmission coefficient of breakwaters under December 1989 swell

CURRENT PATTERNS UNDER SWELL EVENTS

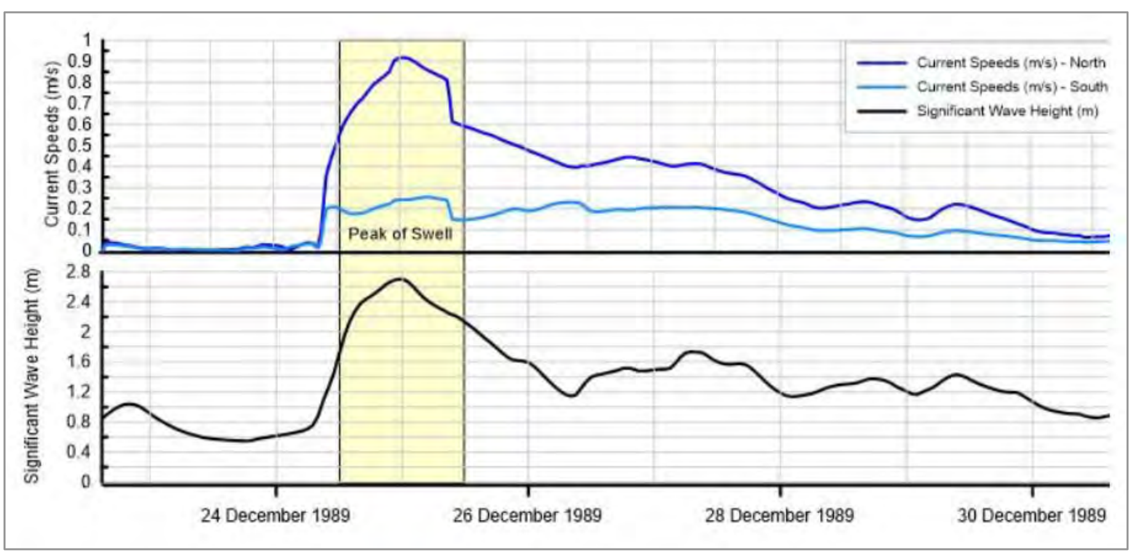
During the swell event, 2D plots indicated a consistent north-south unidirectional current flow (Figure 7-16), unaffected by changes in offshore wave direction. Arrows on the plots depicted lower current velocities during calmer offshore conditions while maintaining consistent patterns. This underscores the dominance of wave-driven currents in the area, which remained unaffected by offshore wave variability and did not alter local wave patterns.

An important focus area identified was the current flow through the gap created by the south breakwater and groyne, particularly posing risks to swimmers at both beaches, especially the north beach during peak swell conditions where currents could reach speeds up to 0.9m/s.



Source: (Smith Warner International Limited, 2023)

Figure 7-16 **Current speeds and directions: (left) peak swell with offshore waves from NW, and (right) offshore wave direction shifted to NE**

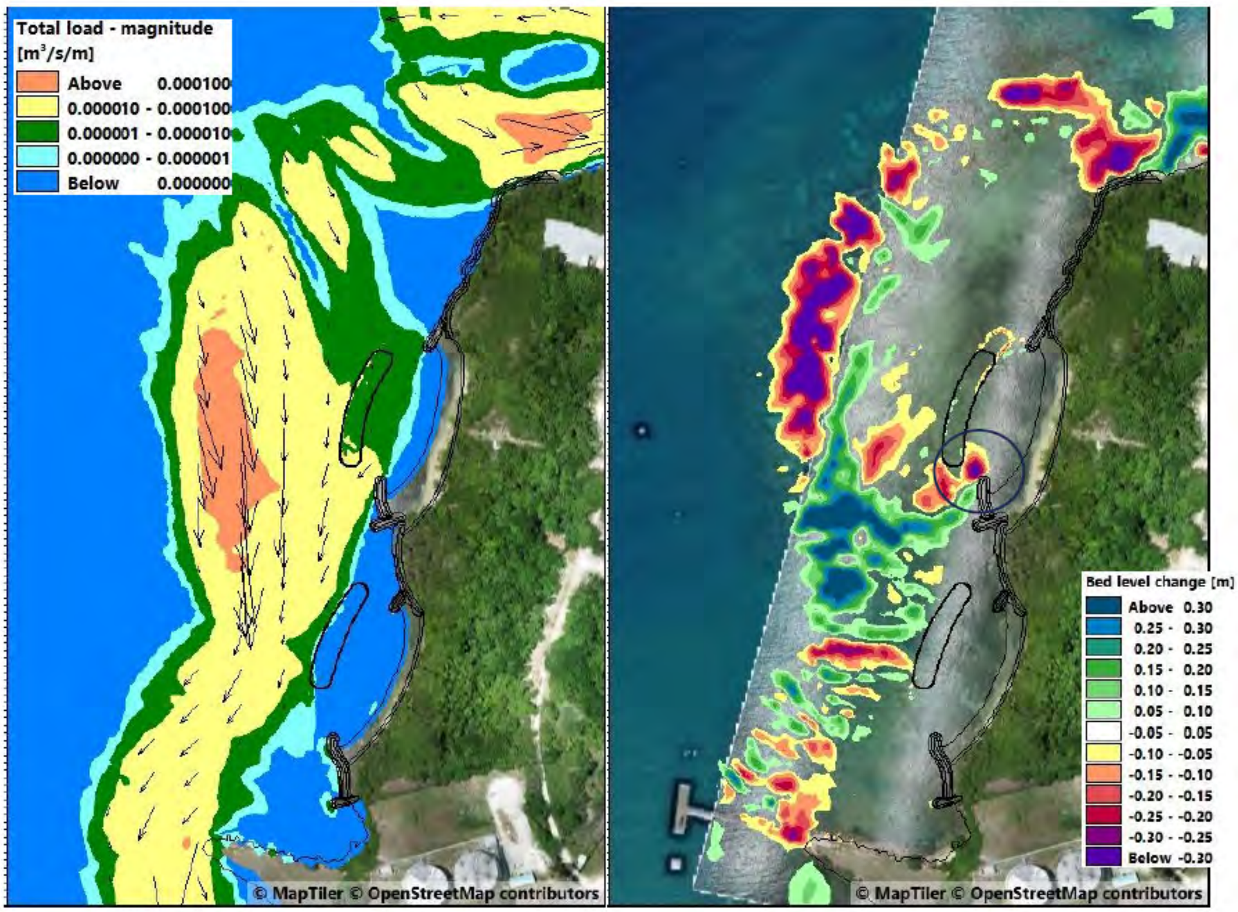


Source: (Smith Warner International Limited, 2023)

Figure 7-17 **Current speeds at the southern gaps between the breakwaters and groynes**

SEDIMENT TRANSPORT POTENTIAL

Wave-induced currents influence sediment movement along the shoreline, initially causing sediment transport from north to south, which was disrupted by the designed beach structures. Breakwaters further mitigate sediment transport, ensuring shoreline stability even during winter swells. The bed level analysis after an 8-day event indicated potential erosion of -0.3m at the gap between the north breakwater and the southern groyne of the northern beach (Figure 7-18). This erosion suggests sediment movement beyond the swimming area, predominantly during peak swell conditions, with stabilization of the groyne being crucial to prevent further erosion.



Source: (Smith Warner International Limited, 2023)

Figure 7-18 **Sediment transport potential at the peak of the swell (left) and bed level change at the end of the swell**

Recommended Mitigation

In the detailed engineering phase, extending the groyne to be more in the lee of the breakwater will be considered to potentially alter the flow intensification in that area (Smith Warner International Limited, 2023). Additionally, management strategies such as clear signage are crucial to inform swimmers about the potential risks of strong currents, particularly during swell wave seasons. By combining the following mitigation strategies, it is possible to enhance beach safety and minimize the risks, thereby promoting a safer recreational environment for beachgoers.

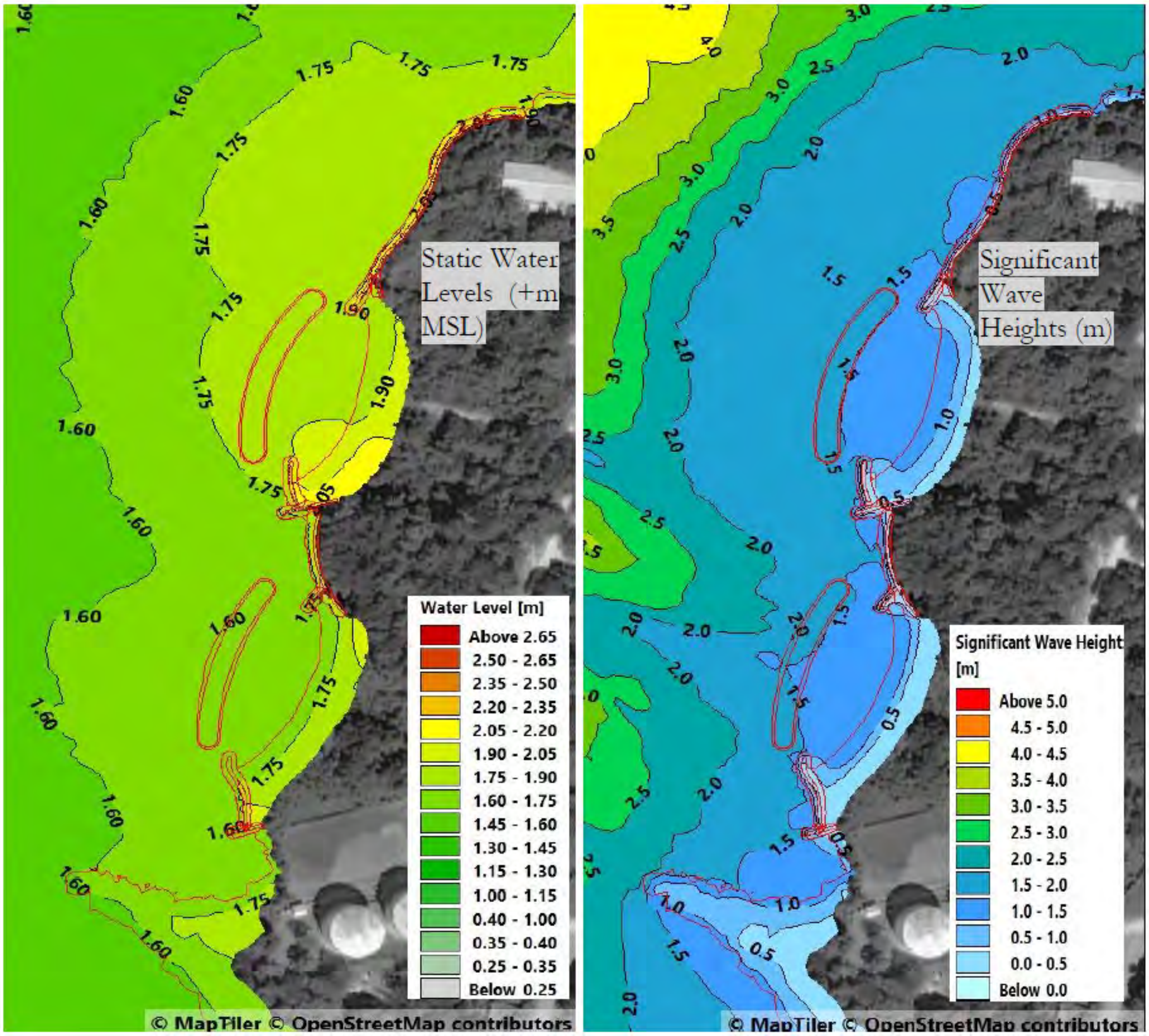
i. Signage and Awareness: Install clear and prominent signage at the north beach to warn swimmers about the potential for strong currents, particularly during peak swell events. Use universally recognized symbols and multilingual messages to ensure comprehension by all beach users.
ii. Beach Management: Implement effective beach management practices, including trained lifeguards stationed at strategic points to monitor water conditions and assist swimmers in distress. Ensure lifeguards are equipped with flotation devices and communication tools.

7.3.2.2 Hurricane Waves

Impact

MIKE21 numerical modelling software, incorporating SW (wave) and HD (hydrodynamic) modules, was utilized to simulate the 1 in 50-year hurricane conditions within the RCP 8.5 50-year horizon (Figure 7-19). The simulation assessed the interactive dynamics of waves and water levels with the existing structures in place.

Under the proposed configuration, wave heights in the sheltered area behind the structures ranged from 0.5 to 1.0m, compared to 0.9 to 1.4m under current conditions. The effectiveness of submerged structures in attenuating waves during hurricanes is limited by static surge water level setup. In this design scenario, where the submerged structure is under 2.0m of water, it would need to be wider than the current 16m base to substantially reduce wave conditions.



Source: (Smith Warner International Limited, 2023)

Figure 7-19 **Wave and surge conditions in response to a 1 in 50-year hurricane event within the 50-year horizon with implemented structures under the RCP 8.5 Scenario**

Recommended Mitigation

Despite the limitations regarding surge water level setup, the structures effectively maintain beach stability under normal conditions by breaking waves. They also had minimal impact on storm surge, with model results indicating potential inundation up to +2.05m MSL, compared to +2.1m for the existing configuration. Critical buildings should be elevated above this level, especially those along the North beach, to mitigate flood risks effectively.

These findings underscore the importance of considering both wave dynamics and storm surge impacts in coastal engineering designs, ensuring resilience against extreme weather events while maintaining functional beach stability. Therefore, mitigation measures to consider include:

i. Design Standards: Adhere to robust engineering standards that account for both wave-induced currents and storm surge dynamics. Implementing these standards ensures that coastal developments withstand extreme weather events while maintaining beach stability and minimizing risks to adjacent structures.
ii. Monitoring and Adaptive Management: Establish a monitoring program to assess the performance of coastal structures over time. This program should include regular assessments of wave conditions, sediment transport patterns, and the effectiveness of mitigation measures. Adaptive management strategies can then be employed to adjust designs or operations based on observed performance and evolving environmental conditions.

7.3.3 Biological

7.3.3.1 Reef and Seagrass Communities

Impact

Reef and seagrass communities, along with corals and other sessile organisms such as sponges, gorgonians, fanworms, and urchins living on the pavement near the impact area, are expected to return to normal conditions in areas with only moderate impacts. Pilings and boulders will provide ecological volume both on the seafloor and in the water column. These hard structures will offer a substrate for colonization, which should change in composition over time.

Seagrass beds located directly beneath the walkways and rooms will experience shading at times throughout the day. While some seagrasses may tolerate a certain amount of shading due to their adaptation to turbid, lower light conditions, excessive shading could deteriorate their health and functionality, potentially leading to species loss and habitat degradation.

Habitat fragmentation may occur due to changes in current patterns and the introduction of permanent hard structures, potentially affecting larval dispersal and recruitment. However, this impact is expected to be minimal, and no mitigation measures are recommended.

Fish may benefit from the presence of pilings, boulders, and shaded areas, which will act as Fish Aggregation Devices (FADs). This area may also be more managed, offering fish some protection from overfishing. Filter feeders are expected to see normal conditions return over time.

Species are anticipated to recolonize suitable rocky shore areas and new areas provided by boulders, promoting ecological recovery and stability.

Recommended Mitigation

Regular monitoring, rehabilitation and restoration initiatives will be implemented within the Fish Sanctuary , including the proposed project area.

7.3.3.2 Sea Turtles

Impact

Operational activities, obstructions and lighting may impact turtle nesting and foraging activity.

Recommended Mitigation

I. All staff and workers should be sensitized to the sensitive ecosystems and species in the area, in particular turtles. The beaches should be inspected daily for any signs of turtle activity. If a nest is suspected or found;
    a. The nest should be cordoned off and remain undisturbed until it is hatched in approximately 60 days.
    b. All activity nearby should stop until an expert can determine if there is a nest and how to relocate the eggs if the nest is located in a highly vulnerable area.

II. Turtle-friendly lighting and light positioning (if any) should also be placed on the overwater villas. Hotel operators should also educate their guests on sea turtle conservation and the correct actions to take if a sea turtle is observed nesting on the beach.

III. The Hotel should also develop a Sea Turtle Monitoring programme which would include tagging and hatchling release. This could add to their attraction offerings (turtle watching).

7.3.4 Socioeconomic and Cultural

7.3.4.1 Employment

Impact

JOB CREATION

The opening of Phase 2 represents a significant opportunity for job creation, particularly in a community where a large portion of the population falls within the working-age bracket. In the SIA, 63.8% of residents are aged between 15-64 years, indicating a demographic well-positioned to benefit from employment opportunities. However, unemployment remains a pressing issue, affecting 38.6% of the labour force, with higher rates among youth and females. Many unemployed individuals have been without jobs for extended periods, highlighting persistent challenges in the local job market. In fact, participants in the household survey undertaken by SDC (Social Development Commission, 2018) pinpointed the following as some of the primary development priorities/needs in Lucea:

- Mitigate elevated levels of youth unemployment (14-24 years)
- Mitigate elevated levels of adult unemployment (25 years and over)

- Enhance skill levels

The introduction of the new hotel promises not only direct employment opportunities within the hospitality sector but also indirect economic benefits through increased demand for local goods and services. This is expected to stimulate economic activity, reduce unemployment rates, and enhance overall socio-economic conditions in Lucea, promoting community development and empowerment. Specifically, once operational, the hotel aims to employ approximately 3,500 individuals, split between 1,600 jobs in Phase I and 1,900 in Phase II. This substantial workforce is projected to generate about 5,800 indirect jobs and 2,200 induced jobs, significantly bolstering the local economy.

TRAINING

The hotel's operational phase will include comprehensive training programs for new employees, aimed at enhancing skills and expertise in the hospitality sector. This investment in training is anticipated to yield long-term benefits by improving employability and expanding career opportunities both within and beyond the hospitality industry.

EMPLOYEE ACCOMMODATION

With increased employment, the demand for housing grows. The existing hotel (Phase 1) has 100 apartments, accommodating around 244 staff members. With the construction of Phase 2 (the proposed project), there are plans to expand the staff quarters by adding 96 more apartments, with capacity to hold 384 persons. This expansion is a separate project and will require regulatory approvals.

Recommended Mitigation

i. Inclusive Hiring Practices:

   To ensure the maximum benefit to the community, it is crucial to prioritize inclusivity in hiring practices. Addressing barriers faced by individuals from diverse sexual orientations and gender identities is essential to ensuring equitable access to employment opportunities and fostering a more inclusive workforce environment. This approach will not only maximize the positive impact of job creation but also contribute to greater social equity and cohesion in Lucea.

   a. Anti-Discrimination Policies: Develop and enforce strict anti-discrimination policies that ensure fair hiring practices regardless of gender, sexual orientation, or gender identity.
   b. Diverse Recruitment Channels: Use diverse recruitment channels to reach a broad range of candidates, ensuring that job opportunities are accessible to all segments of the community.

   To ensure inclusive and equitable employment practices and to mitigate potential negative impacts, the above measures should be implemented. It should be noted that, despite the implementation of measures to prevent Sexual and Gender-Based Violence (SGBV), including sexual harassment, exploitation, and abuse, there remains a potential for such incidents to occur. Therefore, standard response procedures should be employed to address any incidents of SGBV swiftly and effectively.

ii. Training and Development:
   a. Comprehensive Training Programs: Implement training programs that provide all employees with the necessary skills and knowledge, ensuring they can perform their roles effectively and progress in their careers.
   b. Diversity and Inclusion Training: Offer training on diversity and inclusion to all staff members to foster a supportive and respectful workplace culture.

iii. Staff Housing:
   a. Implement the planned expansion to ensure that housing is available as the workforce grows, minimizing the risk of overcrowding and housing shortages.
   b. Ensure proposed accommodations are guided by respective regulatory guidelines and approvals obtained.

iv. Community Engagement:
   a. Outreach Programs: Conduct outreach programs to engage with local communities, particularly marginalized groups, to inform them about job opportunities and the inclusive hiring process.
   b. Feedback Mechanism: Create a feedback mechanism for employees and community members to voice concerns and suggestions regarding employment practices and inclusivity.

7.3.4.2 Water Supply

Impact

Phase 2 will not directly impact water supply. The new hotel complex will source its drinking water from a Reverse Osmosis (RO) seawater desalination plant located in the industrial area, alleviating any potential pressure on the existing community water supply. The potable water system will be connected to the trigeneration plant in Phase I and the desalination plant, with drinking water being conveyed to newly installed storage tanks in Phase II near the parking area. These tanks are designed to cater to the water needs of both Phase I and Phase II.

Despite the hotel's dedicated infrastructure, the overall water demand in the area could rise if local businesses establish and thrive due to Phase II. This increase in demand may potentially impact the already strained public piped water supply, which 94.5% of residents depend on. Among these residents, 93.0% currently experience issues such as irregular supply, complete lack of water, absence of piped connections, and low water pressure.

Recommended Mitigation

No mitigation required.

7.3.4.3 Wastewater

Impact

The existing wastewater treatment plant, currently servicing Phase I, has a capacity of 1,500 m³/day. In response to the expansion of the hotel complex, the existing treatment plant is required to double its capacity from 1,500 m³/day to 3,000 m³/day to handle the increased daily volume. This augmentation is crucial to ensure that the additional wastewater generated by the new hotel phase is properly treated.

Further, the expansion of the wastewater treatment plant and the modification of the treatment process will address the odour issue voiced by concerned nearby residents (section 6.2.2.4), and consistently provide effluent that meets NEPA standards. Specifically, the replacement of the sludge dehydration system to provide timely removal of dried sludge will reduce the odour emissions from the wastewater treatment plant.

Recommended Mitigation

No mitigation required.

7.3.4.4 Solid Waste

Impact

The operation of the hotel development has the potential to significantly increase solid waste generation in the area. The daily activities of guests and staff will generate a substantial amount of solid waste, including food waste, packaging materials, paper, plastics, and other refuse. Improper disposal of solid waste can lead to pollution of the local environment, including land and water bodies. Littering and illegal dumping can result in aesthetic degradation and harm to wildlife. Accumulated waste can also attract vermin and pests, which can pose health risks to both guests and local residents.

Waste generated by the hotel, especially if it is located near a beach, can end up in the marine environment, causing pollution and harm to marine life and ecosystems.

Recommended Mitigation

i. Storage Bins and Skips:
   a. Strategic Placement: Place solid waste storage bins and skips at strategic locations throughout the hotel premises to ensure easy access for both guests and staff.
   b. Adequate Capacity: Ensure that the bins and skips have adequate capacity to handle the expected volume of waste without overflow.
   c. Secure Bins and Skips: Use bins and skips designed with secure lids to prevent access by vermin and other pests, minimizing health risks and maintaining hygiene standards.
ii. Monitoring and Cleanup:
   a. Beach Garbage Monitoring: Regularly monitor and clean the beach area to prevent littering and maintain the aesthetic appeal of the coastal environment.

   b. Routine Inspections: Conduct routine inspections of the hotel grounds to promptly address any waste management issues.

iii. Waste Collection and Disposal:
   a. Private Contractor Engagement: Contracting a private contractor to collect solid waste in a timely fashion to prevent a build-up.
   b. Scheduled Collections: Establish and adhere to a regular waste collection schedule to ensure consistent and efficient removal of waste.
   c. Proper Disposal: Ensure that all collected solid waste is disposed of at approved disposal sites, complying with local regulations and environmental standards.
   d. Verification System: Develop a ticketing system between the hotel (Permittee) and the solid waste contractor to ensure effective management and verification of waste disposal.
   e. Record Keeping: Maintain records of waste collection and disposal activities to monitor compliance and identify areas for improvement.

iv. Waste Sorting and Recycling:
   a. Facilitate Sorting: Implement a waste sorting system to separate plastics, paper, glass, organic waste, and other recyclables. Provide clearly labelled bins to encourage proper waste segregation.
   b. Promote Recycling: Partner with local recycling programs to ensure that sorted materials are recycled and not sent to landfills.

v. Employee and Guest Education:
   a. Training Programs: Provide training for staff on waste sorting, handling, and disposal procedures to ensure effective implementation of the waste management plan.

7.3.4.5 Health and Safety

Impact

The operation of the proposed development will involve a substantial number of workers and guests, which increases the likelihood of illnesses, accidents, and emergencies occurring on-site. Additionally, the development is vulnerable to natural disasters such as earthquakes, floods, storm surges, and fires, all of which pose significant risks to health and safety.

Mitigation

i. First Aid Kits:
   a. Equip various sections of the development with well-stocked first aid kits, ensuring they are easily accessible in case of emergencies.
   b. Regularly check and restock first aid kits to ensure they are always ready for use.

ii. Emergency Response Plan:

a. Comprehensive Planning: Design and implement a comprehensive emergency response plan that covers all potential scenarios, including medical emergencies, natural disasters, and fires.
b. Staff Training: Conduct regular training sessions for staff to familiarize them with the emergency response procedures and ensure they can act swiftly and effectively during an emergency.
c. Healthcare Facilities: Establish mutual assistance agreements with local healthcare facilities, such as Noel Holmes Hospital, to ensure quick and efficient medical care for any eventualities. Coordinate with associated doctors and nurses to facilitate prompt treatment.
d. Fire and Emergency Services: Arrange prior agreements with the Lucea Fire Station to ensure rapid response in the event of a fire or other emergencies requiring firefighting services.
e. Police Services: Coordinate with the Lucea Police Station to ensure prompt law enforcement support for any security or safety incidents that may arise.

iii. Natural Disaster Preparedness:
a. Risk Assessment: Conduct a risk assessment to identify potential vulnerabilities to natural disasters such as earthquakes, floods, and storm surges.
b. Disaster Preparedness Plan: Develop and implement a disaster preparedness plan that includes evacuation routes, safe zones, and communication protocols for staff and guests.
c. Regular Drills: Organize regular drills and simulations to practice emergency procedures and ensure all staff and guests are familiar with the actions to take during a natural disaster.

iv. Safety Infrastructure:
a. Emergency Exits and Signage: Ensure that all buildings are equipped with clearly marked emergency exits and safety signage to guide occupants during an emergency.
b. Fire Safety Systems: Install and maintain fire safety systems, including smoke detectors, fire alarms, and sprinkler systems, to enhance fire prevention and response capabilities.

v. Communication Systems:
a. Emergency Communication: Establish robust communication systems to quickly disseminate information during an emergency, including loudspeakers, alarms, and mobile alerts.
b. Coordination with Authorities: Maintain open lines of communication with local emergency services and authorities to ensure coordinated and efficient response efforts.

vi. Health and Safety Training:
a. Employee Training Programs: Implement ongoing health and safety training programs for employees to ensure they are knowledgeable about potential risks and the appropriate response measures.

b. Guest Information: Provide guests with information on emergency procedures and safety protocols upon check-in to ensure they are prepared for any eventuality.

7.3.4.6 Vehicular Traffic

Impact

The TIA demonstrated that during the operational phase, significant traffic increases are anticipated due to the expansion of the hotel and additional staff requirements.

ENTRANCES

Proposed Guest Entrance

The existing hotel entrance will be repurposed to facilitate only guests during the operation period. Trips will predominantly be generated by guest buses and personal vehicles. According to the Trip Generation Manual, the peak hour trip rate for a resort hotel is 0.49 trips per room. With the existing hotel having 1,054 rooms and an additional 948 rooms planned, the future total will be 2,000 rooms. This would theoretically generate 980 trips during peak hour, with an estimated 700 trips in one direction, which is unlikely and not representative of the local conditions.

The development information indicates the resort will cater mostly to foreign guests, who will be transported primarily by bus. Additionally, a separate gate for staff and service vehicles will reduce the load at the existing gate. To rationalize projected traffic loads, the existing peak counts were used to forecast future conditions. Given the measured peak traffic count of 110 vehicles entering and leaving the property, and assuming 50% hotel capacity during measurement, a trip generation rate of 0.11 trips per room is more representative. This aligns with previous studies for resort hotels, which have generation rates from 0.08 to 0.14 trips per room.

Therefore, a trip generation rate of 0.14 was used to represent a worst-case scenario, yielding a peak hour trip generation value of 280 for the hotel. This assumes the same temporal distribution and directionality as the ITE manual: 69% entering and 31% exiting during the AM peak hour. This worst-case scenario indicates a significant impact on the main road due to potential long queues, as shown in Figure 3.1. This rate is expected to remain constant as long as the hotel's operating program remains unchanged.

Proposed Staff Entrance

The new service entrance proposed by Grand Palladium will remodel the intersection into a four-way configuration with the main arterial A1. One leg will head to a new parking location, and the other will lead to the new service entrance gate. Traveling staff will need to use the main at-grade intersection, impacting traffic flows due to increased staff numbers and movements. The hotel currently employs 618 staff members, and this will double with the addition of another 618 staff members to accommodate the increased room count.

To generate traffic counts for the new service entrance, the following assumptions were made for the operational phase:

- 20 buses transporting hotel workers to and from home;
- 8 buses shuttling workers from the existing staff quarters to the new service gate;
- 120 employees travelling via private vehicle or public transportation; and
- vehicles cannot cross the road from the service entrance to staff housing, will use the tunnel instead.

TRIP GENERATION

The ITE Trip Generation methodology, as previously outlined, was used to estimate traffic counts for the Oceanpointe and new service entrance intersections. For the development, the generated trips were used to determine the number of people entering and leaving during the morning and evening peak hours. For the staff entrance, the manual helped calculate the percentage of employee trips during peak times. The NWA advised that ITE rates tend to be conservative for use in Jamaica.

The trip volume generated was approximately 148 trips at peak hour during the hotel's shift change period. These volumes were adjusted to reflect the trips exiting and entering the hotel, as well as to account for movements in the eastbound or westbound direction. It was assumed that 98% of the traffic would be light vehicular traffic, with the remaining 2% allocated to heavy vehicles, such as garbage and supply trucks.

For Oceanpointe, the trip volume generated was 303 AM peak trips and 412 PM peak trips, representing current and future counts for the development. These volumes were adjusted based on the trip generation to reflect the number of trips entering and leaving the development. They were also adjusted based on ratios determined from main road counts to indicate eastbound and westbound movement. It was assumed that only 3% of the vehicles entering and leaving the development were heavy vehicles. For vehicles on the main road, A1, it was assumed that 10% were heavy vehicles, based on ratios obtained from the NWA counts.

TRAFFIC MODELLING

The operational phase is expected to have a significant impact due to the large increase in rooms and the additional staff required to service these rooms. Traffic counts were projected 10 years into the future at a growth rate of 2% per annum compounded, as recommended by the NWA, while trips to and from the Oceanpointe development would remain consistent. Additionally, traffic to the guest entrance of the hotel is expected to double, and all staff will be routed to the western staff gate. To determine the actual impact of the development, existing conditions were modified based on the trip generation values provided in previous chapters.

Figure 7-20 Level of service - Grand Palladium's guest and service entrances – AM Peak

The modelled scenarios indicate that, 10 years after the project's implementation, the guest entrance will experience a level of service (LOS) of F, indicating delays exceeding 80 seconds for guests leaving the hotel. The service entrance will have an LOS of C, and the staff entrance will have an LOS of D. Despite these changes, the main thoroughfare will remain unaffected due to the proposed entrance alignments. The severe delays at the hotel's entrance will negatively impact guest experience and require rectification.

Figure 7-21 Level of Service - Grand Palladium's guest and service entrances - PM peak

Recommended Mitigation

One solution to improve the hotel's main guest entrance is to implement an actuated stoplight with a 90-second cycle time. This stoplight would improve the LOS of the guest entrance from F in the AM and PM peak to B in both periods. This change would result in an LOS of B heading to Montego Bay and C heading to Negril in both the AM and PM scenarios for the main road. These levels of service remain within acceptable ranges based on NWA standards.

For the operational scenario at the service entrance, the following recommendations are made:

i. Improved road lighting to enhance low-light visibility along the corner.
ii. Appropriate traffic warning signs informing road users of the site entrance ahead and instructing them to reduce speed, placed at least 200m both westbound and eastbound from the site.
iii. Highly visible lane markings as recommended by NWA.
iv. Rumble strips to improve vehicle awareness from the westbound traffic, increasing alertness and serving as traffic calming measures.
v. All employee traffic should be routed through the tunnel and should not be permitted to travel from staff housing to the service gate via the main road.

For the guest entrance, the following are recommended:

i. Formalization of a turning lane with a minimum queue length of 35m.
ii. Implementation of high-visibility lane markings to guide commuters effectively on proposed road.

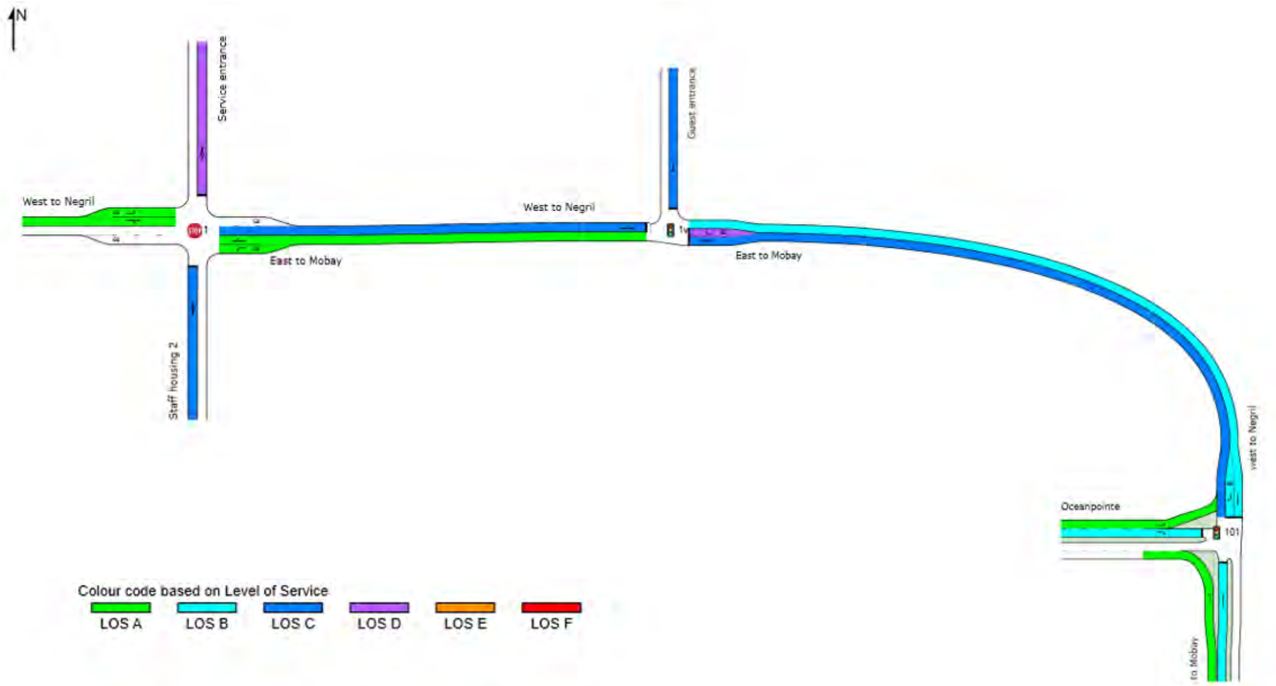


Figure 7-22 **Level of service of hotel entrances with the implementation of the proposed solution - AM**

Figure 7-23 **Level of service of hotel entrances with the implementation of the proposed solution – PM**

7.3.4.7 Maritime Traffic

Impact

The presence of overwater rooms and coastal structures could potentially disrupt existing maritime activities . Overwater rooms can potentially obstruct existing navigational paths, potentially impeding the safe passage of maritime vessels. Further, the risk of accidental collisions increases, particularly during low visibility conditions such as at night or in adverse weather.

Recommended Mitigation

i. Visible Marker Buoys: Installing permanent, highly visible marker buoys around overwater rooms to clearly indicate their presence and boundaries to maritime vessels.
ii. Navigation Lights: Implementing turtle-friendly lighting and strategically positioning lights on overwater structures to ensure visibility for marine vessels during nighttime operations, reducing the risk of collisions.
iii. Clearance and Safety Zones: Establishing and maintaining clearances and safety zones around overwater rooms in accordance with maritime regulations to facilitate safe navigation and prevent congestion.
iv. Monitoring and Compliance: Regular monitoring of maritime traffic patterns and compliance with navigational safety standards to assess any potential impacts and adjust mitigation strategies as necessary.
v. Public Awareness and Education: Conducting outreach and education campaigns to inform maritime stakeholders about the presence of overwater rooms, their potential impacts on navigation, and the importance of adhering to safety measures.

7.3.4.8 Tourism

Impact

The proposed hotel is likely to improve the tourism product of the country and positively impact revenue and infrastructure. Specifically, the Phase 2 hotel can attract more tourists to the area, increasing local tourism revenue. This includes not only the hotel itself but also local businesses such as restaurants, shops, and tour operators. The hotel will also create direct and in direct employment opportunities for locals.

Hotels often promote local culture and traditions through events, decor, and partnerships with local artisans and performers, enriching the cultural experience for tourists. Modern hotels often adopt sustainable practices, such as energy-efficient systems, waste reduction programs, and conservation efforts, which can promote environmental awareness among tourists and locals.

Recommended Mitigation

No mitigation is required.

7.3.4.9 Fisheries

Impact

Based on the observed spatial fishing patterns, designating the waters in front of the Grand Palladium hotel as a protected area would have minimal impact on fishers' incomes. This area is not the primary fishing ground for any of the five local fishing beaches but is frequented by fishers from all of them. In contrast, the outer reefs located farther north are more heavily utilized by several fishing beaches, offering an opportunity for fishers to protect nearby marine habitats and potentially enhance fish stocks through a spillover effect. However, it should be noted that establishing a fish sanctuary in front of Grand Palladium would affect fishing beaches differently; those to the west, such as Haughton Court and Esher, utilize the area less compared to the beaches within Lucea Bay. Given that a significant portion of fishers from the Lucea Fishers Association are from beaches within Lucea Bay, their involvement will be crucial for the successful establishment and management of the sanctuary (Oracabessa Marine Trust, n.d.).

The fishing community in Lucea is supportive of establishing a fish sanctuary, recognizing its benefits such as providing a protected area for fish reproduction and addressing declining fish stocks. The Lucea Fishers Association, representing 35% of local fishers, has actively prepared for the sanctuary's establishment and enjoys strong community trust. Establishing the sanctuary, particularly in this location, will involve active participation from fishers based in Lucea Bay, ensuring their continued engagement and support (Oracabessa Marine Trust, n.d.).

The establishment of the Lucea Fish Sanctuary has the potential to increase the fish stock in the area, hence increasing fisher’s catch and benefiting the local fishing industry.

Recommended Mitigation

i. Stakeholder Engagement and Participation:
   a. Ensure continuous and meaningful involvement of the Lucea Fishers Association and local fishers in the planning, establishment, and management of the fish sanctuary.
   b. Conduct regular consultations and provide updates to the fishing community to maintain transparency and trust.

ii. Education and Awareness:
   a. Conduct education and awareness campaigns to inform the wider community about the benefits of the fish sanctuary, fostering broader support and understanding of marine conservation efforts.
   b. Implement a research program to monitor the ecological and socio-economic impacts of the sanctuary. Use the findings to adapt and improve management practices over time, ensuring the sanctuary meets its conservation and community objectives.

By adopting these mitigation measures, the potential negative impacts on the fisheries sector can be minimized, while maximizing the ecological benefits and ensuring the support and participation of the local fishing community.

7.3.4.10 Land Use and Zoning

Impact

At the project site, the primary land features include urban tree cover, buildings, unpaved roadways, and various infrastructure. Upon completion of Phase 2 construction, there will be a shift in land use from urban tree cover to resort facilities. However, the project is adjacent the existing Phase 1 hotel and the area falls under the Resort and Resort/Residential zoning categories within the Lucea Local Planning Area Land Use Proposal (Inset No. 1), as stipulated by the Town and Country Planning (Hanover Area) Provisional Development Order, 2018. The shift in land use therefore adheres to the prescribed zoning regulations set forth by the Provisional Development Order.

The proposed coastal project components are situated within the Lucea fish sanctuary, and Fort Charlotte, a significant protected asset in Lucea, has been designated as a site by the Jamaica National Heritage Trust. These designations impose specific regulatory frameworks aimed at conserving natural and cultural heritage.

Recommended Mitigation

While no mitigation measures are necessary, it is advisable to review those recommended for fisheries concerning the Lucea fish sanctuary (section 7.3.4.9).

7.3.4.11 Community Relations

Impact

During the operational phase of the hotel, there is potential for inconveniences, health risks, and nuisances to affect stakeholders both on-site and in the surrounding area. Considering the stable population and strong community engagement in the area, it is crucial to anticipate and address their concerns promptly and effectively.

The community has expressed several concerns regarding the construction of the new hotel, based on their experiences with the existing hotel (section 6.0). While the majority of respondents did not report issues with the current hotel, a small percentage did highlight specific problems. These included the smell of sewage effluent in the air, inadequate signage, reduced water supply to surrounding communities, sewage discharge into the ocean, limited staff parking, increased motor vehicle collisions, insufficient local employment, flooding on the hotel property, increased crime and violence during construction, loss of recreational space, negative impacts on the ecosystem, and union busting. Notably, most of these issues were reported as unresolved.

In relation to the proposed hotel development, a significant portion of respondents expressed concerns. These concerns include increased demand on the local water supply system, doubts about equal employment opportunities for locals, potential loss of beach access, possible pollution from sewage effluent, increased crime, inadequate parking leading to traffic issues, loss of livelihood for fisherfolk, increased traffic congestion, loss of marine wildlife, dust pollution, possible relocation, lack of community development benefits, employment of competent workers, beach erosion, and destruction of coral reefs.

Despite these concerns, many community members also see potential positive impacts from the new hotel project. They anticipate the creation of employment opportunities, community and national development, increased tourist presence, infrastructure improvements, increased income opportunities, economic growth, and property appreciation. However, there is also apprehension about negative impacts, such as reduced water supply, increased crime, traffic congestion, increased motor vehicle collisions, loss of fishing areas, and foul sewage odours. Overall, the community is divided, with some expecting positive outcomes and others worried about potential negative effects.

Recommended Mitigation

With the aim of establishing and maintaining a harmonious relationship between the stakeholders (both internal and external) and the Project, a Claims and Complaints Absolution Program will be implemented, whose general objective is to create a system that allows timely response to complaints from residents who are perceived to be affected or harmed by any aspect of the Project.

A Grievance Redress Mechanism (GRM) to include reports of allegations of Gender Based Violence (GBV), Sexual Exploitation and Abuse (SEA) and Sexual Orientation Discrimination will also be formulated. The objectives of the GRM are outlined below:

- Ensure a fair and rapid response by the representatives of the Project to the questions, concerns and / or complaints of the stakeholders, so that they do not become negative impacts.
- Provide alternative methods to solve potential complaints in substitution of legal actions between the parties.
- Properly document complaints and claims, elaborating respective formats for each stage of the process.
- Build a process of mutual trust with local and regional groups of interest.
- Clearly defining policy statements about the handling of complaints and claims (including, when appropriate, mechanisms to ensure confidentiality and access to the information).
- Clearly establishing organizational responsibilities such as the assigning of specific personnel from the operation, managers, and/or functional units to implement the GRM, designating access points for complaints.

- Defining, documenting, and disclosing workflow procedures and standards to ensure that all complaints are understood and analysed, as well as the criteria for decisions to determine the appropriate responses.
- Establishing clear communications mechanisms with claimants, both regarding how to bring problems to the attention of the authorities and how those authorities communicate with the claimants.
- Establishing systems to register and follow up on all complaints, disputes, or claims.
- Establishing an appeal process (or other solutions) for cases where the parties involved in a complaint, or a dispute do not agree with the decisions at the operational level.

8.0 IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

The discussion and analysis of alternatives in should consider other practicable strategies that aim to eliminate or reduce negative environmental impacts. This section, required by the National Environment and Planning Agency (NEPA), is crucial for identifying the most environmentally responsible development options. By evaluating various alternatives, the goal is to find a development approach that minimizes environmental disturbance while still meeting project objectives.

The project alternatives identified include the No-Action Alternative, which evaluates the implications of not proceeding with the project to understand the potential environmental benefits and drawbacks of maintaining the status quo. By thoroughly examining project alternatives, the EIA aims to ensure that the chosen development path aligns with both environmental protection and project goals.

The following project alternatives have been identified and are discussed in further detail below:

- **Alternative 1 - The "No-Action" Alternative**
- **Alternative 2 - The Project as Proposed in the EIA**
- **Alternative 3 - The Project as Proposed in the EIA with Rearrangement of Overwater Rooms and Coastal Works**
- **Alternative 4 - The Project as Proposed in the EIA with Reduced Overwater Rooms and Coastal Works**
- **Alternative 5 - The Project as Proposed in the EIA with Increased Overwater Rooms and Coastal Works**

8.1 ALTERNATIVE 1 - NO ACTION ALTERNATIVE

The "No Action" alternative represents the scenario where no changes are made to the current situation or existing conditions. It serves as a baseline against which other project alternatives are compared.

The advantages of the No-Action Alternative include:

- **Physical**
    - No nuisance from construction activities (dust, noise etc.)
    - No increased turbidity/TSS in the marine environment
    - No potential spillage of fuel/oil/lubricants in the marine environment.
    - No change in hydrodynamics
    - No change to the seafloor
    - No additional light pollution
- **Biological**

  - Flora and fauna remain undisturbed
  - No permanent seagrass and other benthic habitat loss
  - No permanent other benthic species loss (coral)
  - No smothering and sedimentation of seagrass, coral and associated macrofauna
  - No disturbance of possible turtle nesting by obstacles in water, increased noise and lighting
  - No change in ecosystem services
  - No change in blue carbon sequestration
- **Human/Social**
  - Maritime activities will not be affected by the physical presence of the overwater rooms
  - No increased maritime accident potential in the form of vessel collision with overwater rooms structures
  - No increased water usage and solid waste generation

The disadvantages of the No-Action Alternative include:

- **Physical**
  - No change in drainage
- **Biological**
  - No provision of added ecological volume from groynes, breakwaters and overwater rooms pilings resulting in more available space for recruitment and colonization of hard coral and other sessile fauna
  - No creation of Fish Aggregation Devices (FADs) by the presence of groynes, breakwaters and the pilings and the shaded areas provided by the overwater rooms structures
- **Human/Social**
  - No additional economic benefits to the community and economy
  - No increased employment and creation of indirect and induced job opportunities
  - No broadening of the tourism client base and overall diversified and enhanced Jamaican tourism product
  - No further increase the room offerings of the island

8.2 ALTERNATIVE 2 - THE PROJECT AS PROPOSED IN THE EIA

Fiesta Jamaica Ltd. commenced the construction of The Grand Palladium Jamaica & Lady Hamilton Resort & Spa in 2007 (Phase 1) and now intends to undertake the Phase 2 expansion. This expansion project aims to add 948 rooms over approximately 83.78 acres of land. New rooms will be distributed across two hotels:

- Grand Palladium: Comprising eight buildings with 475 rooms, standing at six storeys high. There will also be one-story two- and three-bedroom villas with swim-up pools.
- TRS Hotel: Exclusively for adults, consisting of nine buildings with 473 rooms, also standing at six storeys high. It will also include two-bedroom single-storey villas and a swim-up pool.

Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:

- Sixteen (16) overwater bungalows.
- Creation of 2 beaches, one at the southern overwater bungalows area and the other in the TRS area, exclusively for guest enjoyment.
- Three (3) revetments, 6 groynes, 2 submerged breakwaters.

A new industrial area will be constructed, connected to Phase 2 by a new tunnel under the main road. A new service access point from the main road to the industrial area will be established. The current entrance to Phase 1 of the existing hotel will remain operational.

The existing Wastewater Treatment and Reverse Osmosis plants will be expanded to accommodate Phase 2 demands.

The advantages to this alternative include:

- **Physical**
  - Potential to Increase shoreline protection
  - Potential to improve water quality
  - Potential to reduce sediment loading
- **Biological**
  - Part of the overwater bungalows are located on top of the breakwater, thereby sharing the same footprint and reducing the environmental impact
  - Potential to add ecological volume from groynes, breakwaters and overwater rooms pilings resulting in more available space for recruitment and colonization of hard coral and other sessile fauna

  - Potential to create Fish Aggregation Devices (FADs) by the presence of groynes, breakwaters and the pilings.
  - Potential turtle nesting areas will be better protected (from poachers and animals)
- **Human/Social**
  - Additional economic benefits to the community and economy
  - Increased employment and creation of indirect and induced job opportunities
  - Broadening of the tourism client base and overall diversified and enhanced Jamaican tourism product
  - Further increase the room offerings of the island

The disadvantages to this alternative include:

- **Physical**
  - Potential noise and dust nuisance to surrounding residential communities from construction activities
  - Potential to reduce water quality in the marine environment
  - Potential spillage of fuel/oil/lubricants in the marine environment
  - Potential loss of seafloor features
  - Potential changes in hydrodynamics
- **Biological**
  - Potential loss of flora and associated fauna
  - Potential habitat loss including seagrass
  - Potential species loss and displacement
  - Potential smothering and sedimentation of seagrass, coral and associated macrofauna
  - Potential disturbance of possible turtle nesting by obstacles in water, increased noise and lighting
- **Human/Social**
  - Potential to affect maritime activities by the physical presence of the overwater rooms
  - Potential to increase maritime accident potential in the form of vessel collision with overwater rooms structures
  - Potential solid waste generation
  - Potential to displace fisherfolk by presence of overwater rooms and associated structures
  - Potential to displace recreational use of beach areas by locals

8.3 ALTERNATIVE 3 – THE PROJECT AS PROPOSED IN THE EIA WITH REARRANGEMENT OF OVERWATER ROOMS AND COASTAL WORKS

This expansion project aims to add 948 rooms over approximately 83.78 acres of land (Figure 8-1). New rooms will be distributed across two hotels. Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:

- 16 overwater bungalows
- Creation of 2 beaches
- 1 revetment, 2 groynes, 2 submerged breakwaters

A new industrial area will be constructed, connected to Phase 2 by a new tunnel under the main road. A new service access point from the main road to the industrial area will be established. The current entrance to Phase 1 of the existing hotel will remain operational.

The existing Wastewater Treatment and Reverse Osmosis plants will be expanded to accommodate Phase 2 demands.

Alternative 3 would have similar impacts compared to Alternative 2.

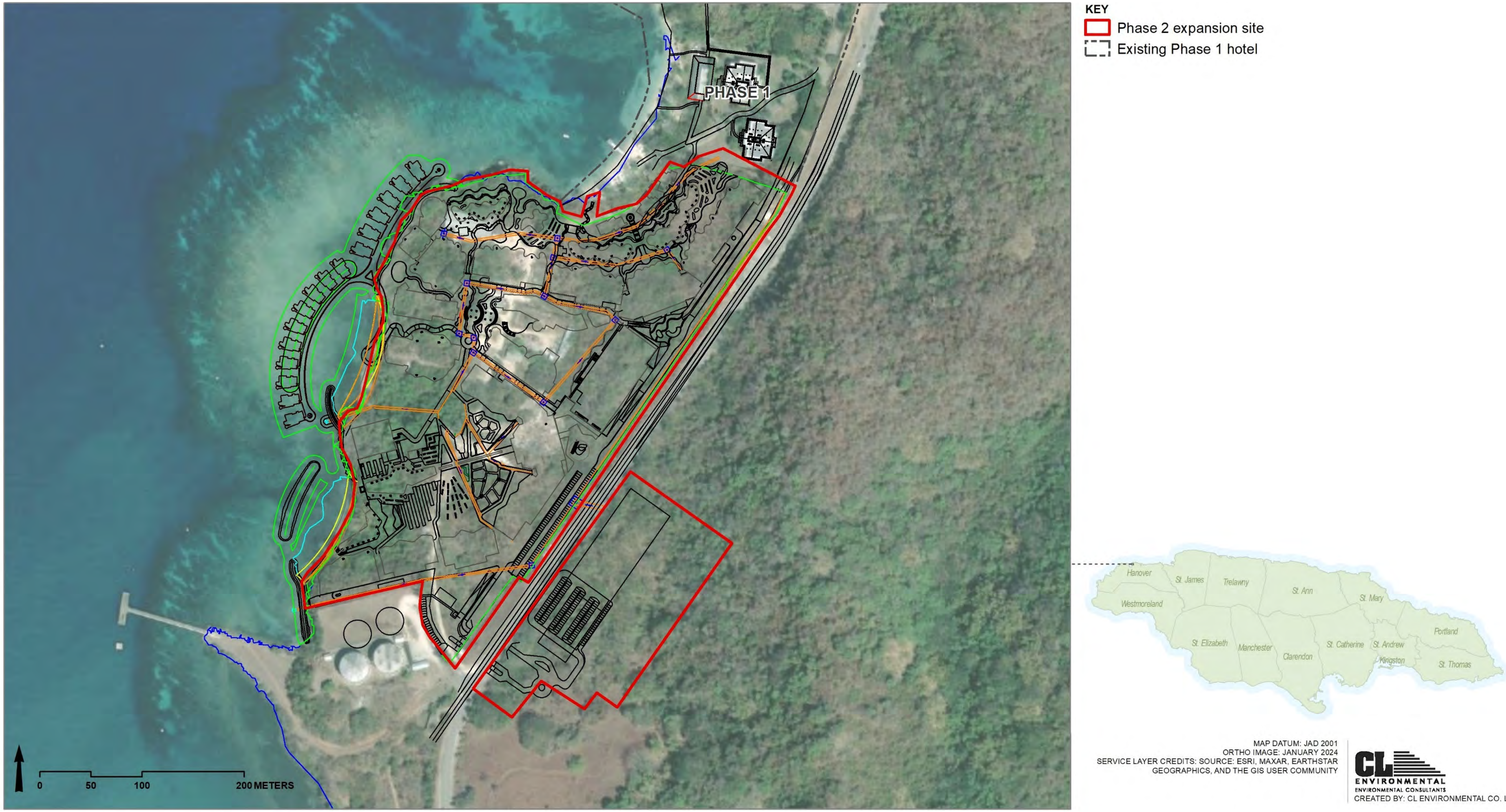


Figure 8-1 Alternative 3 detailed drawing layout

8.4 ALTERNATIVE 4 - THE PROJECT AS PROPOSED IN THE EIA WITH REDUCED OVERWATER ROOMS AND COASTAL WORKS

This expansion project aims to add 948 rooms over approximately 83.78 acres of land (Figure 8-2). New rooms will be distributed across two hotels. Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:

- 14 overwater bungalows
- 2 submerged breakwaters

A new industrial area will be constructed, connected to Phase 2 by a new tunnel under the main road. A new service access point from the main road to the industrial area will be established. The current entrance to Phase 1 of the existing hotel will remain operational.

The existing Wastewater Treatment and Reverse Osmosis plants will be expanded to accommodate Phase 2 demands.

Alternative 4 would have similar but reduced impacts compared to Alternative 2. For example, the benthic footprint is similar, while no new bathing beaches will be created. This reduces the tourism product, options and economic benefits.

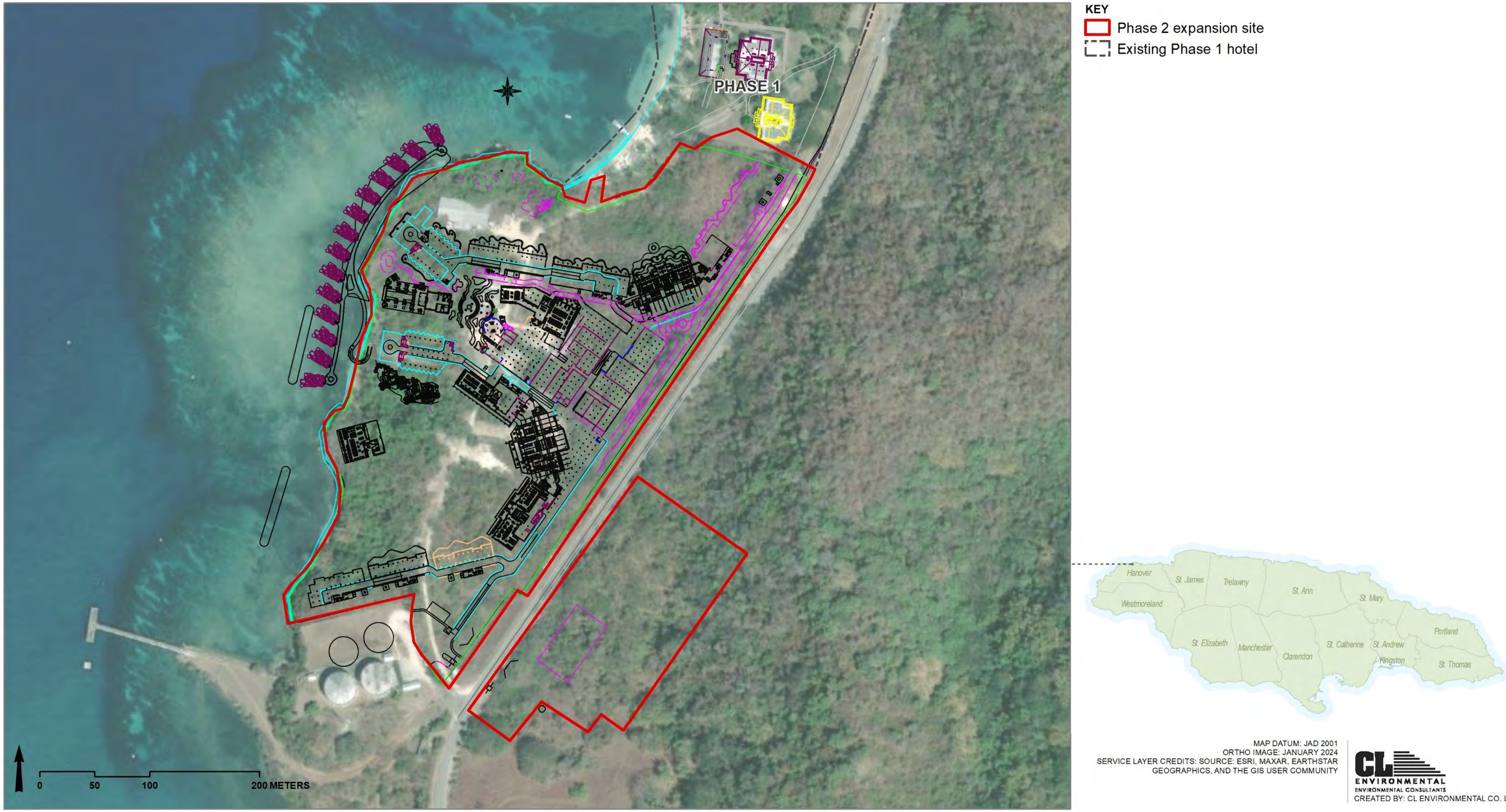


Figure 8-2 Alternative 4 detailed drawing layout

8.5 ALTERNATIVE 5 - THE PROJECT AS PROPOSED IN THE EIA WITH INCREASED OVERWATER ROOMS AND COASTAL WORKS

This expansion project aims to add 948 rooms over approximately 83.78 acres of land (Figure 8-3). New rooms will be distributed across two hotels. Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre. The following is also proposed:

- 20 overwater bungalows
- 2 submerged breakwaters

A new industrial area will be constructed, connected to Phase 2 by a new tunnel under the main road. A new service access point from the main road to the industrial area will be established. The current entrance to Phase 1 of the existing hotel will remain operational.

The existing Wastewater Treatment and Reverse Osmosis plants will be expanded to accommodate Phase 2 demands.

Alternative 5 is similar to Alternative 2, but with a greater benthic impact footprint. Additionally, no new bathing beaches will be created.

8.6 THE PREFERRED ALTERNATIVE

The preferred alternative is Alternative 2 – the Project Proposed in the EIA. This alternative aims to minimize ecological disruption while ensuring the project's feasibility and success.

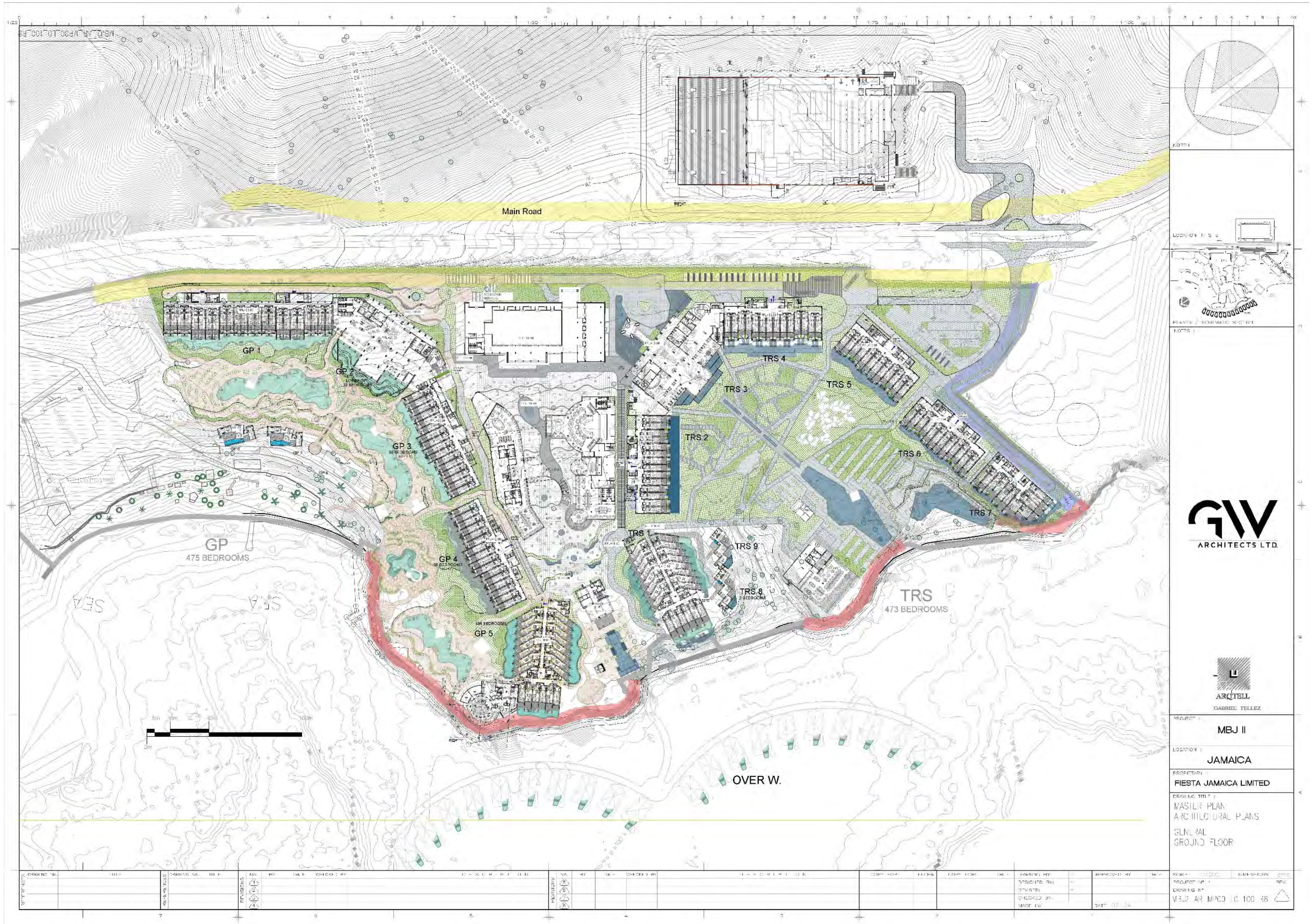


Figure 8-3 Alternative 5 master plan layout

9.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

An Environmental Management System (EMS) is an important tool which can be used to assist operations managers in meeting current and future environmental requirements and challenges. It can be used to measure a company's operations against environmental performance indicators, thereby helping the company to reach its environmental targets. A good management system will integrate environmental management into a company's daily operations, long-term planning and other quality assurance systems.

It is therefore recommended that several parameters be monitored before, during and after the project implementation to record any negative construction impacts and to propose corrective or mitigation measures. The suggested parameters include but are not limited to the following:

11) Water Quality to include but not be limited to:
    a. Nitrates
    b. Phosphates
    c. BOD
    d. Fats, oil and grease
    e. pH
    f. TSS
    g. Turbidity
    h. TDS
    i. Faecal Coliform
12) Noise
13) Sediment loading
14) Coral and Seagrass
15) Traffic
16) Maritime Operations
17) Solid Waste Generation and Disposal
18) Sewage Generation, Treatment and Disposal
19) Equipment Maintenance
20) Health and Safety

9.1 DRAFT CORAL AND SEAGRASS MANAGEMENT PLANS

While the Environmental Monitoring Plan (Section 1.1) entails coral and seagrass related monitoring practices during construction, the draft plans below give more specifics with regard to coral and seagrass monitoring and management.

9.1.1 Coral Management Plan

The Coral Management Plan will include a combination of coral monitoring exercises, water quality monitoring and sediment dispersal monitoring, before, during and after construction. The activities will be conducted by qualified and trained marine scientists and SCUBA divers.

9.1.1.1 Roving Coral Reef Surveys

Roving qualitative surveys will be conducted in and around the project area via snorkelling and/or SCUBA diving. Observations and photographs will be taken to include but not be limited to; incidence of coral disease and excess sedimentation.

9.1.1.2 Water Quality Monitoring

Water quality monitoring is part of the general construction monitoring (see section 9.2.1) and will be included as part of the coral monitoring report.

Onsite observations will also be included where possible.

9.1.1.3 Sediment Dispersal

Sediment dispersal is part of the general construction monitoring(see section 9.2.1) and will be included as part of the coral monitoring report.

Onsite observations will also be included where possible.

9.1.1.4 Phasing and Monitoring Frequency

The Coral Monitoring Programme will be conducted as part of the general site monitoring. Roving surveys will be conducted at least once per month during construction.

Any suspected new or increased incidence of coral disease, mass bleaching event and any other significant change/disaster observed will be immediately reported to NEPA.

9.1.2 Seagrass Management Plan

The Seagrass Management Plan will include a combination of seagrass survey/monitoring exercises and water quality monitoring before, during and after construction. The activities will be conducted by qualified and trained marine scientists and SCUBA divers.

9.1.2.1 Seagrass Bed Health and Survivability

Transect lines and quadrats will be placed within relocation areas where suitable. Data collected will include percentage cover, shoot density and leaf blade length. Other observations to be made include bioturbation, overall health and appearance, and colonisation. Aerial coverage of the bed areas will be monitored by ortho rectified drone imagery.

9.1.2.2 Water Quality Monitoring

Temperature, pH, salinity, conductivity, dissolved oxygen, light irradiance, turbidity and total dissolved solids will be measured in situ using a Hydrolab DataSonde DS-5 multiprobe at the seagrass relocation areas, lab analysis of phosphates and nitrates will also be conducted. The results of the data collected will be compared with National Environment and Planning Agency (NEPA) marine water quality standards and preconstruction values.

9.1.2.3 Phasing and Monitoring Frequency

The Seagrass Monitoring Programme will be implemented over a five year period. The monitoring frequency is outlined below:

- Time zero report (30 days after completion of the relocation exercise)
- Quarterly for the first two years
- Bi-annually for the remaining three years
- Additional reports may be necessary in the event of a hurricane or other natural disaster

9.1.2.4 Seagrass Removal and Replanting Works (if any)

Any seagrass removal and replanting works to be conducted as a mitigation measure will be done in accordance with the NEPA Seagrass Relocation and Monitoring protocols (Table 9-1 and Table 9-2).

Table 9-1 Seagrass Replanting Summary Form – Weekly log of planting activities (from NEPA)

<table>
<tr><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2" rowspan="2">Persons Conducting Planting:

Authorized by:</td><td colspan="2">GPS Location of Planting Site (State format):</td><td>Date of Planting:</td></tr>
<tr><td colspan="2">Site no:</td><td>Week No:</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="3">Average Seagrass Harvested per day (m²):</td><td colspan="2">No. of Grids Harvested per week:</td></tr>
<tr><td colspan="3">Total Seagrass Harvester Per week(m²):</td><td colspan="2">No. of Grid Planted Per week:</td></tr>
<tr><td colspan="3" rowspan="2">Total Seagrass Harvester Per week by species (m²):
Thalassia sp: Syringodium sp:

Halodule sp:</td><td>Name of Harvested Grid</td><td>Name of Equivalent Planting Grid</td></tr>
<tr><td></td><td></td></tr>
</table>

<table>
<tr><td>Total Seagrass Planted to Date (This should include all seagrass planted up to the end of the week stated above):</td><td>Overall weather conditions:</td></tr>
<tr><td colspan="2">Comments and Observation:</td></tr>
</table>

Table 9-2 Seagrass Monitoring Summary Form (post relocation monitoring) (from NEPA)

<table>
<tr><th></th><th></th><th></th></tr>
<tr><td rowspan="3">Persons Conducting Monitoring:

Authorized by:</td><td rowspan="2">GPS Location of Planting Site (state format):</td><td>Date of Monitoring:</td></tr>
<tr><td rowspan="2">Survival Trend Graph:</td></tr>
<tr><td>Site no:
Depth:</td></tr>
<tr><td colspan="3">Monitoring Period: Monitoring Period: () Time Zero () Time Zero Plus 60 days () Time Zero Plus 180 days () Time Zero Plus 365 days
() Year 1 Plus 180 days () Year 1 Plus 365 days () Year 2 Plus 180days () Year 2 Plus 365days
() Year 3 Plus 180 days () Year 3 Plus 365days () Year 4 Plus180 days () Year 4 Plus 365days</td></tr>
<tr><td>Average Leaf Length (cm):</td><td>Percentage Cover Surviving:</td><td>Total Area replanted (m^2):</td></tr>
<tr><td colspan="3">Bioturbation Presence/Absence/Type of Animals noted:</td></tr>
<tr><td colspan="3">Water Quality Data:
Temperature: Total suspended solids: Nutrients {Nitrates and Phosphates}: Salinity:
Temperature: pH: Dissolved Oxygen: BOD: Faecal coliform: PAR:</td></tr>
<tr><td colspan="3">Incidence and Extent of Erosion: N/A</td></tr>
<tr><td colspan="3">Date and Extent of Remedial Planting if any (details should be outlined on the remediation monitoring form):
N/A</td></tr>
<tr><td colspan="3">Comments, Observations, Ecological Trends:</td></tr>
</table>

9.2 DRAFT ENVIRONMENTAL MONITORING PLAN

9.2.1 Site Preparation and Construction Phase

- Undertake fortnightly water quality monitoring (for the first 6 months, then monthly thereafter) for temperature, salinity, pH, Dissolved Oxygen, light irradiance and turbidity and laboratory parameters for Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Nitrates, Phosphates and Faecal Coliform in and around the project area, or at a frequency agreed to with NEPA to ensure that the construction works are not negatively impacting on water quality. Any organization with the capability to conduct monitoring of the listed parameters should be used to perform this exercise. This is estimated to cost approximately **J$450,000** per monitoring exercise.
    - Additional turbidity monitoring will be conducted on both the inside and outside of silt screens during coastal works. The results of the data collected will be compared with preconstruction values.
- Daily inspections to ensure that construction activities are not being conducted outside of regular working hours (e.g., 7 am – 7 pm). In addition to environmental noise monitoring, a noise survey should be undertaken to determine workers exposure and construction equipment noise emission. Noise monitoring to be conducted monthly at the site and residential areas near to site.

  The project engineer / site supervisor should monitor the construction work hours. NEPA should conduct spot checks to ensure that the hours are being followed. Each noise monitoring exercise is estimated to cost approximately **J$400,000**.
- Daily monitoring to ensure that fugitive dust from raw materials is not being entrained in the wind and creating a dust nuisance.

  The project engineer / site supervisor should monitor the construction work hours. NEPA should conduct spot checks to ensure that this stipulation is being followed.
- Conduct daily inspections to ensure that flagmen where necessary are in place and that adequate signs are posted along the roadways where heavy equipment interact with existing roads. This is to ensure that traffic have adequate warnings and direction.
- Undertake daily assessment of the quantity of solid waste generated and keep records of its ultimate disposal.
- Weekly assessment to determine that there are adequate numbers of portable toilets and that they are in proper working order. This will ensure that sewage disposal will be adequately treated.
- Monitoring of vehicle refuelling, and repair should be undertaken to ensure that these exercises are carried out on hardstands. This is to reduce the potential of water/soil/sand contamination from spills. Spot checks should be conducted by NEPA.

- Traffic and maritime operations should be monitored to ensure approved management plans at critical areas are being followed. NEPA and NWA and other relevant authorities should perform spot checks to ensure compliance.
- Contractors should conduct daily toolbox meetings including EHS, best practices and other relevant information, for example:
    - Undertake inspections to ensure that workers are wearing adequate personal protective equipment (PPE), such as hard hats, hard boots, air protection, safety glasses, reflective vests and fall protection is necessary. Ensure that safety signage is in place.
- Health, safety and emergency response plans should be prepared prior to site preparation and construction phases.
- Where possible, construction crews should be sourced from within the study area. This will ensure that the local community will benefit from the investment.
- Coral and seagrass monitoring as outlined previously to include:
    - Photo Inventory and/or Roving Surveys.
    - Corals of particular interest (endangered species, diseased or bleached colonies for example), Fish species and counts.
    - This is estimated to cost approximately **J$ 525,000** per monitoring exercise.
- To monitor the potential sediment impact from construction activities on the marine environment, a total of four (4) sediment traps will be deployed. The sediment traps will be retrieved monthly, its contents analysed and redeployed to determine the rate of sedimentation (mg/cm2/day) and dispersal patterns over the area. The sediment trap will have an internal diameter of 3". Traps will be taken to a Ministry of Health certified laboratory for analysis. This is estimated to cost approximately **J$ 380,000** per monitoring exercise.
    - The contents of the sediment traps will be filtered through a filter paper, dried and then weighed. The results will be represented in the form of mass of sediment recovered. Using the results retrieved from the laboratory, the unit mass of sediment dispersed per day will be calculated by dividing the mass of sediment recovered by the number of days deployed and the area of the sediment trap opening.
    - Onsite observations will also be included where possible for example, sediment plumes.
    - Drone monitoring may also be used to identify areas where sediment is escaping work areas.

9.2.2 Operational Phase

- Water quality monitoring should be conducted quarterly and in the case of adverse events after construction. If three to six results demonstrate that the site or parts of the site have stabilised, the sampling frequency and sampling locations may be reviewed, reduced or discontinued as per an approved monitoring plan. This is estimated to cost approximately **J$ 450,000** per monitoring exercise.

A report shall be prepared by the Contracted party. It shall include the following data:

i. Dates, times and places of test.
ii. Weather condition.
iii. A defined map of each location with distance clearly outlined in metric.
iv. Test Method used.
v. Parameters measured
vi. Results
vii. Conclusions

The report will be submitted to the Client or their designate within two weeks of the monitoring being completed.

The Client shall distribute the report to NEPA within two (2) weeks of receiving the laboratory results.

In the event that the water quality does not meet the required criteria, investigations shall be carried out and corrective actions were necessary taken and a re-test shall be scheduled at the earliest possible time and a new report submitted.

9.2.2.1 Benthic Monitoring (Coral and Seagrass)

The Lucea fish sanctuary will be responsible for all monitoring and reporting activities within the sanctuary, including areas around the overwater rooms. Sanctuary reports should also detail the status of fisheries, including improvements seen since the establishment of the sanctuary, special projects and major events.

10.0 CONCLUSIONS AND RECOMMENDATIONS

This proposed development is expected to increase the island's room offerings, thereby creating jobs and economic benefits, growing the tourist clientele, and enhancing and diversifying the Jamaican tourism product.

However, the project also poses potential negative impacts, including the degradation and loss of natural habitats, as well as adverse effects on noise levels, air quality, and solid waste facilities. These concerns have been highlighted through stakeholder involvement and public interviews conducted for this EIA.

The implementation of the recommended mitigation measures detailed in this EIA, along with the various environmental management and monitoring programs, will assist in reducing these negative impacts.

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12.0 APPENDICES

Appendix 1 – Terms of Reference

TERMS OF REFERENCE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM JAMAICA & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER

DATE | 22 April 2024
PREPARED BY | C.L. Environmental Company Limited

APPLICATION
MAY 03 2024
ACCEPTED

APPLICATION SECRETARIAT BRANCH
MAY 03 2024
NEPA

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Project Description

The Grand Palladium Jamaica & Lady Hamilton Resort & Spa, constructed by Fiesta Jamaica Ltd in 2007 in Lucea, Hanover, aims to initiate Phase 2 expansion of the current hotel. Originally planned for approximately 1000 rooms in 2007, the expansion was halted during the economic recession of 2009. The number of rooms for the Phase 2 expansion has been revised to 948 (Figure 1). The proposed expansion will divide the guest rooms into two hotels: the existing Grand Palladium (GP) and a new TRS hotel, a Palladium brand exclusively for adults (Figure 2 and Figure 3), with several already established in the Caribbean.

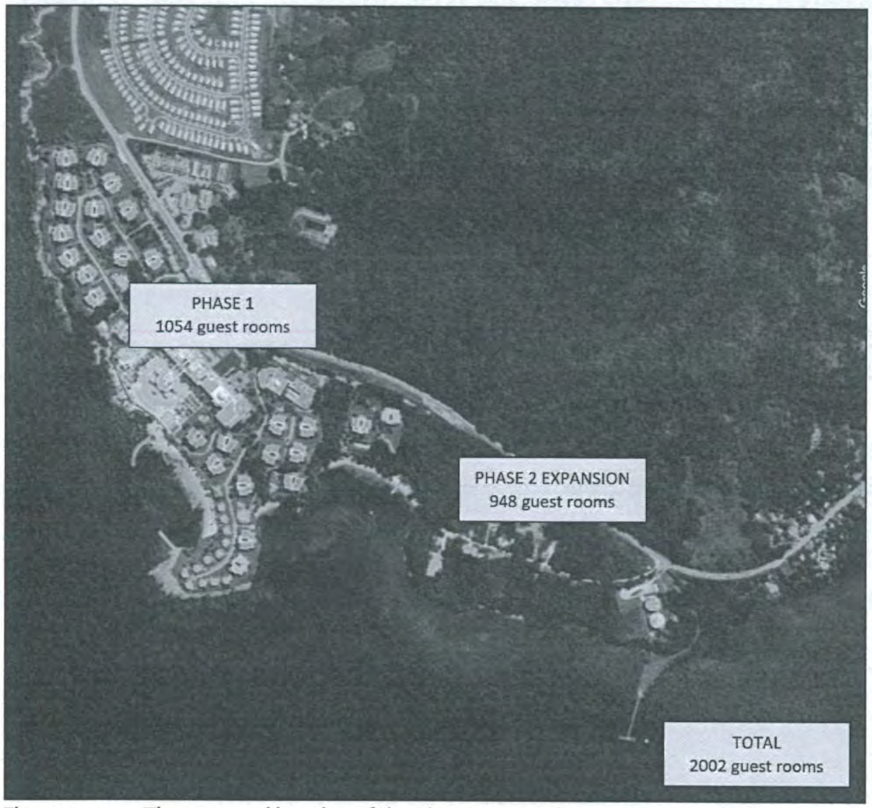


Figure 1 The proposed location of the Phase 2 expansion

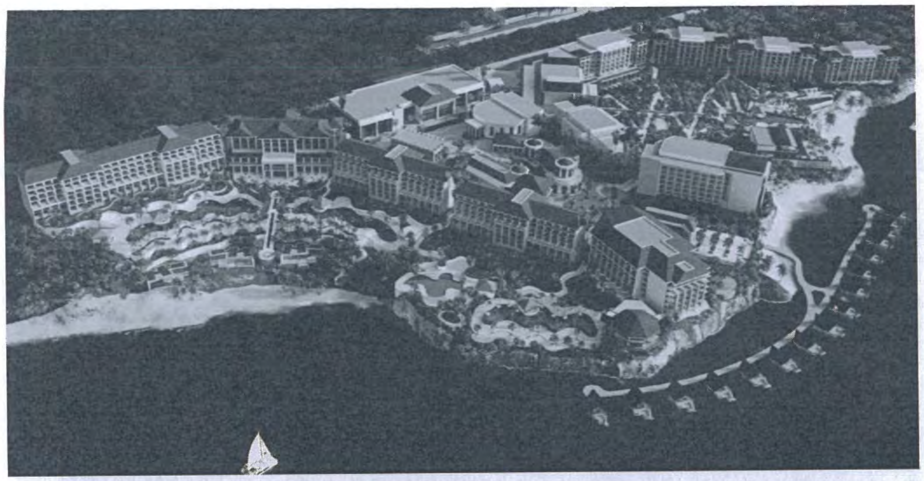


Figure 2 Render of Phase 2 expansion looking to the southwest (GP in the foreground)

Figure 3 Render of Phase 2 expansion looking to the southeast (TRS in the foreground and GP in the background)

Foreword

The purpose of this document is to establish the **Terms of Reference for an Environmental Impact Assessment for the Proposed Phase 2 Expansion of Grand Palladium Jamaica & Lady Hamilton Resort & Spa, Lucea, Hanover**. An EIA seeks to identify the impacts the proposed project is likely to have on the area in which the physical development will be carried out as well as the impact of the environment on the proposed development. It also outlines mitigation measures necessary to reduce the negative impacts of the project.

The EIA will be prepared using a participatory approach involving key stakeholders. The EIA report must be produced in accordance with the agreed TOR issued by the National Environment and Planning Agency (NEPA) to Fiesta Jamaica Limited.

Where the need arises to modify the TOR, the required amendments/modifications are to be made and submitted to the Agency. Approval for the TOR must be obtained from the Agency, in writing, prior to the commencement of the EIA study.

The National Environment and Planning Agency and the Natural Resources Conservation Authority (NRCA) reserves the right to reproduce, transfer and disclose any and all contents contained in the submitted environmental impact assessment report without the written consent of the proponent, consultants and/or its agents.

Terms of Reference

The Terms of Reference to conduct the Environmental Impact Assessment (EIA) are as follows:

1.0 EXECUTIVE SUMMARY

Provide a brief statement on the content of the EIA report. The executive summary should provide a comprehensive overview and objectives for the project proposal, natural resources, justification for the project, etc. In addition, it should include relevant background information and provide a summary of the main findings, including but not limited to main impacts and mitigation measures, analyses, and conclusions in the report. A summary of the environmental monitoring and management plans, as well as alternatives should also be included.

2.0 INTRODUCTION

The introduction should provide a background and seek to explain the need for and the context of the project and the EIA. It should also provide the delineation and justification of the boundary of the study area, general methodology, assumptions, and constraints of the study. Additionally, a profile of the project proponent, implementing organization, project consultants, etc. should also be provided.

This size of the study area should be large enough to include all valued resources that might be significantly affected by the project. This information will form the basis upon which impacts of the project will be assessed. The study area shall include at least the area within a 1 km radius from the centre of the property. While this constitutes the minimum radius for evaluating the various physical, biological, and social environmental receptors, the study area expands for specific assessments, particularly in socio-economic descriptions, in which the area of study is a radius of 5 kilometres.

3.0 LEGISLATION AND REGULATORY CONSIDERATION

This section should provide details of the pertinent regulations, standards, policies, and legislations governing environmental quality, safety and health, cultural significant finds, protection of sensitive areas, protection of endangered species, tourism enterprises, siting, and land use control at the local and national levels. The examination of the legislation should include at a minimum the Natural Resources Conservation Authority Act 1991, Natural Resources Conservation Regulations 1996, amended 2015, Natural Resources Conservation (Wastewater and Sludge) Regulations, 2013, Beach Control Act, Jamaica National Heritage Trust Act, Wild Life Protection Act, Fisheries Act 2018, National Solid Waste Management Authority Act, the Town and Country Planning Act, Town and Country Planning (Hanover Area) Provisional Development Order, 2018, and The Building Act, Codes and Standards promulgated there under and Planning Guidelines - Overwater Structures, and all appropriate international convention/protocol/treaty where applicable. Describe traditional land use and advise of any prescriptive rights including public access rights.

4.0 PROJECT DESCRIPTION

The report should provide a comprehensive description of all proposed terrestrial and marine project component, including information necessary to identify and assess the potential environmental impacts of the project. This should include but not be limited to:

Location and Background

- Location map and total site area.
- An overall master plan of the site including current, proposed, and future use of the lands showing the various components and design elements of the proposed development. Site maps illustrating areas to be impacted and areas to be preserved in their existing state.
- Objectives and information on, rationale for the project.
- History and project background, the nature, location/existing setting, timing, duration, frequency, general layout, as well as the impact on the carbon footprint of the energy sector are to be discussed.
- Existing site and its characteristics (landward & seaward).
- The study area should be clearly delineated and referenced. Considering the types of resources located in the area and the magnitude of the associated impacts, the study area should be large enough to include all valued resources that might be significantly affected by the project.

Project Features and Design

- For each major project component, that is, hotel expansion creating 2 hotels with shared amenities and service areas, overwater features, beach works and upgrades and expansions of service facilities such as power generation and wastewater treatment, Reverse Osmosis Plant where applicable:
    - Detailed description of the project, project objectives and phases (where applicable), including all applicable timelines for the various aspects of the project (from pre to post development). The description should also provide details of the design concept, design

components, material(s) to be used, total number, size, and types of guest rooms/suites, boardwalk or means of access to the overwater rooms; design height of structures above sea level; and supporting services such as administrative, "back-of-house" facilities, power generation, laundry facilities and amenities to serve the proposed development such as pools and restaurants. This should be supported using maps, diagrams, and other visual aids where appropriate.

- Detailed description of all activities and features which will introduce risks or generate an impact (positive or negative) on the environment including but not limited to removal and or relocation and shading of seagrass and/or coral; collection, beach works, transfer, and disposal of waste (solid waste and sewage); provision of potable water and electricity; and dredging/excavation.
- Details of the methods, equipment, and machinery to be employed to undertake each aspect of the project including coral/seagrass relocation, dredging/excavation, transportation of material, disposal of spoils (if applicable), storage of material, installation of pylons, construction of units, installation of required infrastructure and secondary activities such as refuelling of vessels, proposed location(s) for equipment storage (staging area) and establishment of a site office.
- Source and characteristic of fill sediment for beach nourishment and the impact on coastal morpho-dynamics should be include.
- A detailed landscape plan highlighting grading and proposed changes in topography. The landscape plan should emphasize the retention of mature trees and use of native species in landscaping activities.

- Construction methodology, works, duration and maintenance schedule, which must include methodology for the proposed cutting/trenching, beach nourishment, coastal protection works and overwater suites. Coastal works should be supported by modelling data to demonstrate impact on adjacent shorelines to the west and east of project site.
- Details regarding access points and accessibility during pre-construction, construction, and post-construction, to the proposed work site(s).
- Details of any required decommissioning of the works and/or facilities.

Wastewater Treatment Plant

Detailed description of Wastewater Treatment Plant to include but not be limited to:

- Treatment system and design criteria
- Maintenance and operation plan
- Septage and sludge management plan
- Projected daily flows (average and peak)
- Effluent discharge details (including projected water quality)

It will also include description of nay upgrades and changes to the existing Wastewater Treatment Plant.

Drainage

Detailed drainage report which should be designed for a 1 in 50-year event.

5.0 DESCRIPTION OF ENVIRONMENT

This section should include a detailed description of the proposed sites (marine, terrestrial and socioeconomic) and surrounding environment. Baseline data should be generated to give an overall evaluation of the existing environmental conditions. This information will form the basis upon which impacts of the project will be assessed. The following aspects should be described in this section, broken down into the following:

- Physical Environment
- Biological Environment
- Natural Hazards
- Socio-economic and Cultural/Heritage

Physical Environment

- Topography, soils, climate/meteorology, geology (including but not limited to rock type and formation, susceptibility to erosion, seismicity, and faults), geomorphology of the site and impacts on current landscape, aesthetic appeal and hydrology should be examined.
- A geotechnical study should also be conducted within the proposed project area. The methodology must include specifications for the type of equipment used in the geotechnical investigation.
- A detailed hydrological assessment of the proposed project area should be conducted to:
    - Identify and clearly map locations of natural and manmade drainage features within the project area. These are to include sinkholes, rivers, gullies, and drainage infrastructure;
    - Estimation of peak flows under the 10-, 25-, 50- and 100-year Return Periods;
    - Flushing/circulation analysis of immediate coastal area against generated stormwater runoff.
    - Consultations should be had with the National Works Agency (NWA) regarding the drainage plan for the development.
- Hydrodynamics, including but not limited to bathymetry, waves (hurricane, operational and swell), currents, tides, baseline sediment transport and circulation patterns. Scenarios for hurricane should consider 50- and 100-year return periods.
- Water quality of the marine environment (Figure 4). Baseline water quality should include study areas and associated environs and control sites. These should be accurately mapped, and a spatial comparison of the data should be done to determine any possible source(s) of pollutants.
    - Water quality should include but not be limited to the following parameters:
        - Physical parameters: Temperature, salinity, conductivity, pH, dissolved oxygen, turbidity, Total Suspended Solids and Total Dissolved Solids.
        - Chemical Parameters: Nitrate, Phosphate.
        - Biological Parameters: Biochemical Oxygen Demand, Faecal Coliform.
    - Water quality data (primary) shall be collected at the sampling sites identified (Figure 5), during the wet and dry seasons. A minimum of six (6) months data shall be presented and analysed. Water quality sampling events will be conducted, each at least one month apart. Sampling should include at least 3 samples for the wet season and 3 for the dry season. Where there is heavy rainfall during the six months data collection, at least one sample should be collected.

- Where secondary data is used to supplement (not replace) the primary data, it should not be older than five years.
- Results from the water quality sampling should be compared to NRCA water quality standards.

- Analysis of marine sediments (Figure 5) should include but not be limited to the following parameters:
  - Arsenic
  - Cadmium
  - Mercury
  - Lead
  - Total Petroleum Hydrocarbons
- Dry sieve analysis of sediments in project area.
- Analysis of sediment loading in project area (Figure 6).
- Noise and vibration levels of undeveloped site and the ambient noise in the area of influence (Figure 7).
- Particulate Matter (PM10 and PM2.5) of the undeveloped site and in the area of influence (Figure 7). Data is to be compared with the NRCA daily ambient air quality standard limit for PM10, and the USEPA daily limit for PM2.5 since a PM2.5 standard has not yet been promulgated for Jamaica. Ambient air quality sampling will be conducted at six (6) locations for 24 hours each, using Airmetrics Minivol Tactical Air Samplers. Measurements of PM 10 (particles of sizes between 2.5 – 10 mm) and PM 2.5 (2.5 micrometres and smaller) will be taken. PM10 sampling will be conducting on select days according to the US EPA 6-day schedule, while PM2.5 sampling will be conducted on select days according to the US EPA 3-day schedule, for a total of six (6) months.
- Sources of existing pollution (coastal, surface and groundwater) and extent of contamination.

Figure 4 Proposed Water quality station locations

NEPA

TERMS OF REFERENCE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM JAMAICA & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER | 9

Figure 5 Proposed Sediment sample locations

TERMS OF REFERENCE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM JAMAICA & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER | 10


KEY
Sediment trap location
0
50
100
200 METERS
MAP DATUM: JAD 2001
CREATED BY: CL ENVIRONMENTAL CO. LTD.
SERVICE LAYER CREDITS: SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
TERMS OF REFERENCE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM JAMAICA & LADY HAMILTION RESORT & SPA, LUCEA, HANOVER | 11
Figure 6 Proposed Sediment trap locations
NEPA

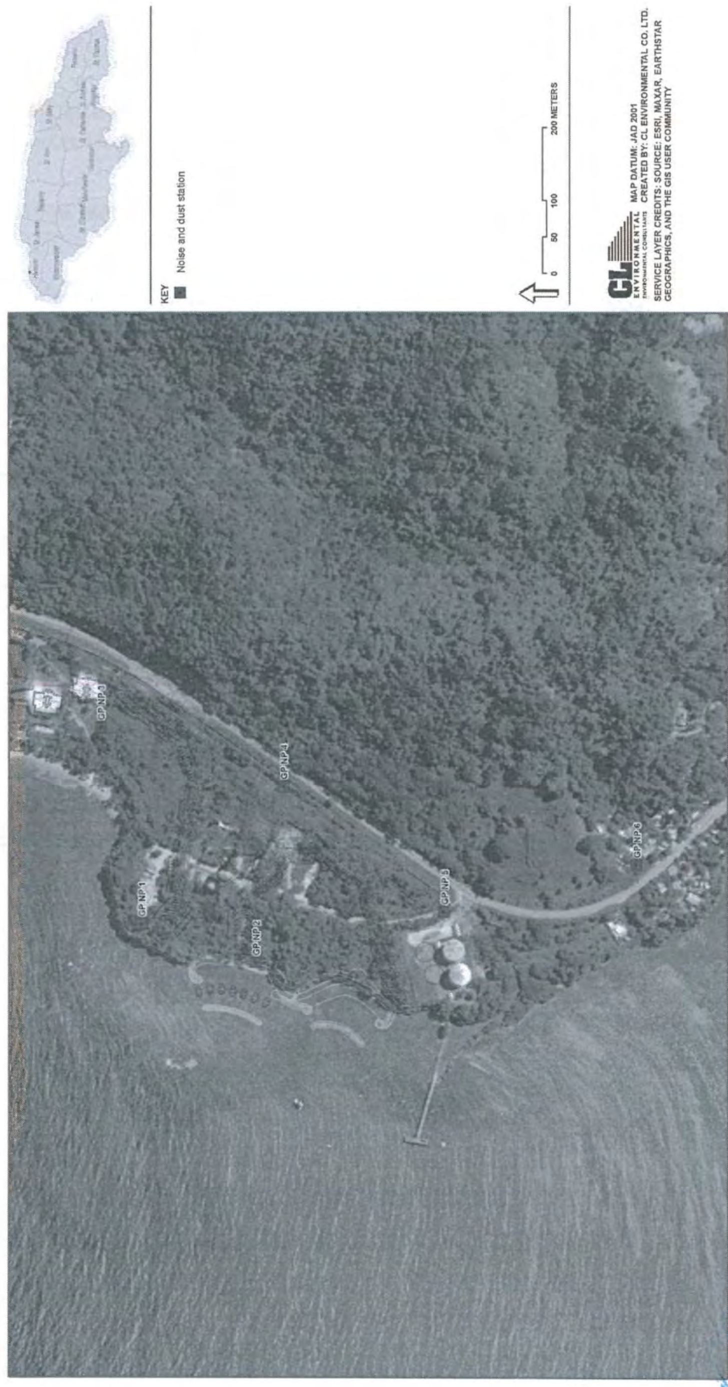


Figure 7 Noise and particulate station locations at the proposed development site

TERMS OF REFERENCE FOR AN ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM JAMAICA & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER | 12

Biological Environment

Detailed description of terrestrial and marine habitats, existing vegetation type, detailed floral and faunal surveys inclusive of a species list, commentary on the biodiversity, ecological health and function in the project area, threats and conservation and significance. This should include:

- A qualitative and quantitative assessment of ecologically sensitive terrestrial and marine habitats in and around the proposed project sites and the areas of impact.
- Habitat Map of area.
- Benthic surveys should be conducted with emphasis placed on the working footprint (seafloor) inclusive of temporary access points and buffer zones, which will be impacted by the proposed project structures/features such as coastal protection works, overwater structures, beach nourishment and dredging/excavation.
    - Where practical, the benthic survey should include the size, number, and species name of coral colonies within the project footprint.
    - Carbon storage and above and below ground biomass should be calculated for seagrasses in the project area, in suitable sediment types.
- A species list of terrestrial and marine flora and fauna (including but not limited to marine mammals, herpetofauna, avifauna, invertebrates, and bats) should be generated with special emphasis on those species considered rare, threatened, endangered, endemic, protected, invasive and economically or nationally important. Migratory and seasonal species variation should also be assessed/considered.
- Identification and description of the different ecosystem types and structure including species dominance, possible biological loss or habitat fragmentation ought to be considered.
- A detailed assessment of the forested areas should be conducted to include:
    - Tree species and diameter at breast height (DBH) of flora species within the sample area.
    - Vegetation profile.
    - Inventory of epiphytes, of bromeliads and orchids.
- Any crocodile, sea turtle or bird nests observed in or around the project area should be recorded and mapped. This should be supported by information including but not limited to the following: existing sea turtle and bird nesting sites and seasons and habitat usage by migratory species.
- GPS mapping of rare, threatened, endangered, endemic species.

Natural Hazards

Natural Hazards and Disaster Risk Reduction for Climate Change, in relation to:

- Earthquakes
- Hurricane
- Storm surges (coastal flooding)
- Flooding
- Beach Stability
- Karstic Hazards

The natural hazard risk assessment should take in account climate change projections for return periods of 25, 50 and 100 years.

Socioeconomic Environment

This section should provide details on demography, regional setting, current and potential land-use patterns; description of existing infrastructure such as transportation, electricity, water and telecommunications, and public health and, educational and social services, amenities; should be explored and other material assets of the area should also be examined. This will be done within 5 km of the proposed site.

Traffic Impact Assessment

A Traffic Impact Assessment must also be undertaken. The objectives are to investigate the potential impact of the traffic during construction and during operations on the existing and future main road traffic.

- Background Data Collection
    - Existing traffic count data on main road
    - Field/road conditions parameters will be collected for all the relevant roads and intersections.
    - Other developments currently planned within the area.

The data collected will be used to describe the existing conditions at all the selected locations. Comparisons will also be drawn to show what the existing conditions are as opposed to what the standards recommend. Analysis will be conducted to determine the existing Level of Service (LOS).

The potential impact of project construction and operations on LOS will be determined and recommended mitigation measures provided.

Cultural/Heritage

An assessment of artefacts, archaeological, and paleontological features of the site must be undertaken. The historical importance of the area should also be examined including identification of culturally significant features e.g., archaeological finds. Where there is a need, this should be conducted in collaboration with the Jamaica National Heritage Trust.

6.0 PUBLIC PARTICIPATION

A socio-economic survey to determine public perceptions of the project (both negative and positive) should be completed and this should include but not be limited to potential impacts on social, physical, biological, and historical/cultural values. This assessment may vary with community structure and may take multiple forms such as public meetings or questionnaires. The methodology for conducting the survey should be included as part of the EIA report. This will be done within 2km of the proposed site.

Stakeholders to be consulted shall include but not be limited to: Hanover Municipal Corporation, National Fisheries Authority, Water Resources Authority, National Works Agency, Ministry of Health, and Wellness - Environmental Health Unit, the owner of the wharf/pier and any other relevant stakeholders and special interest groups.

Describe the public participation methods, timing, type of information provided and collected from public and stakeholder target groups meetings. The instrument used to collect the information must be included in the appendix. It may be useful and necessary to hold stakeholder meetings to inform the public of the proposed development and the possible impacts. This will also gauge the feeling/response of the public toward the development.

The issues identified during the public participation process should be summarized and public input that has been incorporated or addressed in the EIA should be outlined.

Public Meetings should be held in accordance with the Guidelines for Conducting Public Presentation at a time and location signed off by the National Environment and Planning Agency (NEPA). A public meeting will be held to present the findings of the EIA once the EIA is completed and submitted for consideration. All relevant documents are required to be made available to the public. In addition, any material change to the design of the project will require a further public meeting to be undertaken by the developer and all changes made to the document should be clearly outlined to the public.

7.0 IDENTIFICATION AND ASSESSMENT OF POTENTIAL IMPACTS AND RECOMMENDED MITIGATION MEASURES

Impacts

A detailed analysis of the project components should be done in order to: identify the major potential environmental and public health impacts of the project; distinguish between levels of impact, significance of impact (a ranking from major to minor/significant to insignificant should be developed), positive and negative impacts, duration of impacts (long term or short term or immediate), direct and indirect and impacts, reversible or irreversible, long term and immediate impacts and identify avoidable impacts.

Cumulative impacts should also be evaluated considering previous developments and any proposed development immediately adjacent to the subject development within the area. The identified impacts should be profiled to assess the magnitude of the impacts. The major concerns surrounding environmental and public health issues should be noted and their relative importance to the design of the project and the intended activities indicated.

The extent and quality of the available data should be characterized, explaining significant information deficiencies and any uncertainties associated with the predictions of impacts. A major environmental issue is determined after examining the impact (positive and negative) on the environment and having the negative impact significantly outweigh the positive. It is also determined by the number and magnitude of mitigation strategies which need to be employed to reduce the risk(s) introduced to the environment. Project activities and impacts should then be ranked as major, moderate, and minor and presented in separate matrices for all the phases of the project (i.e. preconstruction, construction, operational and decommissioning/closure). The potential impacts may be subdivided into Physical Impacts, Biological Impacts and Socio-economic/Cultural Impacts. All impacts should be listed, ranked, and assessed, preferably in a single table.

The impacts to be assessed should include but not be limited to the following:

Physical Impacts

- Construction activities such as site clearance, earthworks, and spoil disposal
- Sediment plume dispersal

- Oceanography
  - Storm surge
  - Modification of waves and current patterns
- Water quality
- Geotechnical and engineering requirements
- Spoil Disposal
- Impacts of potential spills (such as oil and chemical spills)
- Drainage
- Solid Waste
- Noise and vibration impacts
- Operation and maintenance – provision of and demand requirements for potable water and electricity, waste disposal, sewage treatment and disposal, communication, and other utility requirements
- Impacts on aesthetics, landscape, and seascape
- Climate related impacts will be included where relevant

Biological Impacts

This should include an assessment of the direct and indirect impacts of the project on the ecology of ecologically sensitive coastal marine ecosystems with emphasis being placed on rare, endemic, threatened, protected, endangered, invasive, and economically important species, migratory and seasonal species. Other impacts should include:

- Coastal modification and shoreline modification including but not limited sandy and rocky shore ecosystem. The impact of the coastline to the east and west of the project area should be assessed for risk of adverse impacts associated with proposed coastal modification works.
- Removal of seagrass and corals, relocation of seagrass and corals, shading which should be supported by the criterion for relocation site(s) and an assessment of the sites to determine suitability.
- Reef modification
- Assessment on impacts on other marine resources including but not limited to corals and seagrass
- Noise that will affect marine animals.

An assessment of the direct and indirect impacts of the project on the sensitive ecosystems and communities should also be conducted. This should include but not be limited to:

- Provision of options suitable to compensate for the unavoidable loss, including monitoring and rehabilitation plan
- Determination the total impact area and or number of individuals
- Potential rehabilitation sites and/or other compensation measures

Project impact (land clearance, noise, dust) on other floral and faunal species (birds, herpetofauna, bats etc.) should be explored, with emphasis on impacts on species of importance.

Natural Hazards

Potential impact of natural hazards including tropical storms, hurricanes, earthquakes, and tsunamis

Socioeconomic/Cultural/Heritage Impacts

Effects on the socio-economic status such as changes to public access and recreational use; impacts on existing and potential economic activities; traffic impacts, contribution of the development to the national economy and development of surrounding communities should be examined. Socio-economic and cultural impacts to include prescriptive rights, land use/resource effects, health, and safety of the potential workers as well as the residents of the surrounding environs should be described. Public perception as it relates to loss of property value, loss of aesthetic enjoyment among other things should be explored, as well as Loss of and damage to artefacts, archaeological and paleontological features.

Mitigation

The mitigation measures should endeavour to avoid, reduce, and remedy the potential negative effects while at the same time enhancing the positive impacts projected. Mitigation and abatement measures should be developed for each potential negative impact identified. Full details of the methods proposed to be employed in the implementation of these measures should be provided, including details on the scheduling/timelines, source of materials, location, and responsible parties, where appropriate. Maps and diagrams should also be used to illustrate areas where mitigation measures are proposed to be implemented.

This should be represented in a table/matrix outlining the identified impacts and the proposed mitigation measures.

8.0 IDENTIFICATION AND ANALYSIS OF ALTERNATIVES

Alternatives to the proposed development/project including the no-action alternative should be examined. These should be assessed according to the physical, biological, and socio-economic parameters of the site. This examination of alternatives should incorporate the use of the history of the overall area in which the site is located and previous uses of the site itself. Alternatives should also address specific aspects of the project such as methods proposed in the execution of the project (works) that have been identified as being causes of major impacts. A rationale for the selection/rejection of any project alternative should be provided.

This section should include at least three (3) alternatives including the No-Action alternative.

9.0 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

Environmental Management Plan

An Environmental Management Plan should be developed which will detail the requirements for the construction and operational phases of the project. This should include, but not be limited to methodology, training for construction and operation staff, recommendations to ensure that the implementation of mitigation measures and long-term minimization of negative impacts. Special emphasis should be placed on the preparation of an outline Coral Management Plan and Seagrass Management Plan.

Environmental Monitoring Plan

An outline Environmental Monitoring Plan should be included in the EIA. At the minimum, the outline monitoring plan should include:

- Introduction outlining the need for a monitoring programme
- The locations selected for monitoring
- The mitigation measures to be implemented and the parameters and activities which will be monitored for each activity
- The proposed methodology to be employed for the monitoring of the various parameter.
- The frequency of the monitoring
- The proposed format that the monitoring reports should take
- The frequency of the submission of the monitoring reports
- The responsible parties for the monitoring

10.0 CONCLUSION AND RECOMMENDATIONS

11.0 LIST OF REFERENCES

12.0 APPENDICES

The appendices should include but not be limited to the following documents:

- Composition of the consulting team, team that undertook the study/assessment, including name, qualification, and roles of team members
- Reference documents
- Photographs/ maps
- Data Tables
- Terms of Reference
- Notes of Public Consultation sessions
- Instruments used in community surveys

All findings must be presented in the EIA report and must reflect the headings in the body of the TORs, as well as references. GIS references should be provided where applicable.

Two hard copies and an electronic copy must be submitted to NEPA for review after which the Agency will indicate the number of hard copies along with an electronic copy of the report to be submitted. One copy of the document should be perfect bound.

The report should include appendices with items such as maps, site plans, the study team and their individual qualifications, photographs, and other relevant information. All the foregoing should be properly sourced and credited.

APPLICATION ... MAY 03 2014 NEPA

Appendix 2 – Study Team

C.L. Environmental Company Limited

- Carlton Campbell, Ph.D., CIEC (Project Coordinator)
- Matthew Lee, M.Sc. (Noise, Air Quality, Marine Benthic Sediments)
- Rachel D'Silva, B.Sc. (Marine and Benthic Studies)
- Karen McIntyre, M.Sc. (GIS, Cartography, Socioeconomics)
- Alec Silvera, B. Sc (Water Quality, Marine and Benthic Studies)
- Glen Patrick (Senior Field Technician – Noise, Particulates & Weather)
- Patrick Litchmore (Field Technician – Noise, Particulates & Weather)

Smith Warner International Limited

- Oceanography and Hydrodynamics (Currents and Tides, Wave Climate, Hurricane Wave Climate, Storm Surge, Sediment Transport, Sedimentology, Shoreline Morphology, Bathymetry)
- Drainage and Hydrology

Associate Consultants

- CEAC Solutions Company Limited (Traffic Impact Assessment)
- Damion Whyte, M.Sc. (Faunal Studies)
- Adrian Thomas, M.Sc. (Faunal and Flora Studies)
- Chauntelle Parkins, B.Sc. M. Phil.(pending) (Coral and Fish Studies)
- Le'Anne Green, B.Sc. M. Sc.(Seagrass Studies)
- Jannette Manning, M.Sc. (Public Perception Survey)
- Jamaica National Heritage Trust (Archaeological Impact Assessment)

Appendix 3 – Noise Calibration Certificate

HBK HOTTINGER BRÜEL & KJÆR

The Hottinger Brüel & Kjær Inc. Calibration Laboratory
3079 Premiere Parkway Suite 120
Duluth, GA 30097
Telephone: 770-209-6907
Fax: 770-447-4033
Web site address: http://www.hbkworld.com

ACCREDITED

Calibration Certificate # 1568.01

CERTIFICATE OF CALIBRATION No.: CAS-591652-G7T8J4-401 Page 1 of 2

CALIBRATION OF:

Calibrator: Brüel & Kjær Type 4231 IEC Class: 1 Serial No.: 3018640

CUSTOMER:

CL Environmental
20 Windsor Avenue
5 Kingston, Jamaica

CALIBRATION CONDITIONS:

Environment conditions:	Air temperature:	22.6	°C
	Air pressure:	98.366	kPa
	Relative Humidity:	50.4	%RH

SPECIFICATIONS:

This document certifies that the acoustic calibrator as listed under "Type" has been calibrated and unless otherwise indicated under "Final Data", meets acceptance criteria as prescribed by the referenced Procedure. Statements of compliance, where applicable, are based on calibration results falling within specified criteria with no reduction by the uncertainty of the measurements. The calibration of the listed transducer was accomplished using a test system which conforms to the requirements of ISO/IEC 17025, ANSI/NCSL Z540-1, and guidelines of ISO 10012-1. For "as received" and "final" data, see the attached page(s). Items marked with one asterisk (*) are not covered by the scope of the current A2LA accreditation. This Certificate and attached data pages shall not be reproduced, except in full, without written approval of the Hottinger Brüel & Kjær Inc. Calibration Laboratory-Duluth, GA. Results relate only to the items tested. The transducer has been calibrated using Measurement Standards with values traceable to the National Institute of Standards and Technology, National Measurement Institutes or derived from natural physical constants. The acoustic calibrator has been calibrated in accordance with the requirements as specified in IEC60942.

PROCEDURE:

The measurements have been performed with the assistance of Hottinger Brüel & Kjær Inc. acoustic calibrator calibration application
Software version 2.3.4 Type 7794 using calibration procedure4231 Complete

RESULTS:

[X] "As Received" Data: Within Acceptance Criteria	[ ] "As Received" Data: Outside Acceptance Criteria
[X] "Final" Data : Within Acceptance Criteria	[ ] "Final" Data : Outside Acceptance Criteria

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the calibrator under calibration.

Date of Calibration: August 9, 2022

Certificate issued: August 9, 2022

John Avitabile

Meshaun Hobbs
Calibration Technician

John Avitabile
Quality Representative

CERTIFICATE OF CALIBRATION

No.: CAS-591652-G7T8J4-401

Type: 4231 Serial No.: 3018640 Page 2 of 2

Sound Pressure Levels

All stated values are valid at environmental reference conditions

Nominal Level [dB]	Accept Limit Lower [dB]	Accept Limit Upper [dB]	Measured Level [dB]	Measurement Uncertainty [dB]
94	93.80	94.20	94.02	0.12
114	113.80	114.20	114.01	0.12

Frequency

Nominal Frequency [Hz]	Accept Limit Lower [Hz]	Accept Limit Upper [Hz]	Measured Frequency [Hz]	Measurement Uncertainty [Hz]
1000	999.00	1001.00	999.97	0.10

Total Distortion*

Distortion mode: [X] TD* [ ] THD*

Calibration Level [dB]*	Accept Limit [%]*	Measured Distortion [%]*	Measurement Uncertainty [%]*
94	1.00	0.36	0.13
114	1.00	0.18	0.13

Environmental Reference Conditions:

Pressure: 101.3 kPa, Temperature: 23 °C, Relative Humidity: 50%

Instrument List

Type	Description	Serial no	Cal. date	Due date	Calibrated by	Trace number
3560	PULSE Analyzer	2723320	2021-10-18	2022-10-31	KC	CAS-541708-J2Z8Q8-301
9545	Transfer Microphone	3	2021-10-27	2022-10-31	MH	CAS-541708-J2Z8Q8-403
4228	Reference Sound Source	1618502	2021-04-30	2023-04-30	MH	CAS-512601-T0X4B1-402

During the calibration the calibrator has been loaded by the load volume of the Transfer Microphone. The load volumes for a number of different types of Transfer Microphones are listed in the table below.
For Brüel & Kjær Pistonphones types 4220 and 4228 the result of the SPL calibration has been corrected to be valid for a load volume of 1333 mm^3. For all other types the result is valid with the actual load volume.

Transfer Microphone Type	Fulfils standard IEC 61094-1 LS	Fulfils standard IEC 61094-4 WS	Load Volume 1" (1/2" mic including DP-0776)	Load Volume 1/2"
4180	yes	yes	1126 mm^3	43 mm^3
4192	-	yes	1273 mm^3	190 mm^3
9545	-	-	1333 mm^3	-

Condition "As Received": Good

Comments

Appendix 4 – Airmetrics Tactical Air Sampler Calibration Certificates

NIST Traceable Transfer Standard Calibration

Calibration Date: 09/12/2022
Ambient Temp, °K: 298.0
Amb Press, mmHg: 758.0

Orifice # MNF1829-
Pri Std # LFE786620
Manometer #

By:
Chk:

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
4.62	4.56	7.799	7.810	-0.14
3.78	3.74	7.046	7.061	-0.22
3.00	2.96	6.286	6.268	0.29
2.33	2.29	5.519	5.498	0.38
1.75	1.72	4.745	4.748	-0.06
1.38	1.36	4.227	4.208	0.45
1.08	1.07	3.706	3.718	-0.33
0.81	0.80	3.182	3.198	-0.50

Manometer ΔH vs Act Flow Linear Regression Results:

m_{flo} = 5.9271
b_{flo} = -0.1263
r^2 = 0.9999

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq.A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, millimeters of mercury

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300}\right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
P_{sea} = Sea Level Atmospheric Pressure
E = Site elevation, feet

Airmetrics
1940 Don St., Suite 300
Springfield, OR 97477
(541) 683-5420

NIST Traceable Transfer Standard Calibration

Calibration Date: 12/08/2023 Orifice # MNF1829- By:
Ambient Temp, °K: 298.2 Pri Std # LFE786620
Amb Press, mmHg: 765.0 Manometer # DIG1829 Chk: ________

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
4.63	4.57	7.797	7.798	-0.01
3.77	3.72	7.045	7.036	0.13
3.00	2.97	6.285	6.287	-0.03
2.32	2.29	5.518	5.520	-0.04
1.74	1.71	4.745	4.771	-0.54
1.35	1.33	4.226	4.207	0.44
1.05	1.03	3.705	3.703	0.06
0.78	0.76	3.181	3.181	0.01

Manometer ΔH vs Act Flow Linear Regression Results:

m_{flo} = **5.8423**
b_{flo} = **0.0011**
r^2 = **0.9999**

* all points must be within ± 2%

The MiniFlo calibration is performed with an NIST-traceable standard. Each unit has a unique pair of calibration constants derived from the calibration which are used to calculate the actual air flow rate at all ambient conditions. The unit's calibration should be recertified annually.

The actual flow rate is a function of the pressure drop across the device, the ambient temperature, and the ambient pressure. The relationship of these variables and the unique calibration constants ("m" and "b") for each device is presented in the following equation (Eq A):

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, millimeters of mercury

CAUTION: The weather service, most airports, etc, reduce the atmospheric pressure to a common reference (sea level). The equation above requires the atmospheric pressure at the location where the MiniFlo is being used.

The equation below may be used to estimate the ambient atmospheric pressure at any elevation if the sea level pressure is known.

$$P_{act} = P_{sea} \times \left(1 - \frac{E}{145300}\right)^{5.25}$$

P_{act} = Ambient Atmospheric Pressure
P_{sea} = Sea Level Atmospheric Pressure
E = Site elevation, feet

Airmetrics
1940 Don St., Suite 300
Springfield, OR 97477
(541) 683-5420

NIST Traceable Transfer Standard Calibration

Calibration Date: 12/08/2023 Orifice # MNF1829-
Ambient Temp, °K: 298.2 Pri Std # LFE786620
Amb Press, mmHg: 765.0 Manometer # DIG1829

Std ΔH (inH_2O)	Manometer ΔH (inH_2O)	Actual Flow (alpm)	Calc Flow (alpm)	Difference* (%diff)
4.63	4.57	7.797	7.798	-0.01
3.77	3.72	7.045	7.036	0.13
3.00	2.97	6.285	6.287	-0.03
2.32	2.29	5.518	5.520	-0.04
1.74	1.71	4.745	4.771	-0.54
1.35	1.33	4.226	4.207	0.44
1.05	1.03	3.705	3.703	0.06
0.78	0.76	3.181	3.181	0.01

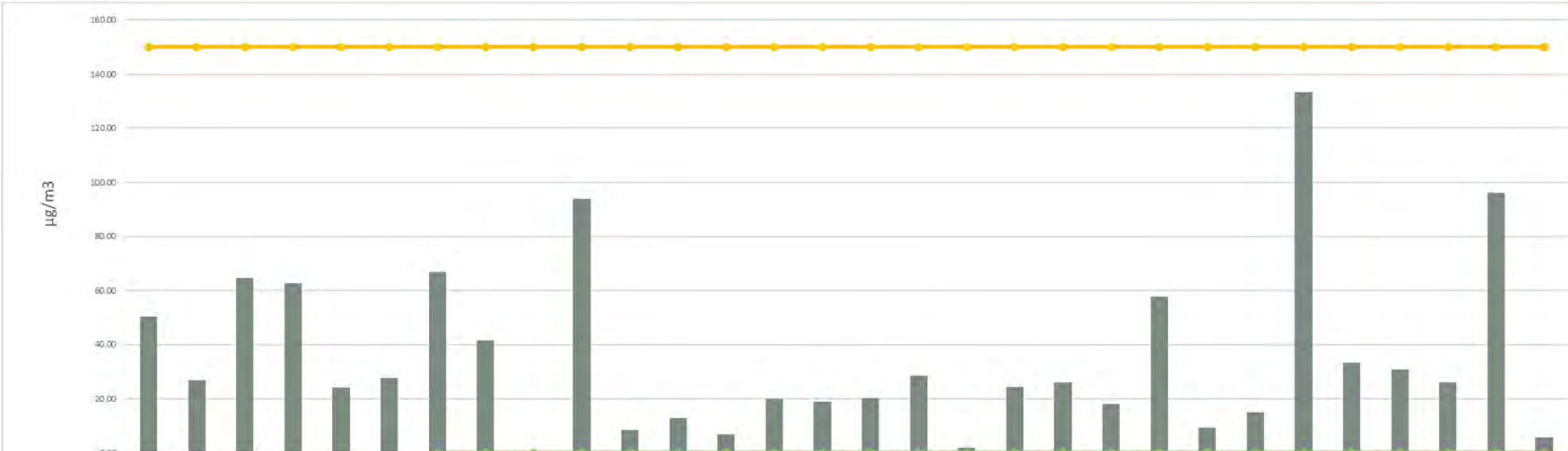
Manometer ΔH vs Act Flow Linear Regression Results:
m_{flo} = 5.8423
b_{flo} = 0.0011
r^2 = 0.9999

* all points must be within ± 2%

$$Q_{act} = m_{flo} \times \sqrt{\frac{\Delta H \times T_{act}}{P_{act}}} + b_{flo}$$

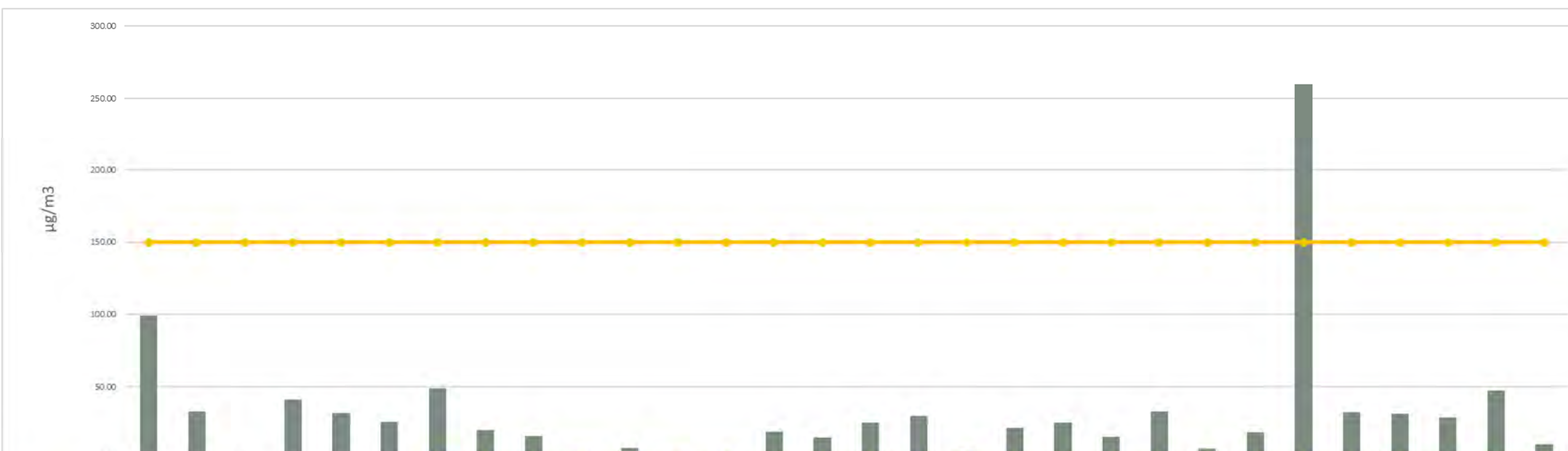
Q_{act} = actual flowrate, liters per min
ΔH = manometer reading, inches of water
T_{act} = ambient temperature, °K
P_{act} = ambient pressure, millimeters of mercury

Appendix 5 – Detailed Particulate Data over the assessment period with corresponding rainfall days



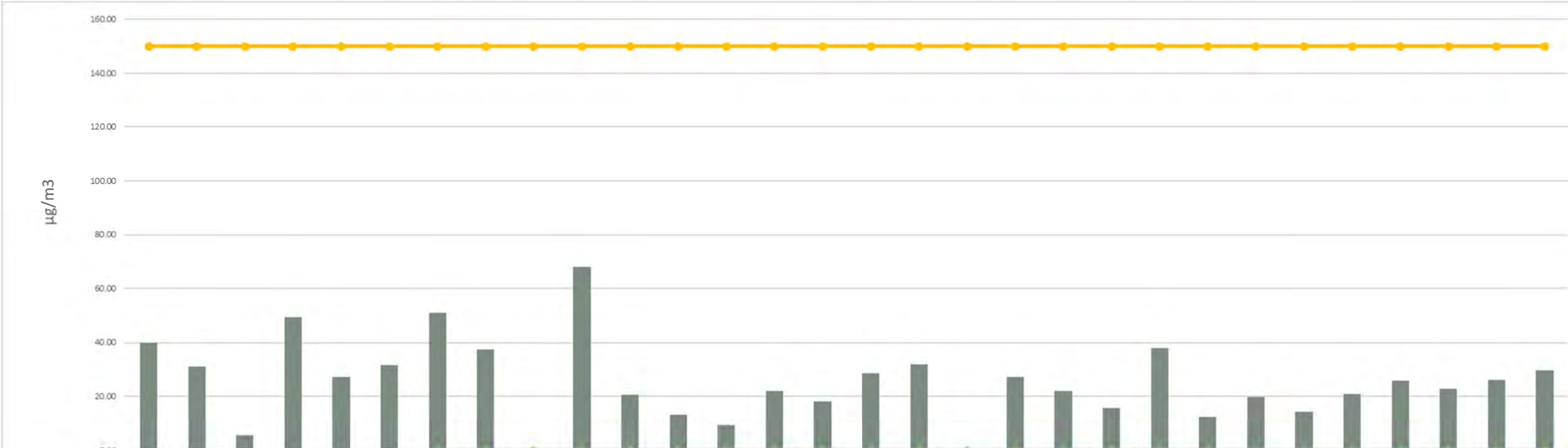
	23-Jun-23	29-Jun-23	2-Jul-23	5-Jul-23	11-Jul-23	17-Jul-23	16-Aug-23	22-Aug-23	3-Sep-23	21-Sep-23	15-Oct-23	21-Oct-23	27-Oct-23	2-Nov-23	8-Nov-23
STN. 1 (PM10)	50.42	27.08	64.86	62.75	24.17	27.92	66.94	41.60		93.89	8.47	12.78	6.81	20.14	19.03
Rainfall (mm)							0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

	14-Nov-23	20-Nov-23	26-Nov-23	2-Dec-23	19-Jan-24	25-Jan-24	31-Jan-24	12-Feb-24	18-Feb-24	24-Feb-24	1-Mar-24	7-Mar-24	13-Mar-24	19-Mar-24	22-Mar-24
STN. 1 (PM10)	20.42	28.75	1.81	24.44	26.25	18.06	57.92	9.44	15.00	133.47	33.19	30.69	26.11	96.25	5.69
Rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150



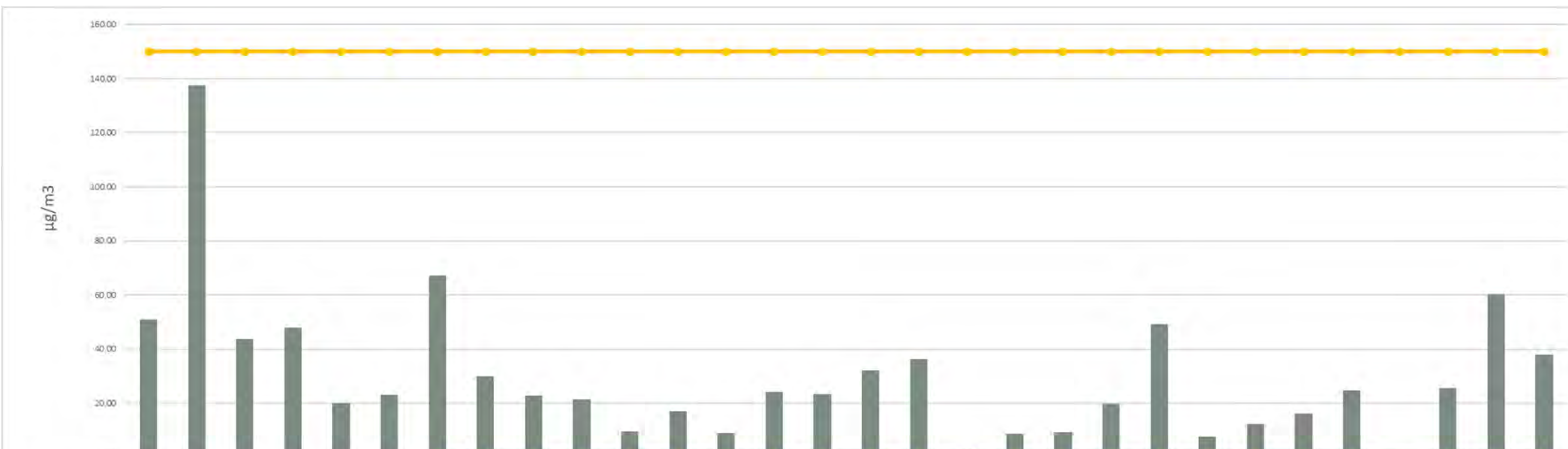
	23-Jun-23	29-Jun-23	2-Jul-23	5-Jul-23	11-Jul-23	17-Jul-23	16-Aug-23	22-Aug-23	3-Sep-23	21-Sep-23	15-Oct-23	21-Oct-23	27-Oct-23	2-Nov-23	8-Nov-23
STN. 2 (PM10)	99.31	32.78	1.67	41.25	31.81	25.97	48.89	20.21	15.83	2.50	7.92			19.03	15.00
Rainfall (mm)							0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

	14-Nov-23	20-Nov-23	26-Nov-23	2-Dec-23	19-Jan-24	25-Jan-24	31-Jan-24	12-Feb-24	18-Feb-24	24-Feb-24	1-Mar-24	7-Mar-24	13-Mar-24	19-Mar-24	22-Mar-24
STN. 2 (PM10)	25.00	30.14	3.19	21.67	25.00	15.56	33.19	6.94	18.47	259.86	32.36	31.39	29.03	47.36	10.28
Rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150



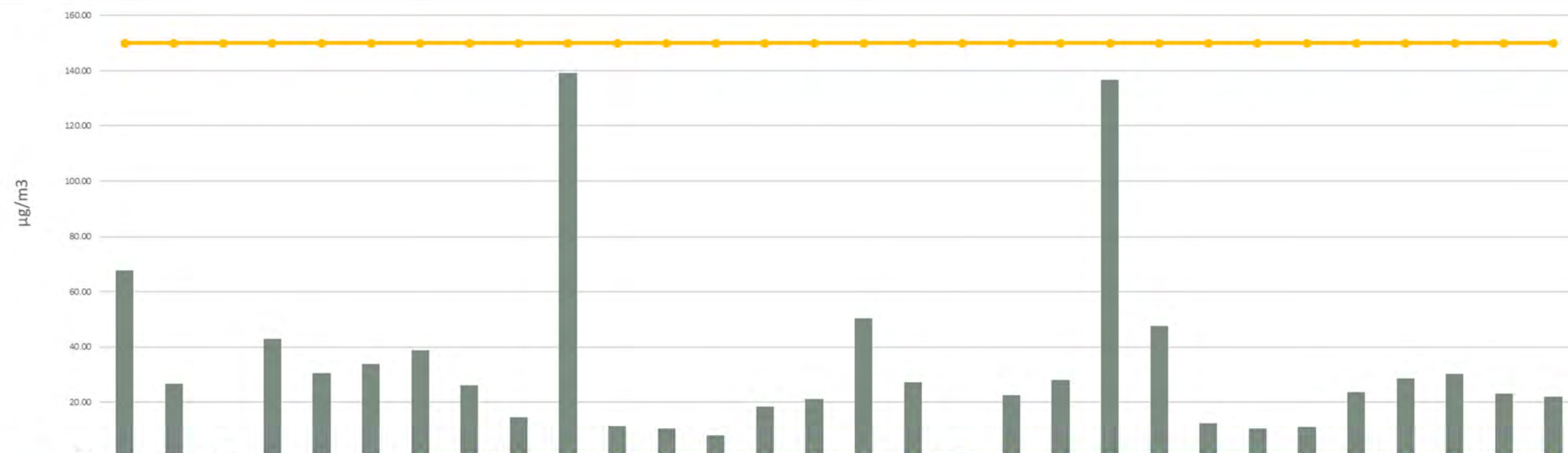
	23-Jun-23	29-Jun-23	2-Jul-23	5-Jul-23	11-Jul-23	17-Jul-23	16-Aug-23	22-Aug-23	3-Sep-23	21-Sep-23	15-Oct-23	21-Oct-23	27-Oct-23	2-Nov-23	8-Nov-23
STN. 3 (PM10)	40.00	30.97	5.69	49.17	27.22	31.67	50.83	37.52		68.06	20.56	13.19	9.31	22.08	18.19
Rainfall (mm)							0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

	14-Nov-23	20-Nov-23	26-Nov-23	2-Dec-23	19-Jan-24	25-Jan-24	31-Jan-24	12-Feb-24	18-Feb-24	24-Feb-24	1-Mar-24	7-Mar-24	13-Mar-24	19-Mar-24	22-Mar-24
STN. 3 (PM10)	28.61	31.94	0.28	27.36	22.08	15.56	38.06	12.36	19.72	14.17	20.83	25.83	22.78	26.25	29.86
Rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150



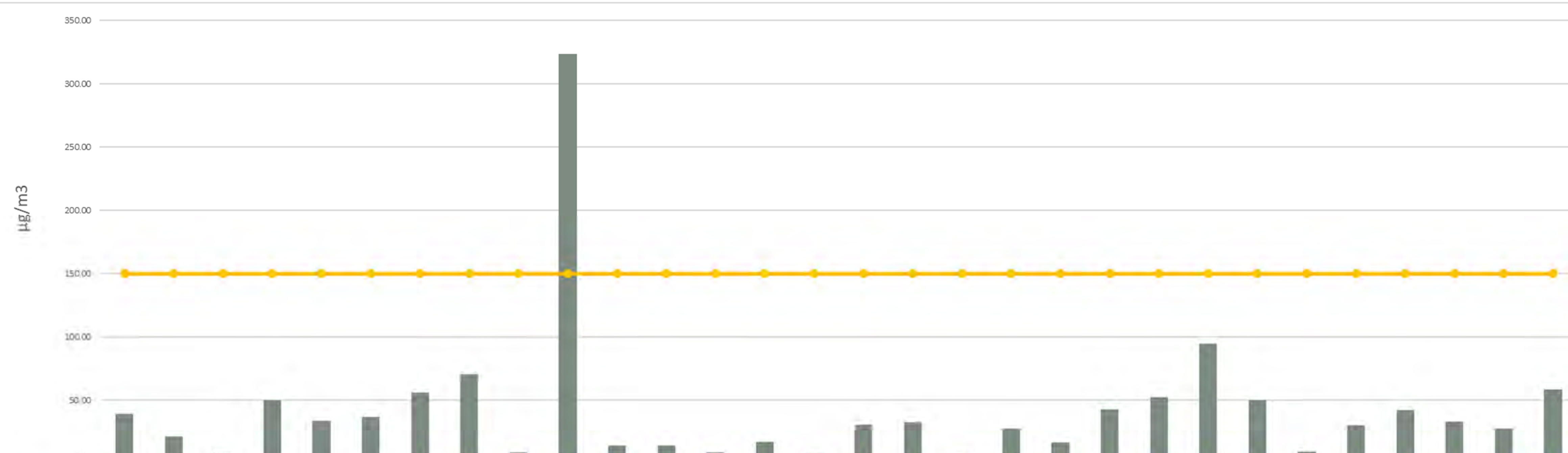
	23-Jun-23	29-Jun-23	2-Jul-23	5-Jul-23	11-Jul-23	17-Jul-23	16-Aug-23	22-Aug-23	3-Sep-23	21-Sep-23	15-Oct-23	21-Oct-23	27-Oct-23	2-Nov-23	8-Nov-23
STN. 4 (PM10)	50.83	137.50	43.92	47.79	20.00	23.19	67.22	29.89	22.78	21.39	9.58	16.94	9.03	24.31	23.33
Rainfall (mm)							0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

	14-Nov-23	20-Nov-23	26-Nov-23	2-Dec-23	19-Jan-24	25-Jan-24	31-Jan-24	12-Feb-24	18-Feb-24	24-Feb-24	1-Mar-24	7-Mar-24	13-Mar-24	19-Mar-24	22-Mar-24
STN. 4 (PM10)	32.22	36.39	1.53	8.75	9.31	19.72	49.31	7.78	12.36	16.25	24.72		25.69	60.42	37.92
Rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150



	23-Jun-23	29-Jun-23	2-Jul-23	5-Jul-23	11-Jul-23	17-Jul-23	16-Aug-23	22-Aug-23	3-Sep-23	21-Sep-23	15-Oct-23	21-Oct-23	27-Oct-23	2-Nov-23	8-Nov-23
STN. 5 (PM10)	67.78	26.81	0.97	43.06	30.56	33.75	38.89	26.24	14.44	139.03	11.25	10.56	7.92	18.47	21.25
Rainfall (mm)							0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

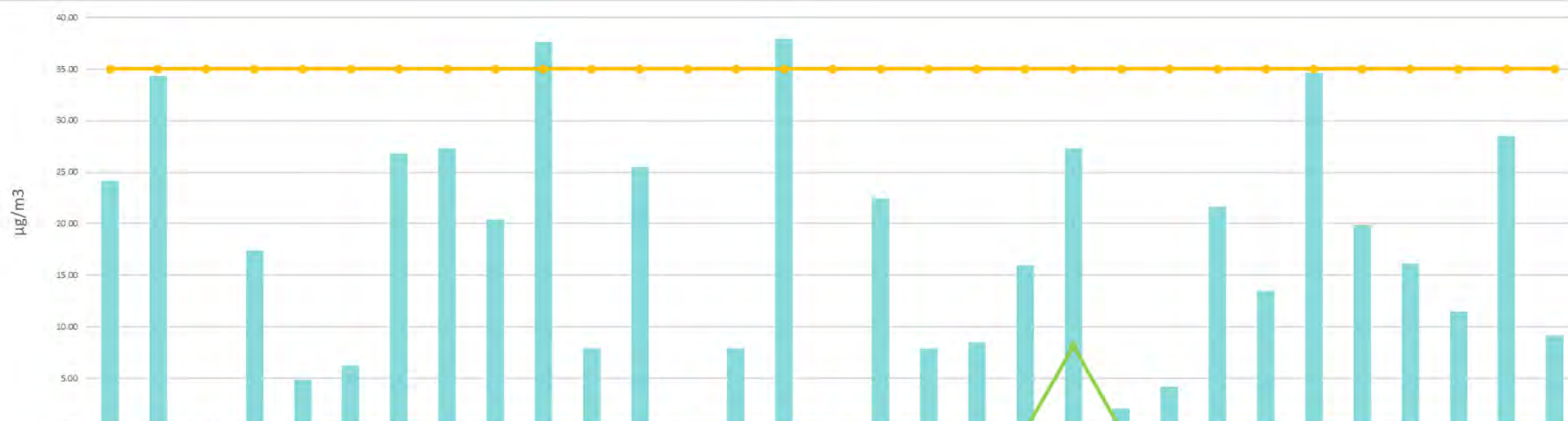
	14-Nov-23	20-Nov-23	26-Nov-23	2-Dec-23	19-Jan-24	25-Jan-24	31-Jan-24	12-Feb-24	18-Feb-24	24-Feb-24	1-Mar-24	7-Mar-24	13-Mar-24	19-Mar-24	22-Mar-24
STN. 5 (PM10)	50.28	27.36	1.11	22.50	28.19	136.67	47.64	12.36	10.42	11.11	23.61	28.75	30.28	23.19	21.94
Rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150



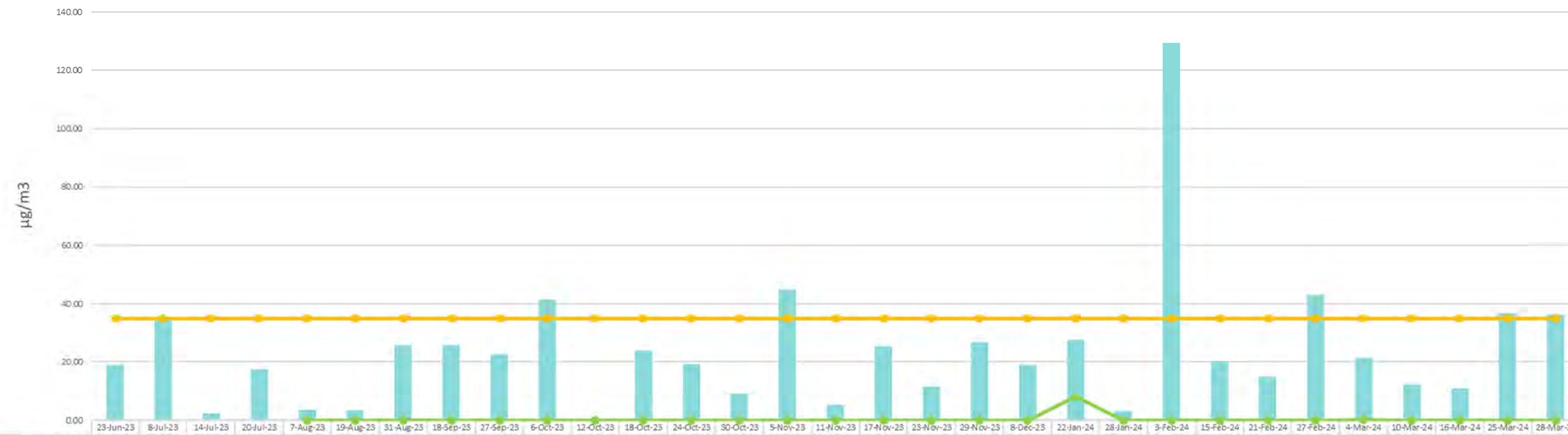
	23-Jun-23	29-Jun-23	2-Jul-23	5-Jul-23	11-Jul-23	17-Jul-23	16-Aug-23	22-Aug-23	3-Sep-23	21-Sep-23	15-Oct-23	21-Oct-23	27-Oct-23	2-Nov-23	8-Nov-23
STN. 6 (PM10)	39.03	21.25	6.94	50.00	33.47	36.81	55.97	70.40	8.33	323.47	13.89	13.89	8.06	16.94	5.69
Rainfall (mm)							0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

	14-Nov-23	20-Nov-23	26-Nov-23	2-Dec-23	19-Jan-24	25-Jan-24	31-Jan-24	12-Feb-24	18-Feb-24	24-Feb-24	1-Mar-24	7-Mar-24	13-Mar-24	19-Mar-24	22-Mar-24
STN. 6 (PM10)	30.42	32.64	3.61	27.36	16.39	42.92	52.64	94.86	50.00	9.17	30.00	41.94	33.33	27.64	58.33
Rainfall (mm)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRCA Std.	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150

	23-Jun-23	8-Jul-23	14-Jul-23	20-Jul-23	7-Aug-23	19-Aug-23	31-Aug-23	18-Sep-23	27-Sep-23	6-Oct-23	12-Oct-23	18-Oct-23	24-Oct-23	30-Oct-23	5-Nov-23	11-Nov-23	17-Nov-23	23-Nov-23	29-Nov-23	8-Dec-23	22-Jan-24	28-Jan-24	3-Feb-24	15-Feb-24	21-Feb-24	27-Feb-24	4-Mar-24	10-Mar-24	16-Mar-24	25-Mar-24	28-Mar-24
STN. 1 (PM2.5)	15.69	34.31	2.08	16.81	4.03	2.78	29.31	18.06	20.69	34.58	9.17	21.25	21.25	6.53	39.44	0.00	32.78	9.03	26.94	13.33	29.72	2.08	3.89	13.33	42.78	34.72	21.39	14.17	9.86	28.47	25.14
Rainfall (mm)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.11	0	0	0	0	0	0.25	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

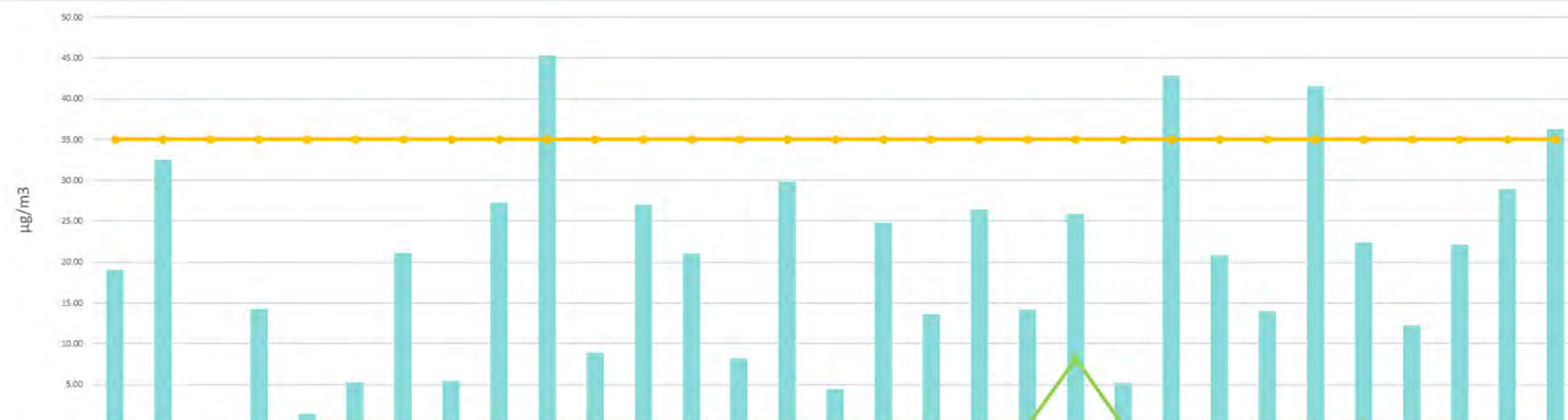


	23-Jun-23	8-Jul-23	14-Jul-23	20-Jul-23	7-Aug-23	19-Aug-23	31-Aug-23	18-Sep-23	27-Sep-23	6-Oct-23	12-Oct-23	18-Oct-23	24-Oct-23	30-Oct-23	5-Nov-23	11-Nov-23	17-Nov-23	23-Nov-23	29-Nov-23	8-Dec-23	22-Jan-24	28-Jan-24	3-Feb-24	15-Feb-24	21-Feb-24	27-Feb-24	4-Mar-24	10-Mar-24	16-Mar-24	25-Mar-24	28-Mar-24
STN. 2 (PM2.5)	24.17	34.31	0.56	17.36	4.89	6.25	26.81	27.36	20.42	37.64	7.92	25.51		7.92	37.92	0.28	22.50	7.92	8.47	15.97	27.36	2.08	4.17	21.67	13.47	34.58	19.86	16.11	11.53	28.47	9.17
Rainfall (mm)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8.11	0	0	0	0	0	0.25	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35



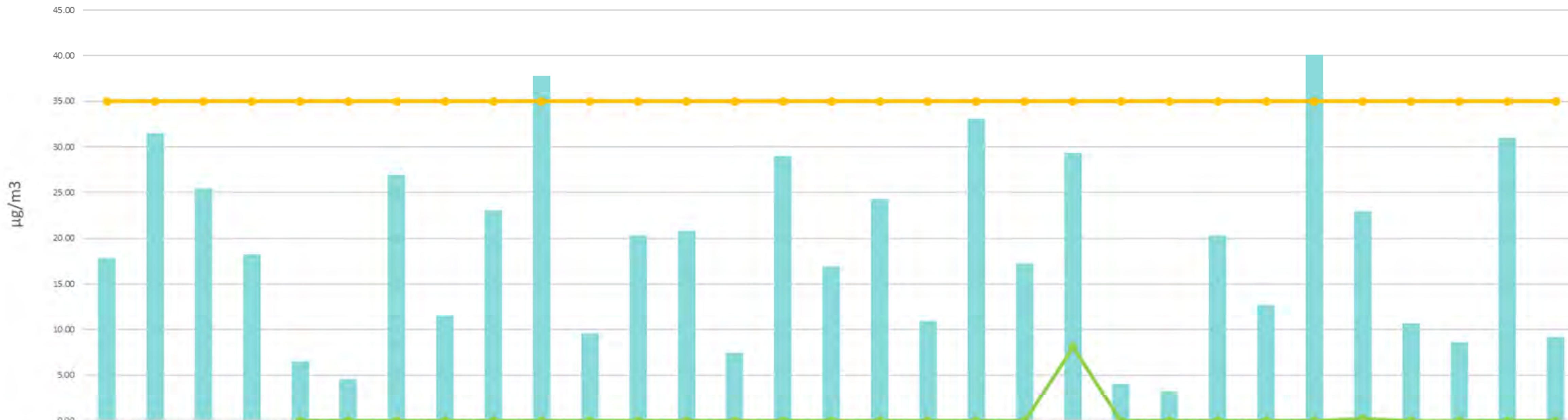
	23-Jun-23	8-Jul-23	14-Jul-23	20-Jul-23	7-Aug-23	19-Aug-23	31-Aug-23	18-Sep-23	27-Sep-23	6-Oct-23	12-Oct-23	18-Oct-23	24-Oct-23	30-Oct-23	5-Nov-23
STN. 3 (PM2.5)	19.17	34.17	2.22	17.50	3.61	3.47	25.69	25.83	22.64	41.39	0.42	24.03	19.31	9.31	44.86
Rainfall (mm)					0	0	0	0	0	0	0	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

	11-Nov-23	17-Nov-23	23-Nov-23	29-Nov-23	8-Dec-23	22-Jan-24	28-Jan-24	3-Feb-24	15-Feb-24	21-Feb-24	27-Feb-24	4-Mar-24	10-Mar-24	16-Mar-24	25-Mar-24	28-Mar-24
STN. 3 (PM2.5)	5.14	25.56	11.67	26.94	19.03	27.50	3.19	129.31	20.42	14.86	43.06	21.39	12.36	10.97	36.94	36.25
Rainfall (mm)	0	0	0	0	0	8.11	0	0	0	0	0	0.25	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35



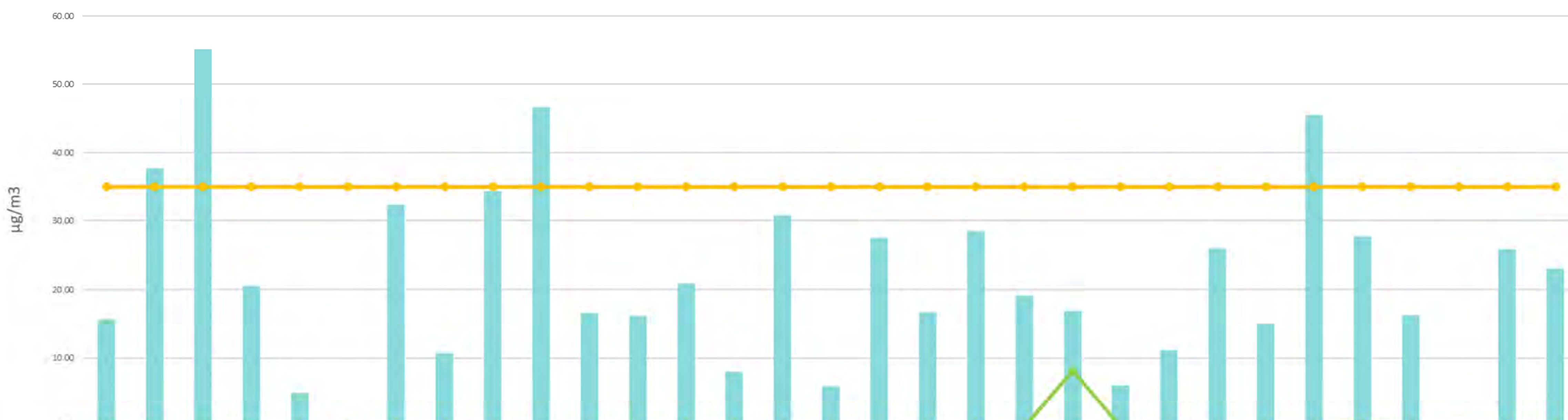
	23-Jun-23	8-Jul-23	14-Jul-23	20-Jul-23	7-Aug-23	19-Aug-23	31-Aug-23	18-Sep-23	27-Sep-23	6-Oct-23	12-Oct-23	18-Oct-23	24-Oct-23	30-Oct-23	5-Nov-23
STN. 4 (PM2.5)	19.03	32.50	0.14	14.31	1.39	5.28	21.11	5.42	27.22	45.28	8.89	26.94	20.97	8.19	29.86
Rainfall (mm)					0	0	0	0	0	0	0	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

	11-Nov-23	17-Nov-23	23-Nov-23	29-Nov-23	8-Dec-23	22-Jan-24	28-Jan-24	3-Feb-24	15-Feb-24	21-Feb-24	27-Feb-24	4-Mar-24	10-Mar-24	16-Mar-24	25-Mar-24	28-Mar-24
STN. 4 (PM2.5)	4.44	24.72	13.61	26.39	14.17	25.83	5.14	42.78	20.83	14.03	41.53	22.36	12.22	22.12	28.89	36.25
Rainfall (mm)	0	0	0	0	0	8.11	0	0	0	0	0	0.25	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35



	23-Jun-23	8-Jul-23	14-Jul-23	20-Jul-23	7-Aug-23	19-Aug-23	31-Aug-23	18-Sep-23	27-Sep-23	6-Oct-23	12-Oct-23	18-Oct-23	24-Oct-23	30-Oct-23	5-Nov-23
STN. 5 (PM2.5)	17.78	31.53	25.42	18.19	6.53	4.58	26.94	11.53	23.06	37.78	9.58	20.28	20.83	7.50	29.08
Rainfall (mm)					0	0	0	0	0	0	0	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

	11-Nov-23	17-Nov-23	23-Nov-23	29-Nov-23	8-Dec-23	22-Jan-24	28-Jan-24	3-Feb-24	15-Feb-24	21-Feb-24	27-Feb-24	4-Mar-24	10-Mar-24	16-Mar-24	25-Mar-24	28-Mar-24
STN. 5 (PM2.5)	16.94	24.31	10.97	33.06	17.22	29.31	4.03	3.19	20.28	12.64	40.14	22.92	10.69	8.61	30.97	9.17
Rainfall (mm)	0	0	0	0	0	8.11	0	0	0	0	0	0.25	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35



	23-Jun-23	8-Jul-23	14-Jul-23	20-Jul-23	7-Aug-23	19-Aug-23	31-Aug-23	18-Sep-23	27-Sep-23	6-Oct-23	12-Oct-23	18-Oct-23	24-Oct-23	30-Oct-23	5-Nov-23
STN. 6 (PM2.5)	15.69	37.64	55.14	20.56	4.86	0.00	32.36	10.69	34.31	46.67	16.53	16.11	20.83	7.92	30.83
Rainfall (mm)					0	0	0	0	0	0	0	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

	11-Nov-23	17-Nov-23	23-Nov-23	29-Nov-23	8-Dec-23	22-Jan-24	28-Jan-24	3-Feb-24	15-Feb-24	21-Feb-24	27-Feb-24	4-Mar-24	10-Mar-24	16-Mar-24	25-Mar-24	28-Mar-24
STN. 6 (PM2.5)	5.83	27.50	16.67	28.47	19.17	16.96	5.97	11.11	25.97	15.00	45.56	27.78	16.25		25.83	23.06
Rainfall (mm)	0	0	0	0	0	8.11	0	0	0	0	0	0.25	0	0	0	0
US EPA Std.	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35

Appendix 6 – Hydrolab MS5 Calibration Certificate

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OTT HydroMet

Section A: **Series 5, and 5x Sonde Functional Test Data Sheet**

Work Order # WO-01378686	Customer CL Environmental	Date Started 04/19/23
Housing Serial # 100500049186	Embedded Serial# 49186	Additional Driver Firmware:
Technician Phillip Druyor	Model: **Datasonde** 5 ✓ **Minisonde** ✓ 5x	Depth100 2.13 Turbidity 3.21 LDO 3.51

Customer Display Information

I/D N/A	DOM 052010	Baud Rate 19200	Security 2	SDI N/A	TTY
Parameter	Time	Temp	pH	SpCond	Sal
Units	HH:MM:SS	°C	Units	mS/cm	ppt
Parameter	Dep100	LDO%	LDO	TurbSC	
Units	meters	Sat	mg/l	NTU	

For Sonde with Depth – Coefficients

A: -38.32925	B: 195.7845	C: 14.57972	D: -294.7495
E: -0.001363	F: -2.33606	G: 137.0065	H: 9.227231E-05
I: -0.001945	J: 1.240447		SER: 0.0

FLUOROMETER OFFSETS

1ST N/A	X10: N/A	X1: N/A
2ND N/A	X10: N/A	X1: N/A

For Sonde with TDG or PAR – Coefficients

~~A:~~ N/A	B: N/A	C: N/A	D: N/A
Local: N/A		Ref: N/A	

Performance, Test and Evaluation

Current MPL Rev-- 5.44 Upgrade to MPL Rev--	pH Electrolyte & Teflon Junction Replaced- Yes ✓ No NA	DO membrane Replaced Yes No NA ✓
Sensors cleaned –Yes ✓	RTC Battery Replaced Yes ✓ No	Desiccant Replaced –Yes ✓ No

Section B:

	Submission 1 Day 1	Submission Day
Customer Observations Verified / Customer Request	Y N N/A ✓ PT&E ✓ Upgrade	Y N N/A PT&E Upgrade
Set Time and Date	Yes ✓	Yes
Verified all hardware updates as current	Yes ✓	Yes
Total current draw. (Check all that apply) MPL PCB 40mA ✓ SC Turbidity 20mA ✓ LDO 80mA ✓ 4Beam Turbidity 10mA Flourometers: 1st 30mA 2nd 30mA 3rd 30mA PAR 10mA (Optimal Values not to exceed +20mA overall.)	140	
Current draw of circulator. (20 mA max. beyond previous values.)	N/A	
Operation of self-cleaning motor verified—	P ✓ F NA	P F NA
Audio functions correctly	P ✓ F	P F
RTC sleep/wake-up test.	P ✓ F	P F

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Additional Notes:

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Temp probe test at room temperature. 20.00 °C (+/- 0.1)	Sonde Temp: 20.03 °C	Sonde Temp: °C
DO 100% sat integrity window verified at +50 mmHg over current bp. (Clark Cell only)	P F NA ✓	P F NA
DO 100% saturation calibration verified - local BP (+/- 0.2 mg/L Clark Cell) (+/- 0.1mg/L LDO)	Temp: 20.04 BP: 625.85 mg/L: 7.43 Drift +/-:	Temp: BP: mg/L: Drift +/-:
Scale Factor (0.7 – 1.3) LDO Only	0.96038	
Conductivity zero (air) calibration verified - (+/-.005mS)	0.0000	
Conductivity calibration verified – 1.412 mS/cm (± .04 mS) ✓ 12.856 mS/cm (± .2 mS) 47.6 mS/cm (± .2 mS)	12.85	
Conductivity linearity verified – .100 mS/cm (± .005 mS) ✓ .500 mS/cm (± .025 mS)	.497	
pH 7 buffer calibration verified- (+/- .2 pH)	7.00	
pH slope calibration verified at 10.01 units.	10.01	
ORP calibration verified at N/A °C (+/- 20 mV)	N/A	
Turbidity - Calibration accepted & verified with DI Water (0.0 +/- 0.7 NTU)	0.0	
Turbidity - Calibration accepted & verified at (100.0 +/- 1 NTU) with Hach StablCal	99.7	
Turbidity - Linearity verified with 40 NTU Hach StablCal – (+/- 4 NTU)	43.5	
Depth zero calibration verified – (.02 meters)	0.00	
Depth Check verified – (+/- 0.03 meters) Tank depth: 0.45	0.46	
Specific Ion N/A Low C N/A mV N/A High C N/A mV N/A / Specific Ion N/A Low C N/A mV N/A	High C N/A mV N/A	Specific Ion N/A Low C N/A mV N/A High C N/A mV N/A
N03- calibration verified	P F NA ✓	P F NA
NH4+ calibration verified	P F NA ✓	P F NA
Cl- calibration verified	P F NA ✓	P F NA
Chlorophyll 'a' calibration verified	P F NA ✓	P F NA
Rhodamine 'wt' calibration verified	P F NA ✓	P F NA
Blue-green Algae calibration verified	P F NA ✓	P F NA
PAR calibration verified	P F NA ✓	P F NA
TDG calibration verified (+/- 2 mmHg)	P ✓ F	P F
Logging/Sensor Stability Test	3.96	
pH linearity verified at 4.01 units. (+/- 0.20 units)	P ✓ F NA	P F NA
Battery pack setup and checked		
Display, Baud Rate, Communications mode settings returned as received.	Yes ✓ No	

Calibrated Test Equipment Used – Description	X-number
Power Supply BK Precision 1617A	X- 8954
Fluke 1524 -- Reference Thermometer	X- 8244
DVM Digital Multimeter	X- 001765

Section C. Final Check-off Prior to Submitting for Estimate

Exterior is clean ✓	Hach Business System updated ✓
Clear pH 4 Buffer in storage cup ✓	Date Completed 04/20/23

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OTT HydroMet

Section A: **Series 5, and 5x Sonde Functional Test Data Sheet**

Work Order # WO-01411307	Customer CL Environmental	Date Started 5/31/2023
Housing Serial # 100100048757	Embedded Serial# 48757	Additional Driver Firmware:
Technician Kayleen Hodge	Model: **Datasonde** ✓ 5 ✓ **Minisonde** 5x	Depth100 2.13 PAR 1.02 Turbidity 3.21 LDO 3.73

Customer Display Information

I/D NA	DOM 1/15/2010	Baud Rate 19200	Security 2	SDI NA	TTY
Parameter	Time	Temp	pH	SpCond	ORP
Units	HH:MM:SS	°C	Units	mS/cm	mV
Parameter	Dep100	PAR	TurbSC	LDO%	LDO
Units	meters	µE/s/m²	NTU	Sat	mg/l

For Sonde with Depth – Coefficients

A: -4.23E3	B: 1.43E4	C: 16.799999	D: -1.6E4
E: -0.0101	F: -6.03	G: 6E3	H: 3.44E-5
I: 0.00852	J: 3.37	SER: 0	

FLUOROMETER OFFSETS

1ST	X10:	X1:
2ND	X10:	X1:

For Sonde with TDG or PAR – Coefficients

A:	**B:**	**C:**	**D:**
Local: -220.979996	Ref: -220.979996		

Performance, Test and Evaluation

Current MPL Rev-- 5.44 Upgrade to MPL Rev--	pH Electrolyte & Teflon Junction Replaced- Yes ✓ No NA	DO membrane Replaced Yes No NA ✓
Sensors cleaned –Yes ✓	RTC Battery Replaced Yes ✓ No	Desiccant Replaced –Yes No

Section B:

	Submission 1 Day 1	Submission Day
Customer Observations Verified / Customer Request	Y N N/A PT&E ✓ Upgrade	Y N N/A PT&E Upgrade
Set Time and Date	Yes ✓	Yes
Verified all hardware updates as current	Yes ✓	Yes
Total current draw. (Check all that apply) MPL PCB 40mA ✓ SC Turbidity 20mA ✓ LDO 80mA ✓ 4Beam Turbidity 10mA Flourometers: 1st 30mA 2nd 30mA 3rd 30mA PAR 10mA ✓ (Optimal Values not to exceed +20mA overall.)	150mA	
Current draw of circulator. (20 mA max. beyond previous values.)	NA	
Operation of self-cleaning motor verified—	P ✓ F NA	P F NA
Audio functions correctly	P ✓ F	P F
RTC sleep/wake-up test.	P ✓ F	P F

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Additional Notes:

380mA current draw with old LDO sensor.

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Temp probe test at room temperature. 20.00 ° C (+/- 0.1)	Sonde Temp : 20.01 ° C	Sonde Temp : ° C
DO 100% sat integrity window verified at +50 mmHg over current bp. (Clark Cell only)	P F NA ✓	P F NA
DO 100% saturation calibration verified - local BP (+/- 0.2 mg/L Clark Cell) (+/- 0.1mg/L LDO)	Temp : 21.21 BP : 631 mg/L : 7.34 Drift +/- : -	Temp : BP : mg/L : Drift +/- :
Scale Factor (0.7 -- 1.3) LDO Only	0.969854	
Conductivity zero (air) calibration verified - (+/-.005mS)	.0000	
Conductivity calibration verified – ✓ 1.412 mS/cm (± .04 mS) 12.856 mS/cm (± .2 mS) 47.6 mS/cm (± .2 mS)	1.412	
Conductivity linearity verified – .100 mS/cm (± .005 mS) ✓ .500 mS/cm (± .025 mS)	0.505	
pH 7 buffer calibration verified– (+/- .2 pH)	7.00	
pH slope calibration verified at 10.02 units.	10.02	
ORP calibration verified at 21.22 ° C (+/- 20 mV)	436	
Turbidity - Calibration accepted & verified with DI Water (0.0 +/- 0.7 NTU)	0.5	
Turbidity - Calibration accepted & verified at (100.0 +/- 1 NTU) with Hach StablCal	100.0	
Turbidity - Linearity verified with 40 NTU Hach StablCal – (+/- 4 NTU)	41.7	
Depth zero calibration verified – (.02 meters)	0.00	
Depth Check verified – (+/- 0.03 meters) Tank depth: 0.685	0.68	

Specific Ion		Specific Ion		Specific Ion	
Low C mV	High C mV	Low C mV	High C mV	Low C mV	High C mV

N03- calibration verified	P F NA ✓	P F NA
NH4+ calibration verified	P F NA ✓	P F NA
Cl- calibration verified	P F NA ✓	P F NA
Chlorophyll 'a' calibration verified	P F NA ✓	P F NA
Rhodamine 'wt' calibration verified	P F NA ✓	P F NA
Blue-green Algae calibration verified	P F NA ✓	P F NA
PAR calibration verified	P ✓ F NA	P F NA
TDG calibration verified (+/- 2 mmHg)	P F NA ✓	P F NA
Logging/Sensor Stability Test	P ✓ F	P F
pH linearity verified at 4.01 units. (+/- 0.20 units)	4.00	
Battery pack setup and checked	P ✓ F NA	P F NA

Display, Baud Rate, Communications mode settings returned as received.	Yes ✓ No

Calibrated Test Equipment Used – Description	X-number
Power Supply BK Precision 1670A	X- 7859
Fluke 1524 -- Reference Thermometer	X- 8244
DVM Digital Multimeter	X- 7893

Section C. Final Check-off Prior to Submitting for Estimate

Exterior is clean ✓	Hach Business System updated ✓
Clear pH 4 Buffer in storage cup ✓	Date Completed 6/2/2023

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Appendix 7 – Detailed In-Situ Water Quality Data

Table 12-1 First Run June 21st, 2023

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	TDS (g/l)
GP1							
	0	29.39	53.12	35.09	8.09	5.96	33.98
	1	29.49	53.08	35.1	8.1	5.77	33.96
	2	29.39	53.07	35.1	8.09	5.56	33.97
	2.5	29.29	53.01	35.07	8.1	5.46	33.97
	Average	**29.39**	**53.07**	**35.09**	**8.10**	**5.69**	**33.97**
GP2							
	0	29.25	53.14	35.14	7.99	3.97	34.02
	0.5	29.22	53.12	35.13	7.97	3.98	34
	Average	**29.24**	**53.13**	**35.14**	**7.98**	**3.98**	**34.01**
GP3							
	0	28.9	52.91	34.97	8.11	6.01	33.88
	0.5	29.25	53.05	35.09	7.99	4.52	33.97
	Average	**29.08**	**52.98**	**35.03**	**8.05**	**5.27**	**33.93**
GP4							
	0	29.32	52.99	35.03	8.08	5.78	33.91
	1	29.3	53.04	35.08	8	4.01	33.93
	2	29.26	53.04	35.06	8.03	4.53	33.93
	Average	**29.29**	**53.02**	**35.06**	**8.04**	**4.77**	**33.92**
GP5							
	0	28.25	53.17	35.12	7.92	3.77	33.95
	1	29.21	53.09	35.11	7.93	3.56	33.99
	1.5	29.19	53.09	35.1	7.92	3.5	33.97
	Average	**28.88**	**53.12**	**35.11**	**7.92**	**3.61**	**33.97**
GP6							
	0.5	29.31	52.85	34.91	8.06	5.31	33.8
	1	29.31	52.81	34.89	8.06	5.38	33.8
	Average	**29.31**	**52.83**	**34.90**	**8.06**	**5.35**	**33.80**
GP7							
	0	29.7	52.93	34.99	8.13	6.33	33.88

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	TDS (g/l)
	1	29.7	53.05	35.11	8.13	6.32	34.02
	2	29.57	53.19	35.16	8.13	6.32	34.02
	3	29.52	53.17	35.13	8.13	6.31	34.02
	4	29.51	53.14	35.16	8.14	6.28	34.03
	5	29.47	53.15	35.15	8.14	6.31	34.01
	6	29.46	53.13	35.14	8.15	6.32	34.01
	7	29.44	53.14	35.15	8.15	6.33	34
	8	29.42	53.13	35.14	8.15	6.32	34
	9	29.4	53.11	35.12	8.15	6.34	34.01
	10	29.4	53.13	35.14	8.14	6.34	34
	15	29.4	53.08	35.1	8.15	6.35	33.98
	Average	**29.50**	**53.11**	**35.12**	**8.14**	**6.32**	**34.00**

Table 12-2 Second Run August 24th, 2023

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)
GP1	0	30.46	53.21	35.2	8.06	4.7	0	34.05
	1	30.49	53.23	35.18	8.06	4.69	0	34.06
	1.5	30.47	53.24	35.2	8.06	4.61	1.8	34.05
	Average	**30.47**	**53.23**	**35.19**	**8.06**	**4.67**	**0.60**	**34.05**
GP2	0	30.42	52.86	34.94	8.07	4.99	0	33.85
	0.5	30.49	52.99	35.08	8.03	4.09	0	33.97
	Average	**30.46**	**52.93**	**35.01**	**8.05**	**4.54**	**0.00**	**33.91**
GP3	0	30.4	52.79	34.9	8.07	5.03	0	33.79
	0.5	30.49	53.01	35.08	7.97	3.6	0	33.97
	Average	**30.45**	**52.90**	**34.99**	**8.02**	**4.32**	**0.00**	**33.88**
GP4	0	30.58	52.95	35.01	8.06	4.62	0	33.88
	1	30.59	52.94	34.99	8.06	4.62	0	33.86
	Average	**30.59**	**52.95**	**35.00**	**8.06**	**4.62**	**0.00**	**33.87**

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)
GP5	0	30.35	52.83	34.91	7.97	4.05	0	33.83
	1	30.39	53.05	35.09	7.91	3	0	33.95
	Average	**30.37**	**52.94**	**35.00**	**7.94**	**3.53**		**33.89**
GP6	0	30.54	52.99	35.01	8.01	4.08	0	33.9
	1	30.6	52.99	35	8.01	4.06	0	33.9
	Average	**30.57**	**52.99**	**35.01**	**8.01**	**4.07**	**0.00**	**33.90**
GP7	0	30.6	52.74	34.84	8.1	6.21	0	33.76
	1	30.59	53.08	35.17	8.17	6.15	0	34
	2	30.67	53.26	35.22	8.12	6.15	0	34.08
	3	30.69	53.24	35.18	8.13	6.13	0	34.06
	4	30.69	53.23	35.21	8.13	6.09	0	34.05
	5	30.7	53.25	35.2	8.14	6.08	0	34.06
	6	30.71	53.24	35.2	8.14	6.08	0	34.06
	7	30.71	53.21	35.2	8.14	6.07	0	34.06
	8	30.7	53.2	35.18	8.14	6.09	0	34.05
	Average	**30.67**	**53.16**	**35.16**	**8.13**	**6.12**	**0.00**	**34.02**

Table 12-3 Third Run October 11th, 2023

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)
GP1	0	31.17	52.79	34.90	8.09	4.98	0.00	33.79
	1	31.32	52.89	34.95	8.11	4.95	0.00	33.85
	2	31.31	52.89	34.96	8.11	4.92	0.00	33.84
	Average	**31.27**	**52.86**	**34.94**	**8.10**	**4.95**	**0.00**	**33.83**
GP2	0	30.66	52.44	34.63	7.99	3.19	0.00	33.57
	1	30.69	52.49	34.66	7.98	3.02	0.00	33.58
	Average	**30.68**	**52.47**	**34.65**	**7.99**	**3.11**	**0.00**	**33.58**

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)
GP3	0	30.86	52.56	34.74	8.06	4.11	0.00	33.64
	1	30.65	52.60	34.73	7.95	3.04	0.00	33.65
	Average	**30.76**	**52.58**	**34.74**	**8.01**	**3.58**	**0.00**	**33.65**
GP4	0	31.00	52.56	34.70	8.16	5.61	0.00	33.66
	1	30.94	52.60	34.76	8.05	3.79	0.00	33.66
	Average	**30.97**	**52.58**	**34.73**	**8.11**	**4.70**	**0.00**	**33.66**
GP5	0	30.73	52.69	34.81	7.96	2.68	0.00	33.71
	1	30.78	52.67	34.80	7.97	2.79	0.00	33.71
	Average	**30.76**	**52.68**	**34.81**	**7.97**	**2.74**		**33.71**
GP6	0	30.76	52.67	34.79	8.08	4.11	0.00	33.70
	1	30.79	52.71	34.81	8.09	4.24	4.10	33.71
	Average	**30.78**	**52.69**	**34.80**	**8.09**	**4.18**	**2.05**	**33.71**
GP7	0	30.9	52.1	34.3	8.2	6.0	0.0	33.4
	1	31.4	52.9	35.0	8.2	5.8	0.0	33.8
	2	31.4	52.9	35.0	8.2	5.8	0.0	33.8
	3	31.4	52.9	34.9	8.2	5.7	0.0	33.8
	4	31.4	52.9	34.9	8.1	5.7	0.0	33.9
	5	31.4	53.0	35.0	8.2	5.9	0.0	33.9
	6	31.4	52.9	35.0	8.2	5.8	0.0	33.9
	7	31.4	52.9	35.0	8.2	5.8	0.0	33.9
	Average	**31.34**	**52.80**	**34.88**	**8.18**	**5.82**	**0.00**	**33.79**

Table 12-4 Fourth Run October 11th, 2023

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (µmol/m2/s)
GP1	0	29.29	54.00	35.77	7.93	4.69	0.00	34.56	28
	1	29.29	54.00	35.77	7.93	4.66	0.00	34.56	20

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (µmol/m2/s)
	2	29.28	54.03	35.82	7.90	4.56	0.00	34.56	19
	3	29.14	54.00	35.77	7.87	3.92	25.30	34.55	18
	Average	**29.25**	**54.01**	**35.78**	**7.91**	**4.46**	**6.33**	**34.56**	
GP2	0	28.81	53.95	35.73	7.85	3.50	1.10	34.53	21
	1	28.82	53.96	35.72	7.85	3.51	1.90	34.53	18
	Average	**28.82**	**53.96**	**35.73**	**7.85**	**3.51**	**1.50**	**34.53**	
GP3	0	28.73	53.94	35.73	7.85	3.77	2.70	34.52	17
	1	28.73	53.95	35.73	7.84	3.71	4.20	34.53	15
	Average	**28.73**	**53.95**	**35.73**	**7.85**	**3.74**	**3.45**	**34.53**	
GP4	0	29.17	53.91	35.78	7.94	5.06	0.60	34.48	12
	1	29.14	53.89	35.67	7.93	4.71	0.80	34.46	10
	Average	**29.16**	**53.90**	**35.73**	**7.94**	**4.89**	**0.70**	**34.47**	
GP5	0	28.60	53.82	35.65	7.78	3.18	3.70	34.46	10
	1	28.58	53.83	35.65	7.75	2.74	4.70	34.45	7
	Average	**28.59**	**53.83**	**35.65**	**7.77**	**2.96**		**34.46**	
GP6	0	29.01	53.82	35.64	7.92	4.62	6.80	34.44	5
	1	29.03	53.82	35.64	7.93	4.69	6.90	34.44	3
	Average	**29.02**	**53.82**	**35.64**	**7.93**	**4.66**	**6.85**	**34.44**	
GP7	0	29.75	54.20	35.20	7.98	6.07	4.30	34.69	6
	1	29.76	54.22	35.93	8.00	6.13	4.10	34.71	5
	2	29.76	54.23	35.94	8.01	6.17	4.00	34.69	5
	3	29.77	54.22	35.93	8.01	6.14	3.90	34.70	5
	4	29.78	54.22	35.94	8.01	6.16	3.80	34.71	4

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (µmol/m2/s)
	5	29.78	54.20	35.92	8.01	6.12	3.70	34.69	4
	6	29.77	54.22	35.94	8.02	6.12	3.60	34.69	4
	7	29.77	54.23	35.95	8.02	6.14	3.60	34.69	5
	8	29.77	54.21	35.94	8.02	6.12	3.50	34.71	5
	9	29.77	54.21	35.93	8.02	6.11	3.40	34.71	4
	10	29.76	54.20	35.94	8.02	6.13	3.30	34.70	4
	15	29.76	54.18	35.92	8.02	6.13	3.20	34.78	4
	Average	**29.77**	**54.21**	**35.87**	**8.01**	**6.13**	**3.70**	**34.71**	

Light Extinction Coefficient

Station	Depth 1	PAR	Depth 2	PAR	EC
1	0	28	3	18	0.1471
2	0	21	1	18	0.1540
3	0	17	1	15	0.1250
4	0	12	1	10	0.1821
5	0	10	1	7	0.3563
6	0	5	1	3	0.5103
7	0	6	15	4	0.0270

Table 12-5 Fifth Run March 20th, 2024

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (µmol/m2/s)
GP1	0	28.52	54.34	36.04	8.30	5.84	0.00	34.78	1497
	1	28.50	54.34	36.06	8.32	6.11	0.00	34.78	1039
	2	28.47	54.34	36.04	8.32	6.35	0.00	34.80	704
	Average	**28.50**	**54.34**	**36.05**	**8.31**	**6.10**	**0.00**	**34.79**	
GP2	0	28.72	54.38	36.04	8.34	6.87	0.00	34.79	1327
	1	28.76	54.37	36.03	8.35	7.09	0.00	34.79	1214
	Average	**28.74**	**54.38**	**36.04**	**8.35**	**6.98**	**0.00**	**34.79**	
GP3	0	28.47	54.32	36.03	8.29	6.16	0.00	34.80	1488

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (µmol/m2/s)
	1	28.43	54.40	36.04	8.31	6.38	0.00	34.78	1279
	Average	**28.45**	**54.36**	**36.04**	**8.30**	**6.27**	**0.00**	**34.79**	
GP4	0	28.47	54.36	36.07	8.27	5.87	0.00	34.80	1181
	1	28.51	54.38	36.02	8.30	6.19	12.90	34.79	991
	Average	**28.49**	**54.37**	**36.05**	**8.29**	**6.03**	**6.45**	**34.80**	
GP5	0	28.35	54.36	36.04	8.22	4.92	0.30	34.79	1280
	1	28.35	54.35	36.03	8.22	5.10	6.20	34.78	1006
	Average	**28.35**	**54.36**	**36.04**	**8.22**	**5.01**	**3.25**	**34.79**	
GP6	0	28.74	54.38	36.07	8.35	7.06	1.60	34.80	455
	1	28.79	54.37	36.06	8.30	7.44	12.20	34.80	213
	Average	**28.77**	**54.38**	**36.07**	**8.33**	**7.25**	**6.90**	**34.80**	
GP7	0	28.44	53.77	35.58	8.24	6.50	7.30	34.70	1226
	1	28.44	54.26	35.96	8.28	6.48	7.20	34.72	1068
	2	28.44	54.25	35.96	8.30	6.49	5.50	34.71	933
	3	28.41	54.24	35.95	8.31	6.47	4.30	34.71	703
	4	28.37	54.21	35.96	8.32	6.46	3.60	34.72	683
	5	28.31	54.26	35.96	8.32	6.46	3.10	34.73	621
	6	28.27	54.22	35.96	8.32	6.48	2.70	34.70	502
	7	28.25	54.17	35.97	8.33	6.46	2.40	34.72	400
	8	28.23	54.27	35.97	8.33	6.45	2.10	34.72	417
	9	28.21	54.22	35.96	8.33	6.40	1.90	34.73	355
	Average	**28.34**	**54.19**	**35.92**	**8.31**	**6.47**	**4.01**	**34.72**	

Light Extinction Coefficient

Station	Depth 1	PAR	Depth 2	PAR	EC
1	0	1497	2	704	0.3768
2	0	1327	1	1214	0.0889
3	0	1488	1	1279	0.1512
4	0	1181	1	991	0.1752
5	0	1280	1	1006	0.2406
6	0	455	1	213	0.7582
7	0	1226	9	355	0.1376

Table 12-6 Sixth Run May 22nd, 2024

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (µmol/m2/s)
GP1	0	29.58	54.17	35.92	8.34	5.06	0.00	34.69	1565
	1	29.55	54.19	35.91	8.34	5.05	0.00	34.67	1303
	2	29.59	54.15	35.90	8.35	5.22	0.00	34.67	1014
	Average	**29.57**	**54.17**	**35.91**	**8.34**	**5.11**	**0.00**	**34.68**	
GP2	0	29.67	54.19	35.93	8.40	6.31	0.00	34.69	1587
	1	29.69	54.19	35.93	8.41	6.40	0.00	34.69	1228
	Average	**29.68**	**54.19**	**35.93**	**8.41**	**6.36**	**0.00**	**34.69**	
GP3	0	29.08	53.70	35.56	8.34	5.59	0.00	34.36	1610
	1	29.14	53.68	35.55	8.35	5.67	0.00	34.36	1213
	Average	**29.11**	**53.69**	**35.56**	**8.35**	**5.63**	**0.00**	**34.36**	
GP4	0	29.28	54.01	35.78	8.34	4.90	0.00	34.54	1534
	1	29.36	54.02	35.80	8.35	4.89	0.00	34.60	1157
	Average	**29.32**	**54.02**	**35.79**	**8.35**	**4.90**	**0.00**	**34.57**	
GP5	0	28.81	53.70	35.56	8.26	4.30	0.00	34.35	1660
	1	28.85	53.75	35.57	8.26	4.39	0.00	34.40	879

STATION	DEPTH (m)	TEMP. °C	COND (mS/cm)	SAL (ppt)	pH	D.O. (mg/l)	Turb (NTU)	TDS (g/l)	PAR (μmol/m2/s)
	Average	**28.83**	**53.73**	**35.57**	**8.26**	**4.35**	**0.00**	**34.38**	
GP6	0	28.89	53.94	35.71	8.31	4.98	0.00	34.51	507
	1	28.68	53.72	35.73	8.30	4.86	0.00	34.52	420
	Average	**28.79**	**53.83**	**35.72**	**8.31**	**4.92**	**0.00**	**34.52**	
GP7	0	29.67	54.33	36.01	8.37	6.03	0.00	34.77	485
	1	29.65	54.30	36.00	8.41	6.01	0.00	34.76	
	2	29.66	54.31	36.01	8.42	6.00	0.00	34.76	401
	3	29.66	54.33	36.01	8.42	6.02	0.00	34.75	
	4	29.65	54.31	36.00	8.42	6.03	0.00	34.75	
	5	29.65	54.32	36.01	8.42	6.02	0.00	34.77	
	6	29.66	54.34	36.03	8.43	5.98	0.00	34.78	
	7	29.64	54.33	36.02	8.43	5.99	0.00	34.77	
	Average	**29.66**	**54.32**	**36.01**	**8.42**	**6.01**	**0.00**	**34.76**	

Light Extinction Coefficient

Station	Depth 1	PAR	Depth 2	PAR	EC
1	0	1565	2	1014	0.2167
2	0	1587	1	1228	0.2562
3	0	1610	1	1213	0.2828
4	0	1534	1	1157	0.2817
5	0	1660	1	879	0.6351
6	0	507	1	420	0.1880
7	0	485	2	401	0.0950

Appendix 8 – Laboratory Water Quality Results Sheets

Caribbean Environmental Testing and Monitoring Services Ltd. (CETMS)

caribbean environmental
TESTING & MONITORING SERVICES LTD.

GP 2023-06-21

July 03, 2023

Name of Company: CL Environmental

Contact Person(s): Matthew Lee

Address: 20 Windsor Ave, Kingston 5, Jamaica

Telephone: 876-439-9584

Email: mlee@clenvironmental.com

Sample Date: June 21, 2023

Date Received: June 21, 2023

Number of Samples: 7

Type of Material: Marine

Date Tested: June 21-30, 2023

RESULTS FOR SAMPLES SUBMITTED

Parameters	Unit	Method	Detection Limit	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	GP 7	NRCA Standard
BOD	Mg/L	HACH 8043	0.01	3.20	2.72	3.98	3.38	1.98	2.66	1.55	0.0-1.16
Nitrates	Mg/L	HACH 8039	0.03	2.4	2.5	2.2	2.3	1.9	2.1	2.0	0.007-0.014
Phosphates	Mg/L PO_4^{3-}	H ACH 8048	0.02	0.15	0.21	0.18	0.11	0.27	0.02	0.07	0.001-0.003
TSS	mg/L	HACH 8006	5.0	<5	<5	<5	<5	<5	<5	<5	NA
Faecal Coliform	MPN/100ml	SMEWW 9221 E	1.1	11	<1.1	51	<1.1	92	22	<1.1	<2-13

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TESTING & MONITORING SERVICES LTD.

GP 2023-06-21

Methods: HACH Water Analysis Handbook 7th Edition
SMEWW Standard Methods for the Examination of Water and Wastewater, 21st Ed 2005

Reported by: Odian Barrett, Analyst

Approved by: Prof. Nilza Aples
Director of Analytical Testing and Monitoring

CETMS Ltd. does not accept responsibility for any deviations in results if:
i. Samples are not collected and handled in accordance with the Ministry of Health, Environmental Health Unit, Sampling and Field Measurements Protocol (January 2015)
ii. Samples are not delivered to the lab within the maximum holding time for each respective analysis requested
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GP 2023-08-24

September 13, 2023

Name of Company: CL Environmental

Contact Person(s): Matthew Lee

Address: 20 Windsor Ave, Kingston 5, Jamaica

Telephone: 876-439-9584

Email: mlee@clenvironmental.com

Sample Date: August 24, 2023

Date Received: August 24, 2023

Number of Samples: 7

Type of Material: Marine

Date Tested: August 24-September 8, 2023

RESULTS FOR SAMPLES SUBMITTED

Parameters	Unit	Method	Detection Limit	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	GP 7	NRCA Standard
Nitrates	Mg/L	HACH 8039	0.03	2.3	2.5	2.2	2.9	2.3	2.4	0.9	0.007-0.014
Phosphates	Mg/L PO_4^{3-}	H ACH 8048	0.02	0.03	0.11	0.03	0.03	0.07	0.08	0.13	0.001-0.003
TSS	mg/L	HACH 8006	5.0	<5	<5	<5	<5	<5	<5	<5	NA
Faecal Coliform	MPN/100ml	SMEWW 9221 E	1.1	11	<1.1	51	<1.1	92	22	1.1	<2-13

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GP 2023-08-24

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Reported by: Odian Barrett, Analyst

Approved by: Prof. Nilza Aples
Director of Analytical Testing and Monitoring

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PL 2023-10-11

November 7, 2023

Name of Company: CL Environmental

Contact Person(s): Matthew Lee

Address: 20 Windsor Ave, Kingston 5, Jamaica

Telephone: 876-439-9584

Email: mlee@clenvironmental.com

Sample Date: October 11, 2023

Date Received: October 11, 2023

Number of Samples: 7

Type of Material: Marine

Date Tested: October 11-20, 2023

RESULTS FOR SAMPLES SUBMITTED

Parameters	Unit	Method	Detection Limit	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	GP 7	NRCA Standard
Nitrates	Mg/L	HACH 8039	0.03	2.6	2.6	3.0	2.5	2.3	2.6	2.9	0.007-0.014
Phosphates	Mg/L PO_4^{3-}	H ACH 8048	0.02	0.08	0.07	0.03	0.10	0.05	0.08	0.09	0.001-0.003
TSS	mg/L	HACH 8006	5.0	<5	<5	<5	10	<5	<5	5	NA
Faecal Coliform	MPN/100ml	SMEWW 9221 E	1.1	1.1	<1.1	<1.1	<1.1	92	<1.1	120	<2-13

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PL 2023-10-11

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GP 2023-11-16

December 15, 2023

Name of Company: CL Environmental

Contact Person(s): Matthew Lee

Address: 20 Windsor Ave, Kingston 5, Jamaica

Telephone: 876-439-9584

Email: mlee@clenvironmental.com

Sample Date: November 16, 2023

Date Received: November 16, 2023

Number of Samples: 7

Type of Material: Marine

Date Tested: November 16-30, 2023

RESULTS FOR SAMPLES SUBMITTED

Parameters	Unit	Method	Detection Limit	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	GP 7	NRCA Standard
Nitrates	Mg/L	HACH 8039	0.03	2.0	2.1	1.9	1.9	2.3	1.8	2.4	0.007-0.014
Phosphates	Mg/L PO_4^{3-}	H ACH 8048	0.02	0.05	0.07	0.06	0.05	0.04	0.08	0.10	0.001-0.003
TSS	mg/L	HACH 8006	5.0	<5	<5	6	<5	<5	5	<5	NA
Faecal Coliform	MPN/100ml	SMEWW 9221 E	1.1	11	<1.1	36	<1.1	56	22	11	<2-13

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GP 2023-11-16

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GP 2024-03-21

May 06, 2024

Name of Company: **CL Environmental**
Contact Person(s): Matthew Lee
Address: 20 Windsor Ave, Kingston 5, Jamaica
Telephone: 876-439-9584
Email: mlee@clenvironmental.com

Sample Date: March 21, 2024
Date Received: March 21, 2024
Number of Samples: 7
Type of Material: Marine
Date Tested: March 21-30, 2024

RESULTS FOR SAMPLES SUBMITTED

Parameters	Unit	Method	Detection Limit	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	GP 7	NRCA Standard
Nitrates	Mg/L	HACH 8039	0.03	2.3	2.6	1.8	1.9	1.9	2.0	1.7	0.007-0.014
Phosphates	Mg/L PO_4^{3-}	H ACH 8048	0.02	0.11	0.04	0.04	0.05	0.06	0.21	0.05	0.001-0.003
TSS	mg/L	HACH 8006	5.0	1	1	2	4	2	3	1	NA
Faecal Coliform	MPN/100ml	SMEWW 9221 E	1.1	11	11	36	36	51	92	<1.1	<2-13

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GP 2024-03-21

Methods: HACH Water Analysis Handbook 7th Edition
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GP 2024-05-22

June 05, 2024

Name of Company: CL Environmental

Contact Person(s): Matthew Lee

Address: 20 Windsor Ave, Kingston 5, Jamaica

Telephone: 876-439-9584

Email: mlee@clenvironmental.com

Sample Date: May 22, 2024

Date Received: May 22, 2024

Number of Samples: 7

Type of Material: Marine

Date Tested: May 22-31, 2024

RESULTS FOR SAMPLES SUBMITTED

Parameters	Unit	Method	Detection Limit	GP 1	GP 2	GP 3	GP 4	GP 5	GP 6	GP 7	NRCA Standard
BOD	Mg/L	HACH 8043	0.01	0.90	0.48	0.54	0.51	0.45	0.93	0.30	0.0-1.16
Nitrates	Mg/L	HACH 8039	0.03	2.7	2.2	1.7	2.6	2.1	2.1	2.9	0.007-0.014
Phosphates	Mg/L PO_4^{3-}	H ACH 8048	0.02	0.05	0.18	0.05	0.05	0.06	0.05	0.03	0.001-0.003
TSS	mg/L	HACH 8006	5.0	1	1	2	3	3	4	2	NA
Faecal Coliform	MPN/100ml	SMEWW 9221 E	1.1	11	11	<1.1	36	69	120	<1.1	<2-13

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GP 2024-05-22

Methods: HACH Water Analysis Handbook 7th Edition
SMEWW Standard Methods for the Examination of Water and Wastewater, 21st Ed 2005

Reported by: Odian Barrett, Analyst

Approved by: Prof. Nilza Aples
Director of Analytical Testing and Monitoring

CETMS Ltd. does not accept responsibility for any deviations in results if:
i. Samples are not collected and handled in accordance with the Ministry of Health, Environmental Health Unit, Sampling and Field Measurements Protocol (January 2015)
ii. Samples are not delivered to the lab within the maximum holding time for each respective analysis requested
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DIRECTORS: DENISE FORREST, MSc, MBA, PMP - MANAGING DIRECTOR • NILZA JUSTIZ-SMITH, PhD, FI • CARLTON CAMPBELL, MPhil, CMC
Tel: 876.906.7638 | Fax: 876.929.1856 4 Chelsea Avenue, Kgn 10, Jamaica

Environmental, Technical and Analytical Services Limited (ETAS)

CLE 2308ET1135_clc.shr (completed) GP1-7

ENVIRONMENTAL, TECHNICAL AND ANALYTICAL SERVICES LIMITED
Hope Gardens, P.O. Box 28, Kingston 6
Telephone: (876) 927-1944 Email: etaslimited1093@gmail.com

Water and Wastewater Report Sheet, Page 1 of 2

REF. #:2308ET1135-1141 **ATTENTION:** Mr. Matthew Lee

COMPANY	C. L. Environmental Co. Ltd.		MEANS OF CONTRACT	Written
DATE RECEIVED	August 25, 2023		DATE REPORTED	August 28, 2023
NO. OF SAMPLES	Seven (7)		SAMPLE VOLUME	Approx. 2L
STARTED	August 25, 2023		SAMPLE TYPE	Marine Water

REF. #	Sample Name	Parameter	Remarks
- - -	- - -	BOD_5, mg/L D. O.	- - -
2308ET1135	GP1	0.6	
2308ET1136	GP2	0.7	
2308ET1137	GP3	0.5	
2308ET1138	GP4	0.6	
2308ET1139	GP5	0.7	
2308ET1140	GP6	0.8	
2308ET1141	GP7	0.6	

R11	DATE SAMPLED	August 24, 2023		TIME SAMPLED	12:00 PM – 1:00 PM
R11	DATE RECEIVED	August 25, 2023		TIME RECEIVED	8:40 AM
R11	DATE STARTED	August 25, 2023		TIME STARTED	8:40 AM

CLE 2308ET1135_etc,shr (completed) GP1-7

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Hope Gardens, P.O. Box 28, Kingston 6
Telephone: (876) 927-1944 Email: etaslimited1093@gmail.com

Water and Wastewater Report Sheet, Page 2 of 2

REF. #: 2308ET1135-1141 **ATTENTION:** Mr. Matthew Lee

Parameter	Test Method	Detection Limit	Range
BOD_5, mg/L D. O.	Dilution Method adapted from HACH Method 8043 **and** Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005 (SMEWW) Method 5210.	(Method 1a) Sample unseeded & diluted: 2 mg/L **X** Dilution Factor [NOTE: Dilution Factor = "Total Volume" divided by "Sample Volume."] (Method 1b) Sample unseeded & undiluted: Approx 0.1 mg/L	

Certified By : ....
Kamara Beckford, Quality Manager

Certified By : ....
Analyst (Name)

....
(Signature)

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Form ET2

CLE 2310ET1434_etc,shr (completed) PA1-7

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Hope Gardens, P.O. Box 28, Kingston 6
Telephone: (876) 927-1944 Email: etaslimited1093@gmail.com

Water and Wastewater Report Sheet, Page 1 of 2

REF. #: 2310ET1434-1440 **ATTENTION:** Mr. Matthew Lee

COMPANY	C. L. Environmental Co. Ltd.	MEANS OF CONTRACT	Written
DATE RECEIVED	October 11, 2023	DATE REPORTED	October 20, 2023
NO. OF SAMPLES	Seven (7)	SAMPLE VOLUME	Approx. 2L
STARTED	October 11, 2023	SAMPLE TYPE	Marine Water

Reference Number	Sample Name	Parameter	Remarks
---	---	BOD_5, mg/L D. O.	---
2310ET1434	PA1	0.3	
2310ET1435	PA2	0.2	
2310ET1436	PA3	1.4	
2310ET1437	PA4	0.3	
2310ET1438	PA5	0.6	
2310ET1439	PA6	0.4	
2310ET1440	PA7	0.6	

R11	DATE SAMPLED	October 11, 2023	TIME SAMPLED	7:00 AM – 8:00 AM
R11	DATE RECEIVED	October 11, 2023	TIME RECEIVED	3:47 PM
R11	DATE STARTED	October 11, 2023	TIME STARTED	3:47 PM

CLE 2310ET1434_etc,shr (completed) PA1-7

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Hope Gardens, P.O. Box 26, Kingston 6
Telephone: (876) 927-1944 Email: etaslimited1093@gmail.com

Water and Wastewater Report Sheet, Page 2 of 2

REF. #: 2310ET1434-1440 **ATTENTION:** Mr. Matthew Lee

Parameter	Test Method	Detection Limit	Range
BOD_5, mg/L D. O.	Dilution Method adapted from HACH Method 8043 **and** Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005 (SMEWW) Method 5210.	Method 1a) Sample unseeded & diluted: 2 mg/L **X** Dilution Factor [NOTE: Dilution Factor = "Total Volume" divided by "Sample Volume."] Method 1b) Sample unseeded & undiluted: Approx. 0.1 mg/L	

Certified By: .... Kamara Beckford, Quality Manager

Certified By: .... Chinell Francis, Laboratory Analyst

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CLE 2311ET1600_etc,slr (completed) PA1-7

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Hope Gardens, P.O. Box 28, Kingston 6
Telephone: (876) 927-1944 / 876-616-2723
Email: etaslimited1093@gmail.com

Water and Wastewater Report Sheet, Page 1 of 2

REF. #: 2311ET1600-1606 **ATTENTION:** Mr. Matthew Lee

COMPANY	C. L. Environmental Co. Ltd.		MEANS OF CONTRACT	Written
DATE RECEIVED	November 17, 2023		DATE REPORTED	November 24, 2023
NO. OF SAMPLES	Seven (7)		SAMPLE VOLUME	Approx. 2L
STARTED	November 17, 2023		SAMPLE TYPE	Marine Water

Reference Number	Sample Name	Parameter	Remarks
- - -	- - -	BOD_5, mg/L D. O.	- - -
2311ET1600	PA1	0.7	
2311ET1601	PA2	0.5	
2311ET1602	PA3	0.5	
2311ET1603	PA4	0.4	
2311ET1604	PA5	1.6	
2311ET1605	PA6	1.4	
2311ET1606	PA7	0.4	

R11	DATE SAMPLED	November 16, 2023		TIME SAMPLED	3:00 PM – 4:00 PM
R11	DATE RECEIVED	November 17, 2023		TIME RECEIVED	10:41 AM
R11	DATE STARTED	November 17, 2023		TIME STARTED	10:41 AM

CLE 2311ET1600_etc,slr (completed) PA1-7

ENVIRONMENTAL, TECHNICAL AND ANALYTICAL SERVICES LIMITED
Hope Gardens, P.O. Box 28, Kingston 6
Telephone: (876) 927-1944 / 876-616-2723
Email: etaslimited1093@gmail.com

Water and Wastewater Report Sheet, Page 2 of 2

REF. #:2311ET1600-1606 **ATTENTION:** Mr. Matthew Lee

Parameter	Test Method	Detection Limit	Range
BOD_5, mg/L D. O.	Dilution Method adapted from HACH Method 8043 **and** Standard Methods for the Examination of Water and Wastewater, 21st Edition, 2005 (SMEWW) Method 5210.	(Method 1c) Sample Seeded and Diluted, (1c) (21st ed): Approx. 1 mg/L (Method 1d) Seeded and Undiluted,(21st ed): 0 mg/L	

Certified By: .... Kamara Beckford, Quality Manager

Certified By: .... Chinell Francis, Laboratory Analyst

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Form ET2

CLE 2403ET242_etc,shr (completed) GP 1-7

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Hope Gardens, P.O. Box 28, Kingston 6
Telephone: 876-927-1944 / 876-616-2723 WhatsApp: 876-309-2469
Email: etaslimited1093@gmail.com IG: https://www.instagram.com/etasltd/

Water and Wastewater Report Sheet, Page 1 of 2

REF. #:2403ET242-248 **ATTENTION:** Mr. Matthew Lee

COMPANY	C. L. Environmental Co. Ltd. 20 Windsor Avenue Kingston 5		MEANS OF CONTRACT	Written
DATE RECEIVED	March 20, 2024		DATE REPORTED	March 28, 2024
NO. OF SAMPLES	Seven (7)		SAMPLE VOLUME	Approx. 2L
STARTED	March 20, 2024		SAMPLE TYPE	Sea Water

NOTE: -	Please see R11

REF. #	Sample Name	Parameter	Remarks
- - -	- - -	BOD_5, mg/L D. O.	- - -
2403ET242	GP 1	1.1	
2403ET243	GP 2	1.3	
2403ET244	GP 3	1.1	
2403ET245	GP 4	1.1	
2403ET246	GP 5	1.6	
2403ET247	GP 6	1.1	
2403ET248	GP 7	1.1	

R11	DATE SAMPLED	March 20, 2024		TIME SAMPLED	9:10 AM – 10:00 AM
R11	DATE RECEIVED	March 20, 2024		TIME RECEIVED	3:00 PM
R11	DATE STARTED	March 20, 2024		TIME STARTED	3:00 PM

CLE 2403ET242_etc,shr (completed) GP 1-7

ENVIRONMENTAL, TECHNICAL AND ANALYTICAL SERVICES LIMITED
Hope Gardens, P.O. Box 28, Kingston 6
Telephone: 876-927-1944 / 876-616-2723 WhatsApp: 876-309-2469
Email: etaslimited1093@gmail.com IG: https://www.instagram.com/etasltd/

Water and Wastewater Report Sheet, Page 2 of 2

REF. #:2403ET242-248 **ATTENTION:** Mr. Matthew Lee

Parameter	Test Method	Detection Limit	Range
BOD_5, mg/L D. O.	Dilution Method adapted from HACH Method 8043 and Standard Methods for the Examination of Water and Wastewater, 23RD Edition, 2017(SMEWW) Method 5210.	0 mg/L	---

Certified By : K. Beckford
Kamara Beckford, Quality Manager

Certified By : CFrancis
Chinell Francis, Laboratory Analyst

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Form ET2

International Analytical Group (IAG) – Eurofins

IAG
INTERNATIONAL ANALYTICAL GROUP

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-239781-1

Grand Palladium

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

INTERNATIONAL ANALYTICAL GROUP 1998 Excellence since 1998

791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

eurofins | Environment Testing

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ANALYTICAL REPORT

PREPARED FOR

Attn: Matthew Lee
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica

Generated 7/5/2023 2:38:26 PM

JOB DESCRIPTION

Grand Palladium

JOB NUMBER

400-239781-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

Page 1 of 19

myEOL

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Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

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7/5/2023 2:38:26 PM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Client: CL Environmental
Project/Site: Grand Palladium

Laboratory Job ID: 400-239781-1

Table of Contents

Definitions/Glossary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

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Case Narrative

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Job ID: 400-239781-1

Laboratory: Eurofins Pensacola

Narrative

Job Narrative
400-239781-1

Comments
No additional comments.

Receipt
The samples were received on 6/28/2023 9:31 AM. The temperature of the cooler at receipt was 0.0° C.

GC Semi VOA
Method FL-PRO: The continuing calibration verification (CCV) associated with batch 400-631585 recovered above the upper control limit for C28-C40. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

Method FL-PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: (LCS 400-631436/2-A), (LCSD 400-631436/3-A) and (MB 400-631436/1-A). These results have been reported and qualified.

Method FL-PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: GP1 (400-239781-1), GP2 (400-239781-2), GP3 (400-239781-3), GP4 (400-239781-4), GP5 (400-239781-5), GP6 (400-239781-6) and GP7 (400-239781-7). These results have been reported and qualified.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method 3511: The following samples were prepared outside of preparation holding time due to Analyst error: GP1 (400-239781-1), GP2 (400-239781-2), GP3 (400-239781-3), GP4 (400-239781-4), GP5 (400-239781-5), GP6 (400-239781-6) and GP7 (400-239781-7).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Sample Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-239781-1	GP1	Water	06/21/23 08:04	06/28/23 09:31
400-239781-2	GP2	Water	06/21/23 07:45	06/28/23 09:31
400-239781-3	GP3	Water	06/21/23 07:40	06/28/23 09:31
400-239781-4	GP4	Water	06/21/23 07:32	06/28/23 09:31
400-239781-5	GP5	Water	06/21/23 07:28	06/28/23 09:31
400-239781-6	GP6	Water	06/21/23 07:23	06/28/23 09:31
400-239781-7	GP7	Water	06/21/23 08:21	06/28/23 09:31

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP1
Date Collected: 06/21/23 08:04
Date Received: 06/28/23 09:31

Lab Sample ID: 400-239781-1
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/29/23 20:59	07/01/23 01:28	1
C8-C10	ND		1.1	mg/L		06/29/23 20:59	07/01/23 01:28	1
C10-C28	ND		1.1	mg/L		06/29/23 20:59	07/01/23 01:28	1
C28-C40	ND		1.1	mg/L		06/29/23 20:59	07/01/23 01:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*160*		*40 - 129*	*06/29/23 20:59*	*07/01/23 01:28*	*1*
o-Terphenyl	*101*		*66 - 139*	*06/29/23 20:59*	*07/01/23 01:28*	*1*

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Client Sample Results

Client: CL Environmental — Job ID: 400-239781-1
Project/Site: Grand Palladium

Client Sample ID: GP2 — **Lab Sample ID: 400-239781-2**
Date Collected: 06/21/23 07:45 — **Matrix: Water**
Date Received: 06/28/23 09:31

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 01:45	1
C8-C10	ND		1.0	mg/L		06/29/23 20:59	07/01/23 01:45	1
C10-C28	ND		1.0	mg/L		06/29/23 20:59	07/01/23 01:45	1
C28-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 01:45	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*163*		*40 - 129*	*06/29/23 20:59*	*07/01/23 01:45*	*1*
o-Terphenyl	*95*		*66 - 139*	*06/29/23 20:59*	*07/01/23 01:45*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP3

Lab Sample ID: 400-239781-3

Date Collected: 06/21/23 07:40

Matrix: Water

Date Received: 06/28/23 09:31

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:02	1
C8-C10	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:02	1
C10-C28	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:02	1
C28-C40	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:02	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*152*		*40 - 129*	*06/29/23 20:59*	*07/01/23 02:02*	*1*
o-Terphenyl	*97*		*66 - 139*	*06/29/23 20:59*	*07/01/23 02:02*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP4
Date Collected: 06/21/23 07:32
Date Received: 06/28/23 09:31

Lab Sample ID: 400-239781-4
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:19	1
C8-C10	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:19	1
C10-C28	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:19	1
C28-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:19	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*165*		*40 - 129*	*06/29/23 20:59*	*07/01/23 02:19*	*1*
o-Terphenyl	*97*		*66 - 139*	*06/29/23 20:59*	*07/01/23 02:19*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP5
Date Collected: 06/21/23 07:28
Date Received: 06/28/23 09:31

Lab Sample ID: 400-239781-5
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:37	1
C8-C10	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:37	1
C10-C28	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:37	1
C28-C40	ND		1.1	mg/L		06/29/23 20:59	07/01/23 02:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*152*		*40 - 129*	*06/29/23 20:59*	*07/01/23 02:37*	*1*
o-Terphenyl	*95*		*66 - 139*	*06/29/23 20:59*	*07/01/23 02:37*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP6
Date Collected: 06/21/23 07:23
Date Received: 06/28/23 09:31

Lab Sample ID: 400-239781-6
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:54	1
C8-C10	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:54	1
C10-C28	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:54	1
C28-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 02:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*183*		*40 - 129*	*06/29/23 20:59*	*07/01/23 02:54*	*1*
o-Terphenyl	*111*		*66 - 139*	*06/29/23 20:59*	*07/01/23 02:54*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP7
Date Collected: 06/21/23 08:21
Date Received: 06/28/23 09:31

Lab Sample ID: 400-239781-7
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 03:11	1
C8-C10	ND		1.0	mg/L		06/29/23 20:59	07/01/23 03:11	1
C10-C28	ND		1.0	mg/L		06/29/23 20:59	07/01/23 03:11	1
C28-C40	ND		1.0	mg/L		06/29/23 20:59	07/01/23 03:11	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*172*		*40 - 129*	*06/29/23 20:59*	*07/01/23 03:11*	*1*
o-Terphenyl	*99*		*66 - 139*	*06/29/23 20:59*	*07/01/23 03:11*	*1*

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Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP1 — **Lab Sample ID: 400-239781-1**
Date Collected: 06/21/23 08:04 — Matrix: Water
Date Received: 06/28/23 09:31

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 01:28

Client Sample ID: GP2 — **Lab Sample ID: 400-239781-2**
Date Collected: 06/21/23 07:45 — Matrix: Water
Date Received: 06/28/23 09:31

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 01:45

Client Sample ID: GP3 — **Lab Sample ID: 400-239781-3**
Date Collected: 06/21/23 07:40 — Matrix: Water
Date Received: 06/28/23 09:31

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 02:02

Client Sample ID: GP4 — **Lab Sample ID: 400-239781-4**
Date Collected: 06/21/23 07:32 — Matrix: Water
Date Received: 06/28/23 09:31

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 02:19

Client Sample ID: GP5 — **Lab Sample ID: 400-239781-5**
Date Collected: 06/21/23 07:28 — Matrix: Water
Date Received: 06/28/23 09:31

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 02:37

Client Sample ID: GP6 — **Lab Sample ID: 400-239781-6**
Date Collected: 06/21/23 07:23 — Matrix: Water
Date Received: 06/28/23 09:31

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 02:54

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Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Client Sample ID: GP7
Date Collected: 06/21/23 08:21
Date Received: 06/28/23 09:31

Lab Sample ID: 400-239781-7
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			631436	JTC	EET PEN	06/29/23 20:59
Total/NA	Analysis	FL-PRO		1	631588	MP	EET PEN	07/01/23 03:11

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Accreditation/Certification Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3511	Water	C10-C28
FL-PRO	3511	Water	C28-C40
FL-PRO	3511	Water	C8-C10
FL-PRO	3511	Water	C8-C40

Method Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-239781-1

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
3511	Microextraction of Organic Compounds	SW846	EET PEN

Protocol References:

FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Eurofins Pensacola
3355 McLemore Drive
Pensacola, FL 32514
Phone: 850-474-1001 Fax: 850-478-2671

Chain of Custody Record

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Client Information	Sampler: Rachel D'Silva	Lab PM: Swafford, Mark H	400-239781 COC	Carrier Tracking No(s):	COC No: 400-121057-41555.5
Client Contact: Matthew Lee	Phone: 954 966 2454	E-Mail: Mark.Swafford@et.eurofinsus.com		State of Origin:	Page: Page 5 of 5
Company: CL Environmental	PWSID:				Job #:

Address: 22 Fort George Heights Stony Hill,	Due Date Requested:
City: Kingston 8	TAT Requested (days):
State, Zip: JA,	Compliance Project: Δ Yes Δ No
Phone: 954-966-2454(Tel)	PO #: Purchase Order not required
Email: mlee @clenvironmetal.com	WO #:
Project Name: Grand Palladium	Project #: 40001189
Site: Lucea	SSOW#:

Analysis Requested

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Y - Trizma
Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD	FL_PRO - FLPRO	6010D, 7471B	Total Number of containers	Special Instructions/Note:
				Preservation Code:			N	N		
GP 1	21/6/23	9:04am	G	W ~~Solid~~			✓			
GP 2	"	7 45am	G	W ~~Solid~~			✓			
GP 3	"	7 40am	G	W			✓			
GP 4	"	7 32am	G	W			✓			
GP 5	"	7.28am	G	W			✓			
GP 6	"	7:23am	G	W			✓			
GP 7	"	8:21am	G	W			✓			

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Deliverable Requested: I, II, III, IV, Other (specify)

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date: 27/6/23	Time:	Method of Shipment: Fedex		
Relinquished by: Alec Silex	Date/Time: 27/6/23	Company: CLE	Received by: Fedex	Date/Time: 27/6/23	Company: Fedex
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by: [signature]	Date/Time: 6.28.23 9:31	Company:
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: 0.0 IR8		

Ver: 06/08/2021

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7/5/2023

Login Sample Receipt Checklist

Client: CL Environmental — Job Number: 400-239781-1

Login Number: 239781 — **List Source: Eurofins Pensacola**
List Number: 1
Creator: Whitley, Adrian

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	0.0°C IR8
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

INTERNATIONAL ANALYTICAL GROUP

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-242906-1

Grand Palladium

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

INTERNATIONAL ANALYTICAL GROUP 1998 Excellence since 1998

791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

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ANALYTICAL REPORT

PREPARED FOR

Attn: Matthew Lee
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica
Generated 9/11/2023 8:12:49 AM

JOB DESCRIPTION

Grand Palladium

JOB NUMBER

400-242906-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

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Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

Generated
9/11/2023 8:12:49 AM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Table of Contents

Definitions/Glossary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
S1-	Surrogate recovery exceeds control limits, low biased.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Eurofins Pensacola

Case Narrative

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Job ID: 400-242906-1

Laboratory: Eurofins Pensacola

Narrative

Job Narrative
400-242906-1

Receipt

The samples were received on 9/2/2023 7:54 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 13.9°C

GC Semi VOA

Method FL_PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: GP1 (400-242906-1), GP2 (400-242906-2), GP3 (400-242906-3), GP4 (400-242906-4), GP5 (400-242906-5), GP6 (400-242906-6), GP7 (400-242906-7), (LCS 400-640027/2-A), (LCSD 400-640027/3-A) and (MB 400-640027/1-A). These results have been reported and qualified.

Method FL_PRO: The following samples were received outside of holding time: GP1 (400-242906-1), GP2 (400-242906-2), GP3 (400-242906-3), GP4 (400-242906-4), GP5 (400-242906-5), GP6 (400-242906-6) and GP7 (400-242906-7).

Method FL_PRO: The method blank for preparation batch 400-640027 contained C8-C40 above the reporting limit (RL). None of the samples associated with this method blank contained the target compound; therefore, re-extraction and/or re-analysis of samples were not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

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Sample Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-242906-1	GP1	Water	08/24/23 07:05	09/02/23 07:54
400-242906-2	GP2	Water	08/24/23 07:00	09/02/23 07:54
400-242906-3	GP3	Water	08/24/23 06:54	09/02/23 07:54
400-242906-4	GP4	Water	08/24/23 06:47	09/02/23 07:54
400-242906-5	GP5	Water	08/24/23 06:45	09/02/23 07:54
400-242906-6	GP6	Water	08/24/23 06:35	09/02/23 07:54
400-242906-7	GP7	Water	08/24/23 06:20	09/02/23 07:54

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP1
Date Collected: 08/24/23 07:05
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-1
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 12:48	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 12:48	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 12:48	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 12:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*4*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 12:48*	*1*
o-Terphenyl	*114*		*66 - 139*	*09/06/23 23:53*	*09/09/23 12:48*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP2
Date Collected: 08/24/23 07:00
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-2
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:04	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:04	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:04	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*5*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 13:04*	*1*
o-Terphenyl	*113*		*66 - 139*	*09/06/23 23:53*	*09/09/23 13:04*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP3
Date Collected: 08/24/23 06:54
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-3
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:21	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:21	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:21	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*4*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 13:21*	*1*
o-Terphenyl	*110*		*66 - 139*	*09/06/23 23:53*	*09/09/23 13:21*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP4
Date Collected: 08/24/23 06:47
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-4
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:37	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:37	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:37	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:37	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*3*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 13:37*	*1*
o-Terphenyl	*114*		*66 - 139*	*09/06/23 23:53*	*09/09/23 13:37*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP5
Date Collected: 08/24/23 06:45
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-5
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:54	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:54	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:54	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 13:54	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*3*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 13:54*	*1*
o-Terphenyl	*109*		*66 - 139*	*09/06/23 23:53*	*09/09/23 13:54*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP6
Date Collected: 08/24/23 06:35
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-6
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:10	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:10	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:10	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*5*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 14:10*	*1*
o-Terphenyl	*114*		*66 - 139*	*09/06/23 23:53*	*09/09/23 14:10*	*1*

Eurofins Pensacola

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9/11/2023

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP7
Date Collected: 08/24/23 06:20
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-7
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:27	1
C8-C10	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:27	1
C10-C28	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:27	1
C28-C40	ND		1.0	mg/L		09/06/23 23:53	09/09/23 14:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*11*	*S1-*	*40 - 129*	*09/06/23 23:53*	*09/09/23 14:27*	*1*
o-Terphenyl	*111*		*66 - 139*	*09/06/23 23:53*	*09/09/23 14:27*	*1*

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Eurofins Pensacola

Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP1 — **Lab Sample ID: 400-242906-1**
Date Collected: 08/24/23 07:05 — Matrix: Water
Date Received: 09/02/23 07:54

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 12:48

Client Sample ID: GP2 — **Lab Sample ID: 400-242906-2**
Date Collected: 08/24/23 07:00 — Matrix: Water
Date Received: 09/02/23 07:54

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 13:04

Client Sample ID: GP3 — **Lab Sample ID: 400-242906-3**
Date Collected: 08/24/23 06:54 — Matrix: Water
Date Received: 09/02/23 07:54

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 13:21

Client Sample ID: GP4 — **Lab Sample ID: 400-242906-4**
Date Collected: 08/24/23 06:47 — Matrix: Water
Date Received: 09/02/23 07:54

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 13:37

Client Sample ID: GP5 — **Lab Sample ID: 400-242906-5**
Date Collected: 08/24/23 06:45 — Matrix: Water
Date Received: 09/02/23 07:54

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 13:54

Client Sample ID: GP6 — **Lab Sample ID: 400-242906-6**
Date Collected: 08/24/23 06:35 — Matrix: Water
Date Received: 09/02/23 07:54

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 14:10

Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Client Sample ID: GP7
Date Collected: 08/24/23 06:20
Date Received: 09/02/23 07:54

Lab Sample ID: 400-242906-7
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			640027	JTC	EET PEN	09/06/23 23:53
Total/NA	Analysis	FL-PRO		1	640374	MP	EET PEN	09/09/23 14:27

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

Accreditation/Certification Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3511	Water	C10-C28
FL-PRO	3511	Water	C28-C40
FL-PRO	3511	Water	C8-C10
FL-PRO	3511	Water	C8-C40

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Method Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-242906-1

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
3511	Microextraction of Organic Compounds	SW846	EET PEN

Protocol References:

FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Eurofins Pensacola
3355 McLemore Drive
Pensacola, FL 32514
Phone: 850-474-1001 Fax: 850-478-2671

Chain of Custody Record

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Client Information	Sampler: Alec Silvera	Lab PM: Swafford, Mark H	Carrier Tracking No(s):	COC No: 400-121057-41555.5
Client Contact: Matthew Lee	Phone: 954 966 2454	E-Mail: Mark.Swafford@et.eurofinsus.com	State of Origin:	Page: Page 5 of 5
Company: CL Environmental	PWSID:			Job #:

400-242906 COC

Address: 22 Fort George Heights Stony Hill,	Due Date Requested:
City: Kingston 8	TAT Requested (days):
State, Zip: JA,	Compliance Project: Δ Yes Δ No
Phone: 954-966-2454(Tel)	PO #: Purchase Order not required
Email: mlee@clenvironmental.com	WO #:
Project Name: Grand Palladium	Project #: 40001189
Site: Lucea	SSOW#:

Analysis Requested

Preservation Codes:
A - HCL
B - NaOH
C - Zn Acetate
D - Nitric Acid
E - NaHSO4
F - MeOH
G - Amchlor
H - Ascorbic Acid
I - Ice
J - DI Water
K - EDTA
L - EDA
M - Hexane
N - None
O - AsNaO2
P - Na2O4S
Q - Na2SO3
R - Na2S2O3
S - H2SO4
T - TSP Dodecahydrate
U - Acetone
V - MCAA
W - pH 4-5
Y - Trizma
Z - other (specify)
Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	FL_PRO - FLPRO	6010D, 7471B	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N		
GP 1	[redacted] "	7:05am	G	Solid			✓			
GP 2	29/8/23	7:00am	G	Solid			✓			
GP 3	"	6:54am	G	W			✓			
GP 4	"	6:48am	G	W			✓			
GP 5	"	6:45am	G	W			✓			
GP 6	"	6:35am	G	W			✓			
GP 7	"	6:20am	G	W			✓			

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: Fedex

Relinquished by	Date/Time	Company	Received by	Date/Time	Company
Alec Silvera	31/8/23	CLE	Fedex	31/8/23	Fedex
			BP	9/2/23 754	

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 13.9°C IR8

Ver: 06/08/2021

Login Sample Receipt Checklist

Client: CL Environmental | Job Number: 400-242906-1

Login Number: 242906
List Number: 1
Creator: Perez, Trina M

List Source: Eurofins Pensacola

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	Water present in cooler; indicates evidence of melted ice.
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	13.9°C IR-8
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	False	Refer to Job Narrative for details.
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

IAG
INTERNATIONAL ANALYTICAL GROUP

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-245068-1

Grand Palladium Lucea

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

INTERNATIONAL ANALYTICAL GROUP 1998 Excellence since 1998

791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

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1 2 3 4 5 6 7 8 9 10 11

ANALYTICAL REPORT

PREPARED FOR

Attn: Matthew Lee
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica
Generated 10/25/2023 4:28:08 PM

JOB DESCRIPTION

Grand Palladium Lucea

JOB NUMBER

400-245068-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

myEOL

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Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

Generated
10/25/2023 4:28:08 PM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Laboratory Job ID: 400-245068-1

Table of Contents

Definitions/Glossary

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

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10/25/2023

Case Narrative

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Job ID: 400-245068-1

Laboratory: Eurofins Pensacola

Narrative

Job Narrative
400-245068-1

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers are applied to indicate exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Receipt
The samples were received on 10/14/2023 8:05 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 15.8°C

GC Semi VOA
Method FL_PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: PA1 (400-245068-1), PA2 (400-245068-2), PA3 (400-245068-3), PA4 (400-245068-4), PA5 (400-245068-5), PA6 (400-245068-6), PA7 (400-245068-7) and (MB 400-645793/1-A). These results have been reported and qualified.

Method FL_PRO: The surrogate recovery for the LCS/LCSD was outside control limits; however, the recovery for the spiked target analyte was within control limits; therefore, the data is reported.

(LCS 400-645793/2-A) and (LCSD 400-645793/3-A)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Sample Summary

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-245068-1	PA1	Water	10/11/23 06:55	10/14/23 08:05
400-245068-2	PA2	Water	10/11/23 08:08	10/14/23 08:05
400-245068-3	PA3	Water	10/11/23 07:40	10/14/23 08:05
400-245068-4	PA4	Water	10/11/23 07:37	10/14/23 08:05
400-245068-5	PA5	Water	10/11/23 07:24	10/14/23 08:05
400-245068-6	PA6	Water	10/11/23 07:17	10/14/23 08:05
400-245068-7	PA7	Water	10/11/23 07:05	10/14/23 08:05

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA1
Date Collected: 10/11/23 06:55
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-1
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	1.4		1.1	mg/L		10/17/23 00:09	10/18/23 02:58	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 02:58	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 02:58	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 02:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*0.2*		*40 - 129*	*10/17/23 00:09*	*10/18/23 02:58*	*1*
o-Terphenyl	*71*		*66 - 139*	*10/17/23 00:09*	*10/18/23 02:58*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA2
Date Collected: 10/11/23 08:08
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-2
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:14	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:14	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:14	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:14	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*3*		*40 - 129*	*10/17/23 00:09*	*10/18/23 03:14*	*1*
o-Terphenyl	*91*		*66 - 139*	*10/17/23 00:09*	*10/18/23 03:14*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA3
Date Collected: 10/11/23 07:40
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-3
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:31	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:31	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:31	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:31	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*0.2*		*40 - 129*	*10/17/23 00:09*	*10/18/23 03:31*	*1*
o-Terphenyl	*91*		*66 - 139*	*10/17/23 00:09*	*10/18/23 03:31*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA4
Date Collected: 10/11/23 07:37
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-4
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:47	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:47	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:47	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 03:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*0.2*		*40 - 129*	*10/17/23 00:09*	*10/18/23 03:47*	*1*
o-Terphenyl	*92*		*66 - 139*	*10/17/23 00:09*	*10/18/23 03:47*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA5
Date Collected: 10/11/23 07:24
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-5
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:03	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:03	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:03	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:03	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*2*		*40 - 129*	*10/17/23 00:09*	*10/18/23 04:03*	*1*
o-Terphenyl	*84*		*66 - 139*	*10/17/23 00:09*	*10/18/23 04:03*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA6
Date Collected: 10/11/23 07:17
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-6
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:36	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:36	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:36	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:36	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*10*		*40 - 129*	*10/17/23 00:09*	*10/18/23 04:36*	*1*
o-Terphenyl	*112*		*66 - 139*	*10/17/23 00:09*	*10/18/23 04:36*	*1*

Eurofins Pensacola

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10/25/2023

Client Sample Results

Client: CL Environmental | Job ID: 400-245068-1
Project/Site: Grand Palladium Lucea

Client Sample ID: PA7 | **Lab Sample ID: 400-245068-7**
Date Collected: 10/11/23 07:05 | **Matrix: Water**
Date Received: 10/14/23 08:05

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:53	1
C8-C10	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:53	1
C10-C28	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:53	1
C28-C40	ND		1.1	mg/L		10/17/23 00:09	10/18/23 04:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*12*		*40 - 129*	*10/17/23 00:09*	*10/18/23 04:53*	*1*
o-Terphenyl	*109*		*66 - 139*	*10/17/23 00:09*	*10/18/23 04:53*	*1*

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Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA1
Lab Sample ID: 400-245068-1
Date Collected: 10/11/23 06:55
Matrix: Water
Date Received: 10/14/23 08:05

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 02:58

Client Sample ID: PA2
Lab Sample ID: 400-245068-2
Date Collected: 10/11/23 08:08
Matrix: Water
Date Received: 10/14/23 08:05

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 03:14

Client Sample ID: PA3
Lab Sample ID: 400-245068-3
Date Collected: 10/11/23 07:40
Matrix: Water
Date Received: 10/14/23 08:05

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 03:31

Client Sample ID: PA4
Lab Sample ID: 400-245068-4
Date Collected: 10/11/23 07:37
Matrix: Water
Date Received: 10/14/23 08:05

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 03:47

Client Sample ID: PA5
Lab Sample ID: 400-245068-5
Date Collected: 10/11/23 07:24
Matrix: Water
Date Received: 10/14/23 08:05

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 04:03

Client Sample ID: PA6
Lab Sample ID: 400-245068-6
Date Collected: 10/11/23 07:17
Matrix: Water
Date Received: 10/14/23 08:05

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 04:36

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Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Client Sample ID: PA7
Date Collected: 10/11/23 07:05
Date Received: 10/14/23 08:05

Lab Sample ID: 400-245068-7
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			645793	JTC	EET PEN	10/17/23 00:09
Total/NA	Analysis	FL-PRO		1	645920	MP	EET PEN	10/18/23 04:53

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Accreditation/Certification Summary

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-245068-1

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3511	Water	C10-C28
FL-PRO	3511	Water	C28-C40
FL-PRO	3511	Water	C8-C10
FL-PRO	3511	Water	C8-C40

Method Summary

Client: CL Environmental | Job ID: 400-245068-1
Project/Site: Grand Palladium Lucea

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
3511	Microextraction of Organic Compounds	SW846	EET PEN

Protocol References:

FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Eurofins Pensacola
3355 McLemore Drive
Pensacola, FL 32514
Phone: 850-474-1001 Fax: 850-478-2671

Chain of Custody Record

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400-245068 COC

Client Information	Sampler: Alec Silvera	Lab PM: Swafford, Mark H	Carrier T
Client Contact: Matthew Lee	Phone: 876 897 0108	E-Mail: Mark.Swafford@et.eurofinsus.com	State of C
Company: CL Environmental	PWSID:		
Address: 22 Fort George Heights Stony Hill,	Due Date Requested:		
City: Kingston 8	TAT Requested (days):		
State, Zip: JA,	Compliance Project: Δ Yes Δ No		
Phone: 954-966-2454(Tel)	PO #: Purchase Order not required		
Email: mlee@ clenvironmental.com	WO #:		
Project Name: Grand Palladium	Project #: 40001189		
Site: Lucea	SSOW#:		

COC No: 400-121057-41555.1
Page: Page 1 of 5
Job #:

Analysis Requested

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	FL_PRO - FLPRO	6010D, 7471B	Total Number of containers	Special Instructions/Note:
			Preservation Code:						
PA 1	11/10/23	6:55am	G	Water		✓			
PA 2	11/10/23	8:08am	G	Water		✓			
PA 3	11/10/23	7:47am	G	Water		✓			
PA 4	11/10/23	7:37am	G	Water		✓			
PA 5	11/10/23	7:24am	G	Water		✓			
PA 6	11/10/23	7:17am	G	Water		✓			
PA 7	11/10/23	7:05am	G	Water		✓			
				Water					
				Water					
				Water					
				Water					

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA
M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Y - Trizma, Z - other (specify)
Other:

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ______ Months*

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:		Method of Shipment: fedex	
Relinquished by: Alec Silvera	Date/Time: 12/10/23 11:30am	Company: CLE	Received by: Fedex	Date/Time: 12/10/23 11:30am	Company: Fedex
Relinquished by:	Date/Time:	Company:	Received by: BP	Date/Time: 10/14/23 805	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: 15.8°C IR8		

Ver: 06/08/2021

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Login Sample Receipt Checklist

Client: CL Environmental — Job Number: 400-245068-1

Login Number: 245068 — **List Source: Eurofins Pensacola**
List Number: 1
Creator: Roberts, Alexis J

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	15.8°C IR8
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Eurofins Pensacola

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IAG
INTERNATIONAL ANALYTICAL GROUP

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-247243-1

Grand Palladium Lucea

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

INTERNATIONAL ANALYTICAL GROUP
1998
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791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

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ANALYTICAL REPORT

PREPARED FOR

Attn: Matthew Lee
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica
Generated 12/5/2023 8:33:03 AM

JOB DESCRIPTION

Grand Palladium Lucea

JOB NUMBER

400-247243-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

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Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

Generated
12/5/2023 8:33:03 AM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Laboratory Job ID: 400-247243-1

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Table of Contents

Definitions/Glossary

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Qualifiers

GC Semi VOA

Qualifier	Qualifier Description
H	Sample was prepped or analyzed beyond the specified holding time. This does not meet regulatory requirements.
H3	Sample was received and analyzed past holding time. This does not meet regulatory requirements.
S1-	Surrogate recovery exceeds control limits, low biased.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

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Case Narrative

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Job ID: 400-247243-1

Laboratory: Eurofins Pensacola

Narrative

Job Narrative
400-247243-1

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers are applied to indicate exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Receipt
The samples were received on 11/24/2023 9:02 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 0.1°C

GC Semi VOA
Method FL_PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: PA 1 (400-247243-1), PA 2 (400-247243-2), PA 3 (400-247243-3), PA 4 (400-247243-4), PA 5 (400-247243-5), PA 6 (400-247243-6), PA 7 (400-247243-7), (LCS 400-651643/2-A), (LCSD 400-651643/3-A) and (MB 400-651643/1-A). These results have been reported and qualified.

Method FL_PRO: The following samples were received outside of holding time: PA 1 (400-247243-1), PA 2 (400-247243-2), PA 3 (400-247243-3), PA 4 (400-247243-4) and PA 5 (400-247243-5).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Sample Summary

Client: CL Environmental

Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-247243-1	PA 1	Water	11/16/23 07:30	11/24/23 09:02
400-247243-2	PA 2	Water	11/16/23 07:20	11/24/23 09:02
400-247243-3	PA 3	Water	11/16/23 07:10	11/24/23 09:02
400-247243-4	PA 4	Water	11/16/23 07:00	11/24/23 09:02
400-247243-5	PA 5	Water	11/16/23 06:50	11/24/23 09:02
400-247243-6	PA 6	Water	11/16/23 06:40	11/24/23 09:02
400-247243-7	PA 7	Water	11/16/23 06:25	11/24/23 09:02

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 1
Date Collected: 11/16/23 07:30
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-1
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:27	1
C8-C10	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:27	1
C10-C28	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:27	1
C28-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*44*		*40 - 129*	*11/25/23 19:51*	*11/29/23 06:27*	*1*
o-Terphenyl	*26*		*66 - 139*	*11/25/23 19:51*	*11/29/23 06:27*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 2
Date Collected: 11/16/23 07:20
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-2
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:43	1
C8-C10	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:43	1
C10-C28	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:43	1
C28-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:43	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*46*		*40 - 129*	*11/25/23 19:51*	*11/29/23 06:43*	*1*
o-Terphenyl	*27*		*66 - 139*	*11/25/23 19:51*	*11/29/23 06:43*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 3
Date Collected: 11/16/23 07:10
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-3
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	1.4		1.1	mg/L		11/25/23 19:51	11/29/23 06:59	1
C8-C10	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:59	1
C10-C28	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:59	1
C28-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 06:59	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*54*		*40 - 129*	*11/25/23 19:51*	*11/29/23 06:59*	*1*
o-Terphenyl	*29*		*66 - 139*	*11/25/23 19:51*	*11/29/23 06:59*	*1*

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12/5/2023

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 4
Date Collected: 11/16/23 07:00
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-4
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:15	1
C8-C10	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:15	1
C10-C28	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:15	1
C28-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:15	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*44*		*40 - 129*	*11/25/23 19:51*	*11/29/23 07:15*	*1*
o-Terphenyl	*27*		*66 - 139*	*11/25/23 19:51*	*11/29/23 07:15*	*1*

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Client Sample Results

Client: CL Environmental | Job ID: 400-247243-1
Project/Site: Grand Palladium Lucea

Client Sample ID: PA 5 | **Lab Sample ID: 400-247243-5**
Date Collected: 11/16/23 06:50 | **Matrix: Water**
Date Received: 11/24/23 09:02

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:32	1
C8-C10	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:32	1
C10-C28	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:32	1
C28-C40	ND		1.1	mg/L		11/25/23 19:51	11/29/23 07:32	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*45*		*40 - 129*	*11/25/23 19:51*	*11/29/23 07:32*	*1*
o-Terphenyl	*26*		*66 - 139*	*11/25/23 19:51*	*11/29/23 07:32*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 6
Date Collected: 11/16/23 06:40
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-6
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	3.7	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 07:48	1
C8-C10	ND	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 07:48	1
C10-C28	2.9	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 07:48	1
C28-C40	ND	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 07:48	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*46*		*40 - 129*	*11/25/23 19:51*	*11/29/23 07:48*	*1*
o-Terphenyl	*52*	*S1-*	*66 - 139*	*11/25/23 19:51*	*11/29/23 07:48*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 7
Date Collected: 11/16/23 06:25
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-7
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	1.5	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 08:04	1
C8-C10	ND	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 08:04	1
C10-C28	ND	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 08:04	1
C28-C40	ND	H H3	1.1	mg/L		11/25/23 19:51	11/29/23 08:04	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*49*		*40 - 129*	*11/25/23 19:51*	*11/29/23 08:04*	*1*
o-Terphenyl	*29*	*S1-*	*66 - 139*	*11/25/23 19:51*	*11/29/23 08:04*	*1*

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Lab Chronicle

Client: CL Environmental — Job ID: 400-247243-1
Project/Site: Grand Palladium Lucea

Client Sample ID: PA 1 — **Lab Sample ID: 400-247243-1**
Date Collected: 11/16/23 07:30 — Matrix: Water
Date Received: 11/24/23 09:02

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 06:27

Client Sample ID: PA 2 — **Lab Sample ID: 400-247243-2**
Date Collected: 11/16/23 07:20 — Matrix: Water
Date Received: 11/24/23 09:02

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 06:43

Client Sample ID: PA 3 — **Lab Sample ID: 400-247243-3**
Date Collected: 11/16/23 07:10 — Matrix: Water
Date Received: 11/24/23 09:02

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 06:59

Client Sample ID: PA 4 — **Lab Sample ID: 400-247243-4**
Date Collected: 11/16/23 07:00 — Matrix: Water
Date Received: 11/24/23 09:02

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 07:15

Client Sample ID: PA 5 — **Lab Sample ID: 400-247243-5**
Date Collected: 11/16/23 06:50 — Matrix: Water
Date Received: 11/24/23 09:02

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 07:32

Client Sample ID: PA 6 — **Lab Sample ID: 400-247243-6**
Date Collected: 11/16/23 06:40 — Matrix: Water
Date Received: 11/24/23 09:02

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 07:48

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Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Client Sample ID: PA 7
Date Collected: 11/16/23 06:25
Date Received: 11/24/23 09:02

Lab Sample ID: 400-247243-7
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			651643	JTC	EET PEN	11/25/23 19:51
Total/NA	Analysis	FL-PRO		1	651845	MP	EET PEN	11/29/23 08:04

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

Eurofins Pensacola

Accreditation/Certification Summary

Client: CL Environmental

Job ID: 400-247243-1

Project/Site: Grand Palladium Lucea

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3511	Water	C10-C28
FL-PRO	3511	Water	C28-C40
FL-PRO	3511	Water	C8-C10
FL-PRO	3511	Water	C8-C40

Method Summary

Client: CL Environmental
Project/Site: Grand Palladium Lucea

Job ID: 400-247243-1

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
3511	Microextraction of Organic Compounds	SW846	EET PEN

Protocol References:

FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Eurofins Pensacola
3355 McLemore Drive
Pensacola, FL 32514
Phone: 850-474-1001 Fax: 850-478-2671

Chain of Custody Record

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Client Information	Sampler: Alec Silvera	Lab PM: Swafford, Mark H	400-247243 COC	Carrier Tracking No(s):	COC No: 400-121057-41555.3
Client Contact: Matthew Lee	Phone: 876 897 0108	E-Mail: Mark.Swafford@et.eurofinsus.com		State of Origin:	Page: Page 3 of 5
Company: CL Environmental	PWSID:	Analysis Requested			Job #:
Address: 22 Fort George Heights Stony Hill,	Due Date Requested:				Preservation Codes:
City: Kingston 8	TAT Requested (days):				
State, Zip: JA,	Compliance Project: Δ Yes Δ No				
Phone: 954-966-2454(Tel)	PO #: Purchase Order not required				
Email: mlee@clenvironmental.com	WO #:				
Project Name: Grand Palladium	Project #: 40001189				
Site: Lucea	SSOW#:				Other:

Preservation Codes: A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Y - Trizma, Z - other (specify)

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	FL_PRO - FLPRO	6010D, 7471B	Total Number of containers	Special Instructions/Note:
			Preservation Code:		X	X	N	N		
PA 1	16/11/23	7:30am	G	Water			✓			
PA 2	"	7:20am	G	Water			✓			
PA 3	"	7:10am	G	Water			✓			
PA 4	"	7:00am	G	Water			✓			
PA 5	"	6:50am	G	Water			✓			
PA 6	"	6:40am	G	Water			✓			
PA 7	"	6:25am	G	Water			✓			
				Water						
				Water						
				Water						
				Water						

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment: Fedex		
Relinquished by: Alec Silvera	Date/Time: 22/11/23 10:30am	Company: CLE	Received by: Fedex	Date/Time: 22/11/23	Company: Fedex
Relinquished by:	Date/Time:	Company:	Received by: BP	Date/Time: 11/24/23 10:30am	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time: 902	Company:
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: 0.1°C IR8		

Ver: 06/08/2021

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12/5/2023

Login Sample Receipt Checklist

Client: CL Environmental

Job Number: 400-247243-1

Login Number: 247243
List Number: 1
Creator: Earnest, Tamantha

List Source: Eurofins Pensacola

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	0.1°C IR8
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	Refer to Job Narrative for details.
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-253122-1

Grand Palladium

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

INTERNATIONAL ANALYTICAL GROUP 1998 Excellence since 1998

791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

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1 2 3 4 5 6 7 8 9 10 11

ANALYTICAL REPORT

PREPARED FOR

Attn: Matthew Lee
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica
Generated 3/29/2024 5:09:48 PM

JOB DESCRIPTION

Grand Palladium

JOB NUMBER

400-253122-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

myEOL

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Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

Generated
3/29/2024 5:09:48 PM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Client: CL Environmental
Project/Site: Grand Palladium

Laboratory Job ID: 400-253122-1

Table of Contents

Definitions/Glossary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

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Case Narrative

Client: CL Environmental
Project: Grand Palladium

Job ID: 400-253122-1

Job ID: 400-253122-1 **Eurofins Pensacola**

Job Narrative
400-253122-1

Receipt
The samples were received on 3/22/2024 9:15 AM. Unless otherwise noted below, the samples arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 1.3° C.

GC Semi VOA
Method FL-PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: GP 1 (400-253122-1) and (LCSD 400-665565/3-A). These results have been reported and qualified.

Method FL-PRO: The continuing calibration verification (CCV) associated with batch 400-665767 recovered above the upper control limit for C8-C10. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The associated sample is impacted: (CCV 400-665767/15).

Method FL-PRO: The method blank for preparation batch 400-665565 contained C8-C40 and C10-C28 above the reporting limit (RL). None of the samples associated with this method blank contained the target compound; therefore, re-extraction and/or re-analysis of samples were not performed.

Method FL-PRO: Surrogate recovery for the following sample was outside the upper control limit: GP 4 (400-253122-4). This sample did not contain any target analytes; therefore, re-extraction and/or re-analysis was not performed.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-253122-1	GP 1	Water	03/20/24 10:05	03/22/24 09:15
400-253122-2	GP 2	Water	03/20/24 09:59	03/22/24 09:15
400-253122-3	GP 3	Water	03/20/24 09:55	03/22/24 09:15
400-253122-4	GP 4	Water	03/20/24 09:50	03/22/24 09:15
400-253122-5	GP 5	Water	03/20/24 09:40	03/22/24 09:15
400-253122-6	GP 6	Water	03/20/24 09:37	03/22/24 09:15
400-253122-7	GP 7	Water	03/20/24 09:21	03/22/24 09:15

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 1
Date Collected: 03/20/24 10:05
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-1
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:24	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:24	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:24	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:24	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*114*		*40 - 129*	*03/23/24 11:35*	*03/26/24 04:24*	*1*
o-Terphenyl	*203*		*66 - 139*	*03/23/24 11:35*	*03/26/24 04:24*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 2
Date Collected: 03/20/24 09:59
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-2
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:35	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:35	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:35	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:35	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*55*		*40 - 129*	*03/23/24 11:35*	*03/26/24 04:35*	*1*
o-Terphenyl	*100*		*66 - 139*	*03/23/24 11:35*	*03/26/24 04:35*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 3
Date Collected: 03/20/24 09:55
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-3
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:47	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:47	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:47	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:47	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*57*		*40 - 129*	*03/23/24 11:35*	*03/26/24 04:47*	*1*
o-Terphenyl	*99*		*66 - 139*	*03/23/24 11:35*	*03/26/24 04:47*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 4
Date Collected: 03/20/24 09:50
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-4
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:58	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:58	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:58	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 04:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*139*		*40 - 129*	*03/23/24 11:35*	*03/26/24 04:58*	*1*
o-Terphenyl	*214*		*66 - 139*	*03/23/24 11:35*	*03/26/24 04:58*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 5
Date Collected: 03/20/24 09:40
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-5
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:10	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:10	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:10	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:10	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*64*		*40 - 129*	*03/23/24 11:35*	*03/26/24 05:10*	*1*
o-Terphenyl	*119*		*66 - 139*	*03/23/24 11:35*	*03/26/24 05:10*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 6
Date Collected: 03/20/24 09:37
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-6
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:21	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:21	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:21	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:21	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*59*		*40 - 129*	*03/23/24 11:35*	*03/26/24 05:21*	*1*
o-Terphenyl	*101*		*66 - 139*	*03/23/24 11:35*	*03/26/24 05:21*	*1*

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 7
Date Collected: 03/20/24 09:21
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-7
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:33	1
C8-C10	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:33	1
C10-C28	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:33	1
C28-C40	ND		1.1	mg/L		03/23/24 11:35	03/26/24 05:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*46*		*40 - 129*	*03/23/24 11:35*	*03/26/24 05:33*	*1*
o-Terphenyl	*95*		*66 - 139*	*03/23/24 11:35*	*03/26/24 05:33*	*1*

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Eurofins Pensacola

Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 1 — **Lab Sample ID: 400-253122-1**
Date Collected: 03/20/24 10:05 — **Matrix: Water**
Date Received: 03/22/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 04:24

Client Sample ID: GP 2 — **Lab Sample ID: 400-253122-2**
Date Collected: 03/20/24 09:59 — **Matrix: Water**
Date Received: 03/22/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 04:35

Client Sample ID: GP 3 — **Lab Sample ID: 400-253122-3**
Date Collected: 03/20/24 09:55 — **Matrix: Water**
Date Received: 03/22/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 04:47

Client Sample ID: GP 4 — **Lab Sample ID: 400-253122-4**
Date Collected: 03/20/24 09:50 — **Matrix: Water**
Date Received: 03/22/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 04:58

Client Sample ID: GP 5 — **Lab Sample ID: 400-253122-5**
Date Collected: 03/20/24 09:40 — **Matrix: Water**
Date Received: 03/22/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 05:10

Client Sample ID: GP 6 — **Lab Sample ID: 400-253122-6**
Date Collected: 03/20/24 09:37 — **Matrix: Water**
Date Received: 03/22/24 09:15

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 05:21

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Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Client Sample ID: GP 7
Date Collected: 03/20/24 09:21
Date Received: 03/22/24 09:15

Lab Sample ID: 400-253122-7
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			665565	YC	EET PEN	03/23/24 11:35
Total/NA	Analysis	FL-PRO		1	665767	MP	EET PEN	03/26/24 05:33

Laboratory References:
EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

Eurofins Pensacola

Accreditation/Certification Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3511	Water	C10-C28
FL-PRO	3511	Water	C28-C40
FL-PRO	3511	Water	C8-C10
FL-PRO	3511	Water	C8-C40

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Method Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-253122-1

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
3511	Microextraction of Organic Compounds	SW846	EET PEN

Protocol References:

FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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Eurofins Pensacola

Eurofins Pensacola
3355 McLemore Drive
Pensacola, FL 32514
Phone: 850-474-1001 Fax: 850-478-2671

Chain of Custody Record

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400-253122 COC

Client Information	Sampler: Alec Silvera	Lab PM: Swafford, Mark H	COC No: 400-121057-41555.4
Client Contact: Matthew Lee	Phone: 876 897 0108	E-Mail: Mark.Swafford@et.eurofinsus.com	Page: Page 4 of 5
Company: CL Environmental	PWSID:		Job #:
Address: 22 Fort George Heights Stony Hill,	Due Date Requested:		
City: Kingston 8	TAT Requested (days):		
State, Zip: JA,	Compliance Project: Δ Yes Δ No		
Phone: 954-966-2454(Tel)	PO #: Purchase Order not required		
Email: mlee@clenvironmental.com	WO #:		
Project Name: Grand Palladium	Project #: 40001189		
Site: Lucea	SSOW#:		

Analysis Requested

Preservation Codes:
A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Y - Trizma, Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	FL_PRO - FLPRO	6010D, 7471B	Total Number of containers	Special Instructions/Note:
			Preservation Code:				N	N		
GP 1	20/8/24	10:05am	G	Water			✓			
GP 2	〃	9:59am	G	Water			✓			
GP 3	〃	9:55am	G	Water			✓			
GP 4	〃	9:50am	G	Water			✓			
GP 5	〃	9:40am	G	Water			✓			
GP 6	〃	9:37am	G	Water			✓			
GP 7	〃	9:21am	G	Water			✓			
				Water						
				Water						
				Solid						
				Solid						

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:		Method of Shipment:	
Relinquished by: Alec Silvera	Date/Time: 21/3/24 10:30am	Company: CLE	Received by: Fedex	Date/Time: 21/3/24	Company: Fedex
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by: BP	Date/Time: 3/22/24 915	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks: 1.3°C IR8		

Ver: 06/08/2021

Login Sample Receipt Checklist

Client: CL Environmental

Job Number: 400-253122-1

Login Number: 253122
List Number: 1
Creator: Roberts, Alexis J

List Source: Eurofins Pensacola

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	1.3°C IR8
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

IAG
INTERNATIONAL ANALYTICAL GROUP

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-256928-1

Grand Palladium

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

INTERNATIONAL ANALYTICAL GROUP
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Excellence since 1998

791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

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1 2 3 4 5 6 7 8 9 10 11

ANALYTICAL REPORT

PREPARED FOR

Attn: Carlton Campbell
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica

Generated 6/6/2024 4:18:38 PM

JOB DESCRIPTION

Grand Palladium

JOB NUMBER

400-256928-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

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Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

Generated
6/6/2024 4:18:38 PM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Client: CL Environmental
Project/Site: Grand Palladium

Laboratory Job ID: 400-256928-1

Table of Contents

Definitions/Glossary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

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Case Narrative

Client: CL Environmental
Project: Grand Palladium

Job ID: 400-256928-1

Job ID: 400-256928-1 **Eurofins Pensacola**

Job Narrative
400-256928-1

Receipt
The samples were received on 5/30/2024 9:59 AM. The temperature of the cooler at receipt was 21.0° C.

Receipt Exceptions

A trip blank was submitted for analysis with these samples; however, it was not listed on the Chain of Custody (COC). It was discarded.

GC Semi VOA
Method FL-PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following sample contained an allowable number of surrogate compounds outside limits: (LCS 400-673676/2-A). These results have been reported and qualified.

Method FL-PRO: The following samples were received outside of holding time: GP 1 (400-256928-1), GP 2 (400-256928-2), GP 3 (400-256928-3), GP 4 (400-256928-4), GP 5 (400-256928-5), GP 6 (400-256928-6) and GP 7 (400-256928-7).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Organic Prep
Method 3511: The following samples were received outside of holding time: GP 1 (400-256928-1), GP 2 (400-256928-2), GP 3 (400-256928-3), GP 4 (400-256928-4), GP 5 (400-256928-5), GP 6 (400-256928-6) and GP 7 (400-256928-7).

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

Sample Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-256928-1	GP 1	Water	05/22/24 10:30	05/30/24 09:59
400-256928-2	GP 2	Water	05/22/24 10:20	05/30/24 09:59
400-256928-3	GP 3	Water	05/22/24 10:00	05/30/24 09:59
400-256928-4	GP 4	Water	05/22/24 09:50	05/30/24 09:59
400-256928-5	GP 5	Water	05/22/24 09:40	05/30/24 09:59
400-256928-6	GP 6	Water	05/22/24 09:30	05/30/24 09:59
400-256928-7	GP 7	Water	05/22/24 09:00	05/30/24 09:59

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 1
Date Collected: 05/22/24 10:30
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-1
Matrix: Water

6

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		06/04/24 16:06	06/05/24 18:53	1
C8-C10	ND		1.0	mg/L		06/04/24 16:06	06/05/24 18:53	1
C10-C28	ND		1.0	mg/L		06/04/24 16:06	06/05/24 18:53	1
C28-C40	ND		1.0	mg/L		06/04/24 16:06	06/05/24 18:53	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*92*		*40 - 129*	*06/04/24 16:06*	*06/05/24 18:53*	*1*
o-Terphenyl	*86*		*66 - 139*	*06/04/24 16:06*	*06/05/24 18:53*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 2
Date Collected: 05/22/24 10:20
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-2
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:05	1
C8-C10	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:05	1
C10-C28	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:05	1
C28-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*72*		*40 - 129*	*06/04/24 16:06*	*06/05/24 19:05*	*1*
o-Terphenyl	*70*		*66 - 139*	*06/04/24 16:06*	*06/05/24 19:05*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 3
Date Collected: 05/22/24 10:00
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-3
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:16	1
C8-C10	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:16	1
C10-C28	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:16	1
C28-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:16	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*69*		*40 - 129*	*06/04/24 16:06*	*06/05/24 19:16*	*1*
o-Terphenyl	*66*		*66 - 139*	*06/04/24 16:06*	*06/05/24 19:16*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 4
Date Collected: 05/22/24 09:50
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-4
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:28	1
C8-C10	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:28	1
C10-C28	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:28	1
C28-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:28	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*77*		*40 - 129*	*06/04/24 16:06*	*06/05/24 19:28*	*1*
o-Terphenyl	*74*		*66 - 139*	*06/04/24 16:06*	*06/05/24 19:28*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 5
Date Collected: 05/22/24 09:40
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-5
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:39	1
C8-C10	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:39	1
C10-C28	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:39	1
C28-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*73*		*40 - 129*	*06/04/24 16:06*	*06/05/24 19:39*	*1*
o-Terphenyl	*67*		*66 - 139*	*06/04/24 16:06*	*06/05/24 19:39*	*1*

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 6
Date Collected: 05/22/24 09:30
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-6
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:51	1
C8-C10	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:51	1
C10-C28	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:51	1
C28-C40	ND		1.1	mg/L		06/04/24 16:06	06/05/24 19:51	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*84*		*40 - 129*	*06/04/24 16:06*	*06/05/24 19:51*	*1*
o-Terphenyl	*78*		*66 - 139*	*06/04/24 16:06*	*06/05/24 19:51*	*1*

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Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 7
Date Collected: 05/22/24 09:00
Date Received: 05/30/24 09:59

Lab Sample ID: 400-256928-7
Matrix: Water

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		1.0	mg/L		06/04/24 16:06	06/05/24 20:02	1
C8-C10	ND		1.0	mg/L		06/04/24 16:06	06/05/24 20:02	1
C10-C28	ND		1.0	mg/L		06/04/24 16:06	06/05/24 20:02	1
C28-C40	ND		1.0	mg/L		06/04/24 16:06	06/05/24 20:02	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
n-C39	*81*		*40 - 129*	*06/04/24 16:06*	*06/05/24 20:02*	*1*
o-Terphenyl	*72*		*66 - 139*	*06/04/24 16:06*	*06/05/24 20:02*	*1*

Eurofins Pensacola

Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Client Sample ID: GP 1 — **Lab Sample ID: 400-256928-1**
Date Collected: 05/22/24 10:30 — **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 18:53

Client Sample ID: GP 2 — **Lab Sample ID: 400-256928-2**
Date Collected: 05/22/24 10:20 — **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 19:05

Client Sample ID: GP 3 — **Lab Sample ID: 400-256928-3**
Date Collected: 05/22/24 10:00 — **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 19:16

Client Sample ID: GP 4 — **Lab Sample ID: 400-256928-4**
Date Collected: 05/22/24 09:50 — **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 19:28

Client Sample ID: GP 5 — **Lab Sample ID: 400-256928-5**
Date Collected: 05/22/24 09:40 — **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 19:39

Client Sample ID: GP 6 — **Lab Sample ID: 400-256928-6**
Date Collected: 05/22/24 09:30 — **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 19:51

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Lab Chronicle

Client: CL Environmental | Job ID: 400-256928-1
Project/Site: Grand Palladium

Client Sample ID: GP 7 | **Lab Sample ID: 400-256928-7**
Date Collected: 05/22/24 09:00 | **Matrix: Water**
Date Received: 05/30/24 09:59

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3511			673676	BKL	EET PEN	06/04/24 16:06
Total/NA	Analysis	FL-PRO		1	673822	MP	EET PEN	06/05/24 20:02

Laboratory References:
EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

Accreditation/Certification Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-256928-1

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3511	Water	C10-C28
FL-PRO	3511	Water	C28-C40
FL-PRO	3511	Water	C8-C10
FL-PRO	3511	Water	C8-C40

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6/6/2024

Method Summary

Client: CL Environmental | Job ID: 400-256928-1
Project/Site: Grand Palladium

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
3511	Microextraction of Organic Compounds	SW846	EET PEN

Protocol References:

FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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6/6/2024

Eurofins Pensacola
3355 McLemore Drive
Pensacola, FL 32514-7045
phone 850.474.1001 fax 850.474.4789

Chain of Custody Record

256923

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	
Your Company Name here	CLE
Address	20 Windsor Av. Kingston 5
City/State/Zip	Kingston
(xxx) xxx-xxxx Phone	876 897 0108
(xxx) xxx-xxxx FAX	
Project Name:	Grand Palladium
Site:	Lucea
P O #	

Project Manager: Carlton Campbell
Email: asilvera@clenvironmental.com
Tel/Fax:

Site Contact:
Lab Contact:
Date: 27/5/24
Carrier: Fedex

Analysis Turnaround Time

☐ CALENDAR DAYS ☐ WORKING DAYS

TAT if different from Below

- ☑ 2 weeks
- ☐ 1 week
- ☐ 2 days
- ☐ 1 day

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS/MSD (Y/N)	FL-PRO
GP 1	22/5/24	10:30am	G	W	2			✓
GP 2	"	10:20am	G	W	2			✓
GP 3	"	10:00am	G	W	2			✓
GP 4	"	9:50am	G	W	2			✓
GP 5	"	9:40am	G	W	2			✓
GP 6	"	9:30am	G	W	2			✓
GP 7	"	9:00am	G	W	2			✓

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are

☐ Return to Client ☐ Disposal by Lab ☐ Arc

Special Instructions/QC Requirements & Comments:

21.0°C IR

Custody Seals Intact: ☐ Yes ☐ No Custody Seal No.:

Login Sample Receipt Checklist

Client: CL Environmental

Job Number: 400-256928-1

Login Number: 256928
List Number: 1
Creator: Earnest, Tamantha

List Source: Eurofins Pensacola

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	21.0°C IR10
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	False	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Appendix 9 – Sediment Chemistry Results

INTERNATIONAL ANALYTICAL GROUP

REVIEW OF ANALYTICAL REPORT

JOB NUMBER: 400-243986-1

Grand Palladium

International Analytical Group, Inc. (IAG) has conducted an independent, third party review of the above referenced analytical report. The samples were analyzed by Eurofins Testamerica Pensacola, a NELAC certified laboratory in Pensacola, Florida.

If you have any questions regarding this analytical report, please contact Marino Fernandez at marino@iagenvironmental.com

791 SKIVIEW ROAD, SEVEN DEVILS, NC 28604

eurofins | Environment Testing

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ANALYTICAL REPORT

PREPARED FOR

Attn: Matthew Lee
CL Environmental
22 Fort George Heights
Stony Hill,
Kingston 8, Jamaica
Generated 10/5/2023 9:38:18 PM

JOB DESCRIPTION

Grand Palladium

JOB NUMBER

400-243986-1

Eurofins Pensacola
3355 McLemore Drive
Pensacola FL 32514

See page two for job notes and contact information.

myEOL

Eurofins Pensacola

Job Notes

This report may not be reproduced except in full, and with written approval from the laboratory. The results relate only to the samples tested. For questions please contact the Project Manager at the e-mail address or telephone number listed on this page.

The test results in this report relate only to the samples as received by the laboratory and will meet all requirements of the methodology, with any exceptions noted. This report shall not be reproduced except in full, without the express written approval of the laboratory. All questions should be directed to the Eurofins Environment Testing Southeast, LLC Project Manager.

Authorization

Mark Swafford

Generated
10/5/2023 9:38:18 PM

Authorized for release by
Mark Swafford, Project Manager II
Mark.Swafford@et.eurofinsus.com
(850)471-6207

Client: CL Environmental
Project/Site: Grand Palladium

Laboratory Job ID: 400-243986-1

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Table of Contents

Definitions/Glossary

Client: CL Environmental

Project/Site: Grand Palladium

Job ID: 400-243986-1

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

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10/5/2023

Case Narrative

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Job ID: 400-243986-1

Laboratory: Eurofins Pensacola

Narrative

Job Narrative
400-243986-1

Analytical test results meet all requirements of the associated regulatory program listed on the Accreditation/Certification Summary Page unless otherwise noted under the individual analysis. Data qualifiers are applied to indicate exceptions. Noncompliant quality control (QC) is further explained in narrative comments.

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD may be performed, unless otherwise specified in the method.
Surrogate and/or isotope dilution analyte recoveries (if applicable) which are outside of the QC window are confirmed unless attributed to a dilution or otherwise noted in the narrative.

Regulated compliance samples (e.g. SDWA, NPDES) must comply with the associated agency requirements/permits.

Receipt
The samples were received on 9/25/2023 9:20 AM. Unless otherwise noted below, the samples arrived in good condition, and, where required, properly preserved and on ice. The temperature of the cooler at receipt time was 12.3°C

GC Semi VOA
Method FL_PRO: Two surrogates are used for this analysis. The laboratory's SOP allows one of these surrogates to be outside acceptance criteria without performing re-extraction/re-analysis. The following samples contained an allowable number of surrogate compounds outside limits: (LCS 400-642768/2-A) and (MB 400-642768/1-A). These results have been reported and qualified.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Metals
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

General Chemistry
No additional analytical or quality issues were noted, other than those described above or in the Definitions/ Glossary page.

Sample Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-243986-1	GPSS 1	Solid	09/12/23 14:06	09/25/23 09:20
400-243986-2	GPSS2	Solid	09/12/23 14:45	09/25/23 09:20
400-243986-3	GPSS3	Solid	09/12/23 14:52	09/25/23 09:20
400-243986-4	GPSS4	Solid	09/12/23 14:57	09/25/23 09:20

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Client Sample ID: GPSS 1
Date Collected: 09/12/23 14:06
Date Received: 09/25/23 09:20

Lab Sample ID: 400-243986-1
Matrix: Solid
Percent Solids: 68.1

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		29	mg/Kg	☼	09/26/23 13:35	09/28/23 09:07	1
C8-C10	ND		29	mg/Kg	☼	09/26/23 13:35	09/28/23 09:07	1
C10-C28	ND		29	mg/Kg	☼	09/26/23 13:35	09/28/23 09:07	1
C28-C40	ND		29	mg/Kg	☼	09/26/23 13:35	09/28/23 09:07	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*93*		*36 - 132*	*09/26/23 13:35*	*09/28/23 09:07*	*1*
o-Terphenyl	*94*		*66 - 136*	*09/26/23 13:35*	*09/28/23 09:07*	*1*

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	5.0		1.4	mg/Kg	☼	10/03/23 12:47	10/04/23 13:24	1
Cadmium	ND		0.70	mg/Kg	☼	10/03/23 12:47	10/04/23 13:24	1
Lead	2.9		1.4	mg/Kg	☼	10/03/23 12:47	10/04/23 13:24	1

Method: SW846 7471B - Mercury (CVAA)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.023		0.022	mg/Kg	☼	09/27/23 09:09	09/27/23 15:22	1

General Chemistry

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture (EPA Moisture)	31.9		0.01	%			09/29/23 14:33	1

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Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Client Sample ID: GPSS2
Date Collected: 09/12/23 14:45
Date Received: 09/25/23 09:20

Lab Sample ID: 400-243986-2
Matrix: Solid
Percent Solids: 70.3

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Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	29		27	mg/Kg	☼	09/26/23 13:35	09/28/23 09:23	1
C8-C10	ND		27	mg/Kg	☼	09/26/23 13:35	09/28/23 09:23	1
C10-C28	ND		27	mg/Kg	☼	09/26/23 13:35	09/28/23 09:23	1
C28-C40	ND		27	mg/Kg	☼	09/26/23 13:35	09/28/23 09:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*95*		*36 - 132*	*09/26/23 13:35*	*09/28/23 09:23*	*1*
o-Terphenyl	*96*		*66 - 136*	*09/26/23 13:35*	*09/28/23 09:23*	*1*

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	6.8		1.4	mg/Kg	☼	10/03/23 12:47	10/04/23 13:28	1
Cadmium	ND		0.68	mg/Kg	☼	10/03/23 12:47	10/04/23 13:28	1
Lead	3.2		1.4	mg/Kg	☼	10/03/23 12:47	10/04/23 13:28	1

Method: SW846 7471B - Mercury (CVAA)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.022	mg/Kg	☼	09/27/23 09:09	09/27/23 15:23	1

General Chemistry

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture (EPA Moisture)	29.7		0.01	%			09/29/23 14:33	1

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Client Sample ID: GPSS3
Date Collected: 09/12/23 14:52
Date Received: 09/25/23 09:20

Lab Sample ID: 400-243986-3
Matrix: Solid
Percent Solids: 49.8

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		61	mg/Kg	☼	09/26/23 13:35	09/28/23 12:33	1
C8-C10	ND		61	mg/Kg	☼	09/26/23 13:35	09/28/23 12:33	1
C10-C28	ND		61	mg/Kg	☼	09/26/23 13:35	09/28/23 12:33	1
C28-C40	ND		61	mg/Kg	☼	09/26/23 13:35	09/28/23 12:33	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*94*		*36 - 132*	*09/26/23 13:35*	*09/28/23 12:33*	*1*
o-Terphenyl	*101*		*66 - 136*	*09/26/23 13:35*	*09/28/23 12:33*	*1*

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	7.6		1.9	mg/Kg	☼	10/03/23 12:47	10/04/23 13:32	1
Cadmium	ND		0.97	mg/Kg	☼	10/03/23 12:47	10/04/23 13:32	1
Lead	4.9		1.9	mg/Kg	☼	10/03/23 12:47	10/04/23 13:32	1

Method: SW846 7471B - Mercury (CVAA)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	0.031		0.031	mg/Kg	☼	09/27/23 09:09	09/27/23 15:24	1

General Chemistry

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture (EPA Moisture)	50.2		0.01	%			09/29/23 14:33	1

Eurofins Pensacola

Client Sample Results

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Client Sample ID: GPSS4
Date Collected: 09/12/23 14:57
Date Received: 09/25/23 09:20

Lab Sample ID: 400-243986-4
Matrix: Solid
Percent Solids: 49.1

Method: FL-DEP FL-PRO - Florida - Petroleum Range Organics (GC)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
C8-C40	ND		41	mg/Kg	☼	09/26/23 13:35	09/28/23 09:40	1
C8-C10	ND		41	mg/Kg	☼	09/26/23 13:35	09/28/23 09:40	1
C10-C28	ND		41	mg/Kg	☼	09/26/23 13:35	09/28/23 09:40	1
C28-C40	ND		41	mg/Kg	☼	09/26/23 13:35	09/28/23 09:40	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
n-C39	*84*		*36 - 132*	*09/26/23 13:35*	*09/28/23 09:40*	*1*
o-Terphenyl	*96*		*66 - 136*	*09/26/23 13:35*	*09/28/23 09:40*	*1*

Method: SW846 6010D - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	7.1		1.9	mg/Kg	☼	10/03/23 12:47	10/04/23 13:36	1
Cadmium	ND		0.95	mg/Kg	☼	10/03/23 12:47	10/04/23 13:36	1
Lead	3.7		1.9	mg/Kg	☼	10/03/23 12:47	10/04/23 13:36	1

Method: SW846 7471B - Mercury (CVAA)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	ND		0.030	mg/Kg	☼	09/27/23 09:09	09/27/23 15:25	1

General Chemistry

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Moisture (EPA Moisture)	50.9		0.01	%			09/29/23 14:33	1

Eurofins Pensacola

Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Client Sample ID: GPSS 1 — **Lab Sample ID: 400-243986-1**
Date Collected: 09/12/23 14:06 — Matrix: Solid
Date Received: 09/25/23 09:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	643491	TMP	EET PEN	09/29/23 14:33

Client Sample ID: GPSS 1 — **Lab Sample ID: 400-243986-1**
Date Collected: 09/12/23 14:06 — Matrix: Solid
Date Received: 09/25/23 09:20 — Percent Solids: 68.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3546			642768	LH	EET PEN	09/26/23 13:35
Total/NA	Analysis	FL-PRO		1	643074	MP	EET PEN	09/28/23 09:07
Total/NA	Prep	3050B			643876	KWN	EET PEN	10/03/23 12:47 - 10/03/23 15:58 ¹
Total/NA	Analysis	6010D		1	644168	LSS	EET PEN	10/04/23 13:24
Total/NA	Prep	7471B			642901	JR	EET PEN	09/27/23 09:09 - 09/27/23 11:49 ¹
Total/NA	Analysis	7471B		1	643003	NET	EET PEN	09/27/23 15:22

Client Sample ID: GPSS2 — **Lab Sample ID: 400-243986-2**
Date Collected: 09/12/23 14:45 — Matrix: Solid
Date Received: 09/25/23 09:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	643491	TMP	EET PEN	09/29/23 14:33

Client Sample ID: GPSS2 — **Lab Sample ID: 400-243986-2**
Date Collected: 09/12/23 14:45 — Matrix: Solid
Date Received: 09/25/23 09:20 — Percent Solids: 70.3

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3546			642768	LH	EET PEN	09/26/23 13:35
Total/NA	Analysis	FL-PRO		1	643074	MP	EET PEN	09/28/23 09:23
Total/NA	Prep	3050B			643876	KWN	EET PEN	10/03/23 12:47 - 10/03/23 15:58 ¹
Total/NA	Analysis	6010D		1	644168	LSS	EET PEN	10/04/23 13:28
Total/NA	Prep	7471B			642901	JR	EET PEN	09/27/23 09:09 - 09/27/23 11:49 ¹
Total/NA	Analysis	7471B		1	643003	NET	EET PEN	09/27/23 15:23

Client Sample ID: GPSS3 — **Lab Sample ID: 400-243986-3**
Date Collected: 09/12/23 14:52 — Matrix: Solid
Date Received: 09/25/23 09:20

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	643491	TMP	EET PEN	09/29/23 14:33

Eurofins Pensacola

Lab Chronicle

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Client Sample ID: GPSS3

Lab Sample ID: 400-243986-3

Date Collected: 09/12/23 14:52
Date Received: 09/25/23 09:20

Matrix: Solid
Percent Solids: 49.8

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3546			642768	LH	EET PEN	09/26/23 13:35
Total/NA	Analysis	FL-PRO		1	643074	MP	EET PEN	09/28/23 12:33
Total/NA	Prep	3050B			643876	KWN	EET PEN	10/03/23 12:47 - 10/03/23 15:58 [1]
Total/NA	Analysis	6010D		1	644168	LSS	EET PEN	10/04/23 13:32
Total/NA	Prep	7471B			642901	JR	EET PEN	09/27/23 09:09 - 09/27/23 11:49 [1]
Total/NA	Analysis	7471B		1	643003	NET	EET PEN	09/27/23 15:24

Client Sample ID: GPSS4

Lab Sample ID: 400-243986-4

Date Collected: 09/12/23 14:57
Date Received: 09/25/23 09:20

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Analysis	Moisture		1	643491	TMP	EET PEN	09/29/23 14:33

Client Sample ID: GPSS4

Lab Sample ID: 400-243986-4

Date Collected: 09/12/23 14:57
Date Received: 09/25/23 09:20

Matrix: Solid
Percent Solids: 49.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Analyst	Lab	Prepared or Analyzed
Total/NA	Prep	3546			642768	LH	EET PEN	09/26/23 13:35
Total/NA	Analysis	FL-PRO		1	643074	MP	EET PEN	09/28/23 09:40
Total/NA	Prep	3050B			643876	KWN	EET PEN	10/03/23 12:47 - 10/03/23 15:58 [1]
Total/NA	Analysis	6010D		1	644168	LSS	EET PEN	10/04/23 13:36
Total/NA	Prep	7471B			642901	JR	EET PEN	09/27/23 09:09 - 09/27/23 11:49 [1]
Total/NA	Analysis	7471B		1	643003	NET	EET PEN	09/27/23 15:25

[1] This procedure uses a method stipulated length of time for the process. Both start and end times are displayed.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

Eurofins Pensacola

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Accreditation/Certification Summary

Client: CL Environmental

Project/Site: Grand Palladium

Job ID: 400-243986-1

Laboratory: Eurofins Pensacola

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	Identification Number	Expiration Date
ANAB	ISO/IEC 17025	L2471	02-22-26

The following analytes are included in this report, but the laboratory is not certified by the governing authority. This list may include analytes for which the agency does not offer certification.

Analysis Method	Prep Method	Matrix	Analyte
FL-PRO	3546	Solid	C10-C28
FL-PRO	3546	Solid	C28-C40
FL-PRO	3546	Solid	C8-C10
FL-PRO	3546	Solid	C8-C40
Moisture		Solid	Percent Moisture

Method Summary

Client: CL Environmental
Project/Site: Grand Palladium

Job ID: 400-243986-1

Method	Method Description	Protocol	Laboratory
FL-PRO	Florida - Petroleum Range Organics (GC)	FL-DEP	EET PEN
6010D	Metals (ICP)	SW846	EET PEN
7471B	Mercury (CVAA)	SW846	EET PEN
Moisture	Percent Moisture	EPA	EET PEN
3050B	Preparation, Metals	SW846	EET PEN
3546	Microwave Extraction	SW846	EET PEN
7471B	Preparation, Mercury	SW846	EET PEN

Protocol References:

EPA = US Environmental Protection Agency
FL-DEP = State Of Florida Department Of Environmental Protection, Florida Administrative Code.
SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

EET PEN = Eurofins Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

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3355 McLemore Drive
Pensacola, FL 32514
Phone: 850-474-1001 Fax: 850-478-2671

Chain of Custody Record

eurofins | Environment Testing

Client Information	Sampler: Alia Silva	Lab PM: Dwafford, Mark H	COC No: 400-121057-41555.5
Client Contact: Matthew Lee	Phone: 876 897 0108	E-Mail: Mark.Swafford@et.eurofinsus.com	Page: Page 5 of 5
Company: CL Environmental	PWSID:	Analysis Requested	Job #:
Address: 22 Fort George Heights, Stony Hill	Due Date Requested:		Preservation Codes:
City: Kingston 9	TAT Requested (days):		
State, Zip: JA	Compliance Project: Δ Yes Δ No		
Phone: 924-986-2(454(Tel)	PO #: Purchase Order not required		
Email: mlee@clenvironmental.com	WO #:		
Project Name: Grand Palladium	Project #: 40001159		
Site: Lucea	SSOW#:		

Analysis Requested: Arsenic, Cadmium, Mercury, Lead

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix	Analyses	Special Instructions/Note
GPSS 1	12/9/23	2:06pm	G	Solid	✓ ✓✓	
GPSS 2	"	2:45pm	G	Solid	✓ ✓✓	
GPSS 3	"	2:52pm	G	Solid	✓ ✓✓	
GPSS 4	"	2:57pm	G	Solid	✓ ✓✓	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ___ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:		
Relinquished by: Alia Silva	Date/Time: 21/9/23	Company: CLE	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

400-243986 COC

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Login Sample Receipt Checklist

Client: CL Environmental

Job Number: 400-243986-1

Login Number: 243986
List Number: 1
Creator: Earnest, Tamantha

List Source: Eurofins Pensacola

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	N/A	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	12.3°C IR10
COC is present.	False	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Appendix 10 – Survey Questionnaires

Community Questionnaire

PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER

COMMUNITY QUESTIONNAIRE

DATE:________________________ **INTERVIEWER:**____

Purpose and Objectives

CL Environmental Co. Ltd. is conducting a community survey as part of the Environmental Impact Assessment (EIA) for the Proposed Phase 2 Expansion Of Grand Palladium & Lady Hamilton Resort & Spa, Lucea, Hanover, in compliance with the requirements set out by the National Environment & Planning Agency (NEPA). The responses will provide insight into the community and gather opinions and concerns of residents regarding the proposed project.

Participation and Data Protection

Participation is voluntary and respondents are free to decline or withdraw at any time without consequence. Information provided will aid in assessing potential impacts and ensure that community perspectives are thoroughly considered throughout the EIA process. All responses will be treated confidentially and utilized solely for the EIA.

Project Synopsis

Fiesta Jamaica Ltd. commenced the construction of The Grand Palladium Jamaica & Lady Hamilton Resort & Spa in 2007 and now intends to undertake the Phase 2 expansion of the existing hotel. This expansion project aims to add 948 rooms over approximately 83.78 acres of land.

- New rooms will be distributed across two hotels:
  - Grand Palladium: Comprising eight buildings with 475 rooms, standing at six storeys high. There will also be one-story two- and three-bedroom villas with swim-up pools.
  - TRS Hotel: Exclusively for adults, consisting of nine buildings with 473 rooms, also standing at six storeys high. It will also include two-bedroom single-storey villas and a swim-up pool.
- Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre.
- Sixteen (16) overwater bungalows are proposed.
- Creation of two (2) beaches, one at the southern overwater bungalows area and the other in the TRS area, exclusively for guest enjoyment.
- A new industrial area will be constructed, connected to Phase 2 by a new tunnel under the main road. A new service access point from the main road to the industrial area will be established.
- The current entrance to Phase 1 of the existing hotel will remain operational.

COHORT DESCRIPTION

1. What is the name of this/your community? ____
2. Gender (i) male (ii) female (iii) do not wish to disclose
3. Age group (i) 18- 24 yrs (ii) 25 - 34 yrs (iii) 35 – 44 yrs (iv) 45 – 54 yrs (v) 55 - 64 yrs (vi) older than 65 yrs
4. Are you the head of your household (i) yes (ii) no
5. What is your current employment status? (i) self-employed (ii) employed full time (iii) employed part-time (iv) unemployed (v) retired (vi) other
6. Including yourself, how many people live in your household? ____ (i) # adults ____ (ii) # children under 18 yrs ___
7. How long have you lived in your community? (i) < 1 yr (ii) 1-5 yrs (iii) 5- 10 yrs (iv)10-15 yrs (v) >15 yrs
8. What is your average weekly income? (i) no income (ii) under $13,000 per week (iii) $13,000 per week (iv) $13,001 - $16,000 per week (v) $16,001 - $20,000 per week (vi) over $20,000 per week (vii) do not wish to disclose
9. What was the last school you attended? (i) None (ii) Primary/All Age (iii) High School (iv) College (v) University (vi) HEART/Vocational training institute (vii) Other
10. Is there anyone in your household attending school at this time? (i) yes (ii) no
    If yes, what school(s) do they attend (i) infant/basic (ii) primary/all age (iii) high school (iv) college (v) university (vi) HEART/ Vocational Training Institute (vii) home schooled
11. Are there any recreational centres/spaces in your community? (i) yes (ii) no (iii) not sure
    a. **If yes,** please give name and type ____
    b. **If yes,** is this facility accessible to all age groups and persons with special needs (i) yes (ii) no (iii) not sure
    c. **If yes,** is this facility maintained and in "good condition"? (i) yes (ii) no (iii) not sure

PERCEPTION

12. Before this interview, had you ever heard of a company called Fiesta Jamaica Limited? (i) yes (ii) no
13. Before this interview, did you know that Fiesta Jamaica Limited is proposing to start Phase 2 of its hotel in the Lucea area of Hanover? (i) yes (ii) no

    If yes:
    a. How were you made aware? (i) newspaper (ii) television (iii) radio (iv) community meeting (v) word of mouth
    b. (vi) social media (vii) other__________
    c. Are you aware of the details? (i) yes (ii) no

If yes, please answer the following to assess awareness of details:	Yes	No
Were you aware that this development would include 16 overwater suites/villas		
Were you aware that this development would include seventeen buildings comprising 948 rooms in total		
Were you aware that this development would include modifying a section of existing beach		

14. Have there been any problems with the existing hotel? (i) yes (ii) no (iii) don't know
    a. **If yes** what were/are the issues
    b. **If yes** have these issues been resolved? (i) yes (ii) no (iii) don't know
15. Have there been any problems/issues (environmental, social, or other) on the proposed project site in the Lucea area? (i) yes (ii) no (iii) don't know
    a. **If yes** what were/are the issues
16. Do you have any general concerns about the project as proposed? (i) yes (ii) no (iii) not sure/don't know
    a. **If yes**, what are they?
    b. **f yes**, what would you suggest to address/resolve your concern(s)?
17. Do you have any specific concern(s) relating to a section of the beach being modified? (i) yes; (ii) no (iii) not sure/don't know
    a. **If yes**, what are they?
    b. **If yes**, what would you suggest to address/resolve your concern(s)?
18. Do you know what an overwater suite/villa is? (i) yes (ii) no
    (**If no, explain that these are rooms built on piles over the sea**)
19. Do you have any specific concern(s) relating to over water suites/villas ? (i) yes (ii) no (iii) not sure/don't know
    a. **If yes**, what are they?
    b. **If yes**, what would you suggest to address/resolve your concern(s)?
20. Do you use the proposed site for any type of activity? (i) yes (ii) no
    If yes, please answer the following:

	Yes	No	If yes, for what purpose
Land			
Beach			
Sea			

21. Do you think this project will affect your life/livelihood? (i) positively (ii) negatively (iii) not at all (iv) not sure/don't know
    a. **If positive,** how so? __________
    b. **If negative,** how so?__________
    c. **If negative,** how do you think your issue could be resolved?

22. Do you think this project will affect your community (i) positively or (ii) negatively? (iii) not at all (iv) not sure/don't know
    a. **If positive,** how so? ____________________
    b. **If negative,** how so?____________________
    c. **If negative,** how do you think your issue could be resolved?
    ____
    ____

23. Do you think this project will affect the environment (i) positively or (ii) negatively? (iii) not at all (iv) not sure
    a. **If positive,** how so? ____________________
    b. **If negative,** how so?____________________
    c. **If negative,** how do you think your issue could be resolved?
    ____
    ____

HOUSING, HEALTH AND SOCIAL SERVICES

24. What is the ownership status of the house you live in? (i) Own (ii) Lease (iii) Rent (iv) Government Own (v) Squat (vi) Family own (vii) Other, please specify ____________________

25. What is the ownership status of the land on which your house is located? (i) Own (ii) Lease (iii) Squat on (iv) Family Owned (v) Government Owned (vi) Other, please specify ____________________

26. What type of construction material is your residence made from?
    a. **Walls:** (i) Concrete and blocks (ii) Wood/Board (iii) Zinc (iv) Other specify____________________
    b. **Roof:** (i) Metal sheeting (zinc) (ii) Concrete (iii) Wood (iv) Other specify____________________

27. What type of toilet facility do you have? (i) Water Closet (ii) Pit Latrine (iii) None (iv) Other, specify ____________

28. What does your household use for lighting? (i) Electricity (ii) Kerosene oil (iii) Gas (iv) Solar (v) Other, specify ____________________

29. What (type of fuel does the household) do you **use most** for cooking? (i) Gas (ii) Electricity (iii)Wood (iv) Coal (v) Other, specify ____________________

30. What is the main source of household domestic water supply? (i) Public piped water into dwelling (ii) Community Tank (iii) Government Water Trucks (free) (iv)Public Standpipe (vi). Private Water Trucks (paid) (vi) Spring or River (vii) Rainwater harvesting (ix) Other, please specify____________________

31. Do you have any problems with domestic/household water supply (i) yes (ii) no
    If yes, what is the problem? (i) no water at all (ii) no pipes run to the area (iii) irregular water supply (iv) low water pressure (v) other, please specify ____________________

32. What type of telephone service do you use (i) fixed/land line (ii) mobile/cellular telephone (iii) none (iv) other, please specify ____________________

33. Does your community have fixed line (residential) telephone (land line) service? (i) yes (ii) no (iii) don't know

34. What is the main method of garbage disposal for your household? (i) Public Garbage Truck (ii) Private Collection (iii) Burn (iv) Other, please specify ____________________

35. Do you recycle? (i) yes (ii) no
    If yes, what recycling programme do you use? (**write name & location**) ____________________

36. A times when you are sick, where do you mainly seek health care (**write in name & location**)?
    (i) Public Clinic/Community Health Centre____________________
    (ii) Public Hospital ____________________ (iii) Private Doctor ____________________
    (iv) Private Hospital____________________

NATURAL HAZARDS & SOCIAL AMENITIES

37. Are there frequent flooding problems in your community? (i) yes (ii) no (iii) don't know
    a. **If yes,** when does flooding occur (i) each time it rains (ii) only times of heavy rains (iii) during hurricanes (iv) not sure
    b. **If yes,** how often does flooding occur? (i) once weekly (ii) once monthly (iii) once in three months (iv) once in six months (v) once in a year (vi) less than once in a year (vi) not sure
    c. **If yes** where are the affected areas? ____________________
    d. **If yes** how high does the water level rise? (i) less than 1 foot (ii) 1-5 ft (iii) more than 5 ft (iv) don't know

38. Are there frequent flooding problems at or near the proposed area? (i) yes (ii) no (iii) don't know
    a. **If yes** when does flooding occur (i) each time it rains (ii) only times of heavy rains (iii) during hurricanes (iv) not sure
    b. **If yes** how often does flooding occur? (i) once weekly (ii) once monthly (iii) once in three months (iv) once in six months (v) once in a year (vi) less than once in a year (vi) not sure
    c. **If yes** where are the affected areas? ____________________
    d. **If yes** how high does the water level rise? (i) less than 1 foot (ii) 1-5 ft (iii) more than 5 ft (iv) don't know

39. Is the proposed area affected by storm surge or sea level rise? (i) yes (ii) no (iii) not sure/don't know

40. Do you know of any site or area nearby considered to be (i) a protected area/ area of environmental importance (ii) historic area (iii) or other area of national importance? (i) yes (ii) no (iii) don't know
    If yes please give us as much detail as you can on this area ____________________
    ____

41. Is there any other relevant information that you would like to share ?
____
____
____
____

Thank you for your time in participating in this survey.

Occasionally, NEPA may need to contact survey participants for verification or follow-up purposes. Are you willing to share your name and contact information for this purpose only? (i) yes (**insert complete given name and telephone/email below, and verify spelling**) (ii) no

____

Signature of Interviewer: ____________________

Fishers Questionnaire

PROPOSED PHASE 2 EXPANSION OF GRAND PALLADIUM & LADY HAMILTON RESORT & SPA, LUCEA, HANOVER

FISHERS QUESTIONNAIRE

DATE:________________________ **INTERVIEWER:**____

Purpose and Objectives

CL Environmental Co. Ltd. is conducting a fishers survey as part of the Environmental Impact Assessment (EIA) for the Proposed Phase 2 Expansion Of Grand Palladium & Lady Hamilton Resort & Spa, Lucea, Hanover, in compliance with the requirements set out by the National Environment & Planning Agency (NEPA). The responses obtained will provide insight into the fishing community and gather opinions, concerns, and preferences of fishers regarding the proposed project.

Participation and Data Protection

Participation is voluntary and respondents are free to decline or withdraw at any time without consequence. Information provided will aid in assessing potential impacts and ensure that fisher concerns and perspectives are thoroughly considered throughout the EIA process. Please rest assured that all responses will be treated confidentially and utilized solely for fulfilling the requirements of the social impact assessment.

Project Synopsis

Fiesta Jamaica Ltd. commenced the construction of The Grand Palladium Jamaica & Lady Hamilton Resort & Spa in 2007 and now intends to undertake the Phase 2 expansion of the existing hotel. This expansion project aims to add 948 rooms over approximately 83.78 acres of land.

- New rooms will be distributed across two hotels:
  - Grand Palladium: Comprising eight buildings with 475 rooms, standing at six storeys high. There will also be one-story two- and three-bedroom villas with swim-up pools.
  - TRS Hotel: Exclusively for adults, consisting of nine buildings with 473 rooms, also standing at six storeys high. It will also include two-bedroom single-storey villas and a swim-up pool.
- Both hotels will operate independently but will share common services such as restaurants, shops, and a convention centre.
- Sixteen (16) overwater bungalows are proposed.
- Creation of two (2) beaches, one at the southern overwater bungalows area and the other in the TRS area, exclusively for guest enjoyment.
- A new industrial area will be constructed, connected to Phase 2 by a new tunnel under the main road. A new service access point from the main road to the industrial area will be established.
- The current entrance to Phase 1 of the existing hotel will remain operational.

COHORT DESCRIPTION

1. What is the name of this Fishing Beach/community? ____________________________________
2. Do you live in this community? (i) yes (ii) no
   If no, which community do you live in? ____
3. Gender (i) male (ii) female (iii) do not wish to disclose
4. Age group i (i) 18- 24 yrs (ii) 25 - 34 yrs (iii) 35 – 44 yrs (iv) 45 – 54 yrs (v) 55 - 64 yrs (vi) older than 65 yrs
5. Are you involved in fishing/the fishing industry? (i) yes (ii) no
   If yes, which of these statements best describes you**:**

Statement	Mark with X
I am a fisher - I catch fish and sell directly to customers	
I am a fisher - I catch fish but I do not sell directly to customers	
I am a vendor - I have a boat that goes to sea, and I sell the catch	
I am a vendor - I buy directly from local fishermen	
I am a vendor I buy from outside the community	
I am a fish scaler/cleaner - I gut and scale fish after customers make their purchase	

Questions 6 - 14 for fishers who "catch fish/go to sea" and for vendors who "have a boat that goes to sea"

6. Are you a registered fisher with the National Fisheries Authority (i) yes (ii) no (iii) do not wish to disclose
7. Are you a member of Lucea Fishers Association (i) yes (ii) no (iii) do not wish to disclose
8. What do you use for fishing (i) line (ii) spear (iii) net (iv) fish pot (v) canoe without engine (vi) canoe with engine (vii) large boat with net (trawler) (viii) other, please specify ______________________________
9. What is the name(s) of the area(s) where you dock/beach your boat and launch your boat or swim from to go fishing? ____
10. Where do you fish? (i) nearshore/inner harbour (ii) deep sea 1-5 miles from shore (iii) deep sea more than 5 miles from shore

11. What are the names of the areas that you fish? ______________________________

____

12. How many times per week do you go fishing? (i) one (ii) two (iii) three (iv) four (v) five (vi) more than 5
13. Each time you go fishing on average how many pounds of fish do you usually catch? (i) less than 10lbs (ii) 11 – 20 lbs (iii) 21 -50lbs (iv) 51-100 lbs (v) more than 100 lbs

ALL to answer

14. Is anyone else in your household involved in fishing? (i) yes (ii) no
15. Is your fishing related job your full-time job (i) yes (ii) no
    If no, are you otherwise employed (i) yes full time (ii) yes part time (iii) unemployed
16. What was the last school you attended? (i) None (ii) Primary/All Age (iii) High School (iv) College (v) University (vi) HEART/Vocational training institute (vii) Other
17. How long have you been working in the fishing industry? (i) 0 - 5 yrs. (ii) 6 - 11 yrs. (iii) 12 - 17 yrs. (iv) 18 - 24 yrs. (v) 25 - 30yrs. (vi) Over 30 yrs.
18. Over time have you noticed a change in the earning from/ size/ type of fish you catch or sell? (i) yes (ii) no (iii) no change (iv) not sure
    a. **If yes,** what change have you noticed (i) increase (ii) decrease
    b. **If yes,** what do you think is the reason (s)? ______________________________
19. What is the average weekly income of fish sales/fishing related activities?

    (i) Below $2000, (ii) $2001 - $4000, (iii) $4001 - $6000, (iv) $6001 - $8000, (v) $8001 - $10000, (vi) Over $10000 (vii) do not wish to disclose

PERCEPTION

20. Before this interview, had you ever heard of a company called Fiesta Jamaica Limited? (i) yes (ii) no
21. Before this interview, did you know that Fiesta Jamaica Limited is proposing to start Phase 2 of its hotel in the Lucea area of Hanover? (i) yes (ii) no

    If yes:
    a. How were you made aware? (i) newspaper (ii) television (iii) radio (iv) community meeting (v) word of mouth
    b. (vi) social media (vii) other______________________________
    c. Are you aware of the details? (i) yes (ii) no

If yes, please answer the following to assess awareness of details:	Yes	No
Were you aware that this development would include 16 overwater suites/villas		
Were you aware that this development would include seventeen buildings comprising 948 rooms in total		
Were you aware that this development would include modifying a section of existing beach		

22. Have there been any problems with the existing hotel? (i) yes (ii) no (iii) don't know
    a. **If yes** what were/are the issues

       ____
    b. **If yes** have these issues been resolved? (i) yes (ii) no (iii) don't know
23. Have there been any problems/issues (environmental, social, or other) on the proposed project site in the Lucea area? (i) yes (ii) no (iii) don't know
    a. **If yes** what were/are the issues

       ____
24. Do you have any general concerns about the project as proposed? (i) yes (ii) no (iii) not sure/don't know
    a. **If yes**, what are they?

       ____
    b. **f yes**, what would you suggest to address/resolve your concern(s)?

       ____

       ____
25. Do you have any specific concern(s) relating to a section of the beach being modified? (i) yes; (ii) no (iii) not sure/don't know
    a. **If yes**, what are they?

       ____

b. **If yes**, what would you suggest to address/resolve your concern(s)?

____

____

26. Do you know what an overwater suite/villa is? (i) yes (ii) no
(**If no, explain that these are rooms built on piles over the sea**)

27. Do you have any specific concern(s) relating to over water suites/villas ? (i) yes (ii) no (iii) not sure/don't know
   a. **If yes**, what are they?

   ____

   b. **If yes**, what would you suggest to address/resolve your concern(s)?

   ____

   ____

28. Do you use the proposed site for any type of activity? (i) yes (ii) no
If yes, please answer the following:

	Yes	**No**	**If yes, for what purpose**
Land			
Beach			
Sea			

29. Do you think this project will affect your life/livelihood? (i) positively (ii) negatively (iii) not at all (iv) not sure/don't know
   a. **If positive,** how so? ____________________
   b. **If negative,** how so? ____________________
   c. **If negative,** how do you think your issue could be resolved?

   ____

   ____

30. Do you think this project will affect your community (i) positively or (ii) negatively? (iii) not at all (iv) not sure/don't know
   a. **If positive,** how so? ____________________
   b. **If negative,** how so? ____________________
   c. **If negative,** how do you think your issue could be resolved?

   ____

   ____

31. Do you think this project will affect the environment (i) positively or (ii) negatively? (iii) not at all (iv) not sure
   a. **If positive,** how so? ____________________
   b. **If negative,** how so? ____________________
   c. **If negative,** how do you think your issue could be resolved?

   ____

   ____

32. Is there any other relevant information that you would like to share ?

____

____

____

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Thank you for your time in participating in this survey.

Occasionally, NEPA may need to contact survey participants for verification or follow-up purposes. Are you willing to share your name and contact information for this purpose only? (i) yes (**insert complete given name and telephone/email below, and verify spelling**) (ii) no

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Signature of Interviewer: ____________________