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Environmental Baseline Assessment (EBA) for Hatchet Bay Power Station, Hatchet Bay, Eleuthera Island

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1.0 Executive Summary

This Environmental Baseline Assessment (EBA) has as its prime objectives, (i) to assess present environmental quality and the environmental impacts and (ii) to identify environmentally significant factors that could preclude project development. In doing so, regard must be made to local legislation, international conventions, and BEST management practices. Guidelines for the drafting of the EBA was prepared in collaboration with the Department of Environmental Planning and Protection (DEPP), Ministry of the Environment and Natural Resources to facilitate the granting of the Environmental Clearance Certificate (CEC) for the commencement of project development activities.

EA Energy Limited proposes to develop 32 acres of Crown land property into a first-class fully sustainable, solar and natural gas powered, Hatchet Bay Eleuthera Power Station. The property is situated in Hatchet Bay, Eleuthera.

Key features of the development include:

- Investment of some B$45,000,000.00
- Hybrid Microgrid of Solar PV, Battery Storage and Natural Gas Engines
- Provision of Reliable Energy Source for Eleuthera
- Employment of 45-60 Bahamian workers during construction
- Employ permanently 15 -20 Bahamians.

1.2 Biological Baseline Studies

Assessments regarding botanical, avian and wildlife were undertaken to document baseline conditions and to analyze effectively the impacts associated with the proposed development. Botanical and avian surveys took place over the course of five days (January 20th- 24th 2025) to document existing biological conditions. Botanical results and on ground inspections determined that the entire area is dominated by a Dry Broadleaf Evergreen Formation (DBEF) Ecosystem which are common in the central and southern islands of The Bahamas. Common plant species include the Gum Elemi (Bursera simaruba*)* Thatch Palm (*Leucothrinax morrisii), and* Sabal Palm (*Sabal palmetto)*

Some nine (9) species found in site are protected under the *Forestry (Declaration of Protected Tree) Order, 2021*, and hence the need for a mitigation strategy to offset their removal, and associated biodiversity habitats during construction of the plant and associated developments. These species include Agave (Agave millspaughii) Gum Elemi (Bursera simaruba), Silver top palm (Cocothrinax argentata), Small Leaf Blolly (Guapira discolor), Railroad vine (Ipomea-pes-caprae), Buccaneer palm (Pseudophoenix sargentii), Thatch Palm (Leucothrinax morrisii), Sabal Palm (Sabal palmetto) and Brasiletto (Tara vesicaria).

The Avian surveys identified the presence, abundance, and habitats of bird species. A total of ten (10) birds were recorded over five field surveys (20th- 24th January 2025). Of the total birds recorded, one was endemic (Bahama Mockingbird – *Mimus gundlachii*). All birds are protected under the Wildbirds Protection Act 1952

From the perspective of associated wildlife observed on property during field surveys, some thirteen (13) species of reptiles, insects and amphibians were recorded.

1.3 Environmental Impacts

Impacts were viewed in the context of how the physical environment will be impacted by both the infrastructural developments (roads, water supply, waste management infrastructure, solar powered systems) separately, utilizing qualitative criteria (i.e., nature, type, likelihood, scale, duration, reversibility, and significance) to assess impact.

The criterion of severity is used to measure the magnitude of impact an event has on the environment (i.e., terrestrial, fauna, wildlife, coastal, visual and aesthetics, hydrology, soils, and socio-economic, etc.). Severity in this circumstance was given ratings of 1 for low impact, 3 for medium impact and 5 for high impact.

The most direct impact associated with the Hatchet Bay Power Plant project is the removal of significant area of natural vegetation to accommodate the infrastructural plant development and the footprint for the constructions with associated facilities. Due to the size of the area, subject to vegetation removal, the qualitative criteria rating significance was high. Additionally, the magnitude of the severity of the overall average impact to the natural and physical environment was scaled as high. Although Noise levels and Air quality impacts were rated as High, due to the anticipated construction activities, these will be temporal in nature once construction activities are completed. It is anticipated that a waiver for the removal of the Protected Trees identified will be obtained from the Forestry Unit, Ministry of the Environment and Natural Resources, to allow for the removal of the protected trees. A buffer zone of natural vegetation will be retained along the periphery boundary of the site as green space and serve as a biodiversity corridor and protective buffer for the power plant, from high winds.

Native and endemic plant species will be used in the landscaped areas to offset any losses of protected trees. In this respect, particular attention will be given the Forestry (Declaration of Protected Trees) Order, 2021, in the selection of replacement Trees for areas subject to landscaping.

The project in its current form and associated operational activities will have no negative impact on the nearby marine environment.

1.4 Socio-economic Impacts

The Hatchet Bay Power Station construction timeline is anticipated to be up to 15 months. Total development costs are anticipated to be up to BSD 45,000,000.00. At full build, the project anticipates annually accommodating up to 80m kWh of electricity based on expected data received from BPRL and Ministry of Energy and Transport (MoET), to service those on the Island of Eleuthera.

The project anticipates creating up to 60 jobs for Bahamians during construction and during operations.

This vast investment in sustainable energy is expected to contribute to the environment by reducing the CO2 emission and pollutants, inevitably ensuring the growth of Eleuthera’s ecosystem. The removal of outdated diesel facilities and replacing it with natural gas engines will not only reduce the cost of fuel imports as well as aid in preventing excess emissions and pollutants which may have contributed to ocean acidification and pollution of surrounding vegetation. While meeting the energy needs of the inhabitants of Eleuthera with reliable and robust power source. These are just a few ways the Hatchet Bay Eleuthera Power Station will become a conduit for economic and environmental growth and development.

1.5 Key Mitigation Measures and Recommendations

***Terrestrial*:**

- Relocate where practical, protected species identified within the footprint of the new road reservations, power plant footprint, solar panels installations, prior to construction activities.
- Remove invasive species (Australian Pine (*Casuarina equisetifolia*), and Hawaiian Sea Lettuce
- Plant native and endemic species in landscape areas.
- Maintain a 25 to 50 feet vegetation buffer ring at the periphery of the power station to serve as protective mechanism from strong winds associated with any potential tropical storm/hurricane event, and also function as a wildlife/biodiversity corridor.

***Avian*:**

- Protected trees identified and flagged for removal (a permit from the Forestry Unit, Ministry of the Environment and Natural Resources, under the Forestry Act, 2010), or to be maintained, where feasible.
- Train staff in the importance of birds.

Hydrology:

- Implement fuel and chemical BEST management practices to ensure ground water resources are not negatively impacted.
- Retention of natural vegetation buffer around periphery of property boundary
- Given the geological conditions, uncased boreholes should be used to abstract water from the limestone aquifer. Also, abstraction should be spread over many boreholes

Geotechnical matters

- The subsurface soil profile consists of approximately 3 inches of relatively loose sand TOPSOIL underlain by the LIMESTONE formation to the explored depths.
- The encountered subsurface soil conditions are suitable to support the structures on a system of shallow foundations bearing on the existing LIMESTONE or engineered fill material.
- Design the footings using a maximum allowable bearing pressure of 5,000 lb/ft2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE).

Air Quality and Noise:

- Employ BEST practices in construction methods to minimize dust emissions which impair air quality.
- Construction workers to always wear PPE

***Solid and hazardous Waste*:**

- Solid waste generation is limited to construction waste, and vegetation removal from road
- Vegetation removed will be reused/mulched for landscaping purposes.
- Solid and hazardous waste will be placed in containers and properly disposed of (removed to the Eleuthera Landfill Site) in accordance with Department of Environmental Health Services (DEHS) regulations and standards.

Fire and Hurricane Preparedness:

- A Fire Control and Prevention Plan, to be prepared detailing steps to prevent, contain and control

fires during construction and operation the residential resort.
- Maintain a 25 to 50 feet vegetation zone around the periphery boundary of the site
- All residences and associated buildings will follow fire requirements of the Bahamas Building Code.
- A Hurricane Preparedness and Contingency Plan will be developed in the event the island is impacted by a storm or hurricane.

Occupational Health and Safety:
- Workers to be provided with appropriate Protective Personal Equipment (PPE).
- All workers be trained in handling equipment, before starting work on property.
- Regular enforcement of occupational health and safety protocols on a weekly basis.

Environmental Management Plan

The purpose of the Environment Management Plan (EMP) is to outline the mitigation measures and monitoring necessary to reduce or eliminate the identified negative impacts associated with the project activities (both developmental and operational). The Plan will be developed once a No Objection to the EBA is received from the DEPP.

Conclusion:

The Hatchet Bay Power Plant investment of some $45,000,000.00 is expected to generate much need economic stimulus for the Eleuthera Island (construction jobs, permanent jobs, and entrepreneurial activities). The project benefits far out way any limited unavoidable negative environmental impact identified.

Employment of BEST management practices, having regard to national environmental legislation and International Conventions and standards will ensure the project is developed and becomes operational in a sustainable manner. The developers have indicated their intention to, and based on the Masterplan, ensure that the project lives up to its expectations, (solar energy, retention of a 25 – 50 feet natural vegetation buffer around property boundary) on the natural environment. Utilizing the mitigation measures will guarantee that the negative impacts identified are reduced/or are mitigated and sustained.

2.0. Description of Proposed Project and Scope

2.1. Description of Proposed Project

2.1.1. Conceptual Master Plan:

EA Energy Limited proposes to develop 32 acres of Crown leased property into a first-class fully sustainable, solar and natural gas powered, situated at the Hatchet Bay Power Station. A summary of the key project capacity features is provided below: ***(see Appendix – A for full details).*** The property is situated in the vicinity of Hatchet Bay Settlement, Eleuthera Island, due north the existing diesel power plant. ***(see Figure 2.1),*** with ***Figure 2.2*** providing a general layout of the proposed plant facilities.

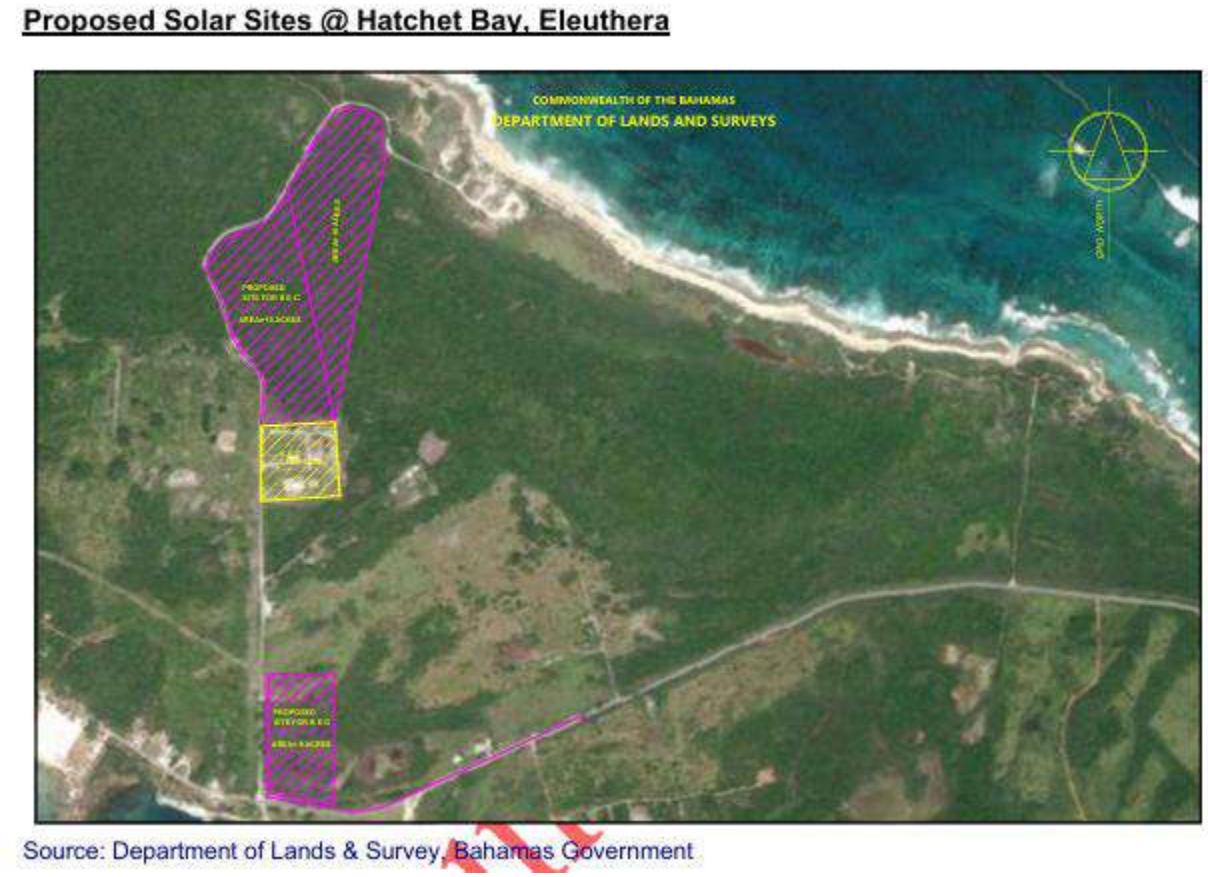


Figure 2.1*: Imagery reflecting survey boundary of 32 acres for new power plant and (edged in Pink) and its relation to the existing BPL plant (due North of existing BPL plant edged in yellow).*

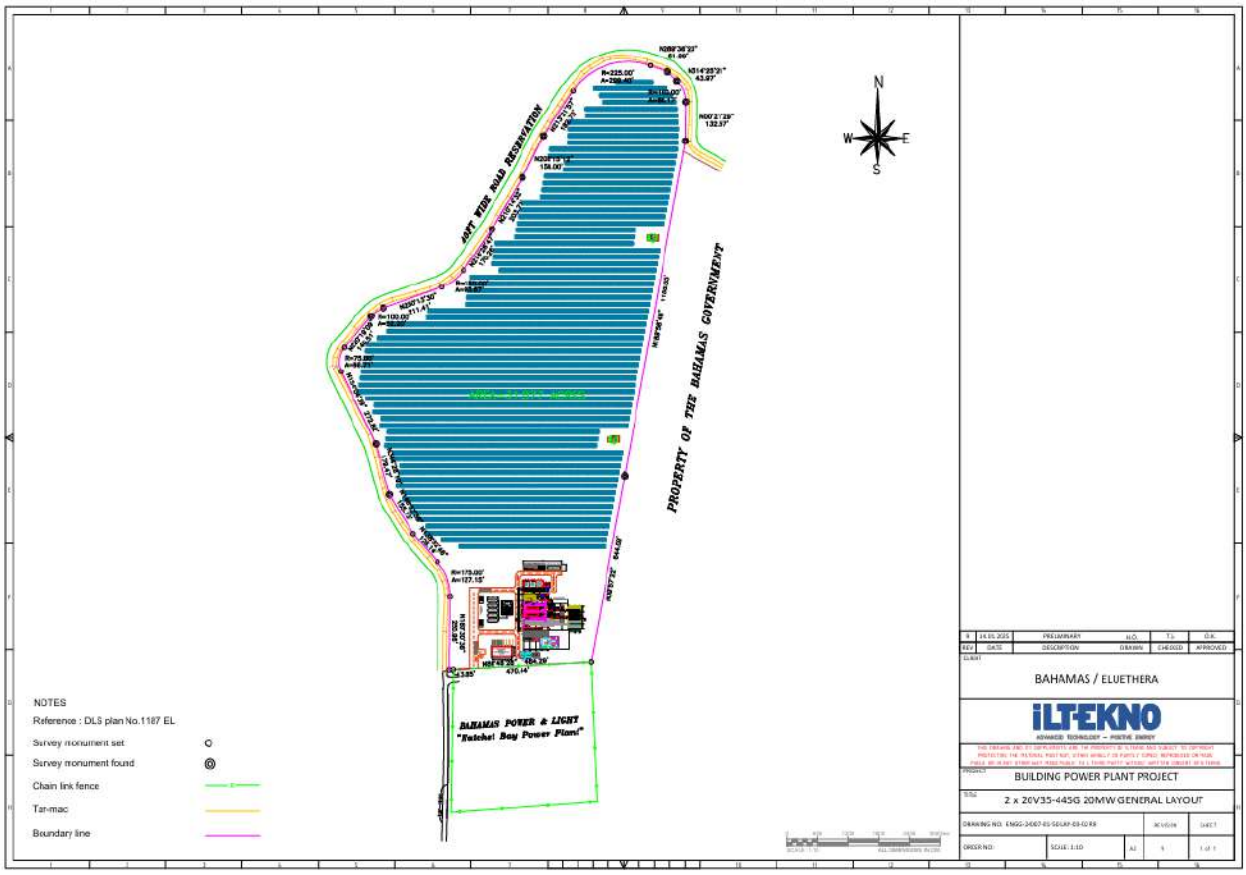


***Figure 2.2**: General layout of new proposed power plant, situated at Hatchet Bay Eleuthera Island*

Project Capacity Selection

The primary reason for selecting a baseload power plant is that, as the sole power producer on Eleuthera Island, it must ensure that the baseload capacity can meet the demand even during both planned and unplanned outages of the generators.

In this regard the baseload plant has been selected with 2 x 9,976kWe net output MAN 20V35 44 G model with total capacity 19.95kWe. As per the requirement by the MoE specification for renewable energy, following configuration selected.

1. 10 MWp Solar PV selected with AC output of 8.7 MWe

2. 1 x 5MWe (settable) AC usable power @ POI and 10.539 MWh AC usable power capacity @ POI Battery System

Battery storage system has been selected in 10MWe 0.5C (5MWe/10MWh) due to below rea sons;

i. During any unplanned outage of any genset at baseload plant, in order to cover the response time of gas engines ii.

ii. iii. For covering the 5MWe of island demand alone for approximately two hours in case of any unplanned outage at the baseload plant

iii. In order to cover load steps of Genset due to the instant load profile change in the Island.

In this regard the Plant configuration studied as follows;

19.5MWe Baseload + 10MWp Solar + 5 MWe Battery Storage Eleuthera Power Plant

Via PVsyst software, hourly generation study performed for Solar Plant and according to the load profile provided by MoE for the 78,935MWh yearly production value, below results have been gathered;

i. Solar Power → 16,787 MWh production directly to the grid and capacity usage 22% whereas the surplus amount of energy to be utilized for filling the batteries depending on the load demand and forecast
ii. Gensets → 62,014 MWh production with 35.49% capacity usage
iii. Remaining 134 MWh demand will be covered with batteries where the demand is lower than the Gensets' low load limit
iv. iv. Running hours of batteries is calculated as 214 hours

Based on the hourly production values provided by the Ministry of Energy and Transport (MoET), the selected capacity will be sufficient to provide reliable and constant electricity to the Island. On top of that, to be able to meet the demand in future years, an additional one reserve Genset area will be considered in the layout studies together with its electrical and mechanical auxiliaries.

Solar Plant

The Solar Power Plant will consist of 22,272 x 450 Wp Half Cut Bifacial PV modules. These PV modules will be grouped into 1392 tables, each with 32 modules-1string. These strings will transmit the direct current generated by the solar panels to the inverters. 300 kWe inverters will be used in the project and these inverters will convert the incoming energy into alternating current at 800 Volts and transmit it to 4 main distribution panels. The main distribution panels will be positioned near the transformers and connected to 4 each 2750 kVA transformers. The voltage of 0.8 kV will be stepped up to 13.8 kV and the system will be connected to the distribution center.

Bifacial PV modules that have transparent back sheets produce additional energy from the backside thanks to reflected solar irradiance. The PV Modules will be mounted with the optimum azimuth and tilt angles to maximize efficiency. The system can be monitored instantly via Data Logger devices and any faults in the field can be detected quickly.

Battery Storage System

Solar and Battery system will be connected to the PV Solar and BESS 13.8kV Distribution Busbar. AC coupling will be considered for the MV connection.

4 units of battery pack and 2 units of PCS with relevant Transformers and MV cubicles are to be manufactured in containerized skids. Via the integrated battery and energy management system, grid frequency control will be established for solar and baseload side.

BESS manufacturer is considered to be Clou Midea Industrial Tech. as of the concept design engineering which would be subject to change during the detailed design and procurement stage.

Features of the skid solution is provided below;

- Renewable Power Plant Integration (Ramp rate control, energy shifting)
- Grid Ancillary Control (Frequency regulation, peak shaving)
- Distributed Network and Micro-grid (Peak shaving, autonomous operation)

Performance

- Advanced three-level technology, max. efficiency reaches 98.8%
- Effective forced air cooling
- High DC voltage up to 1500V
- Support two independent DC inputs
- Bidirectional power conversion system
- Battery charge & dis-charge management and black start function integrated

EASY O&M

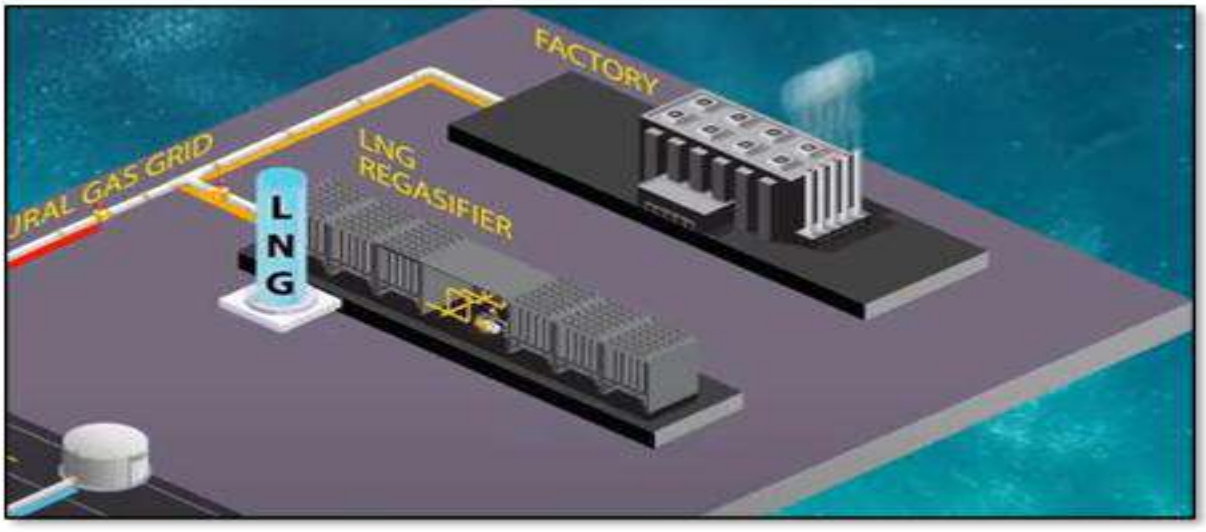
- Integrated monitoring function and fast trouble shooting
- Integrated auxiliary power supply panels for external devices
- Low transportation and installation cost
- GRID SUPPORT
- Compliant with UL1741, IEEE1547 Rev.: 03
- L/HVRT, L/HFRT, specified power factor control and reactive power support.

LNG Supply and Gasification System

LNG supply will be performed with LNG trucks and/or LNG ISO containers. The Project will be occupied with LNG unloading station (pump requirement details will be also verified with LNG supplier) and truck scale.

For Eleuthera Island, the port of entry to be utilized will be Alice Town Port, attributable to its proximity of 1 km. to the project site. However, due to the constraints of the ports entrance, a smaller Ro-Ro vessel will be conducting the transfer operations with its ten 40 ft. ISO-Trailer carrying capacity. The above figure of gas consumption in the amount of approximately 13.8 million m3 of gas corresponds to 23.000 m3 of LNG approximately. By taking into account that this figure and ISO and/or LNG tanker capacity as 44m3, yearly 420 trucks to be dispatched to the power plant in order to cover the electricity demand which corresponds to almost twice filling in a day. Remaining

regasification system will consist of liquid natural gas storage tanks, atmospheric vaporizers, electric heater and regulation station.



3D View of Gasification System (Only for Reference)

***Figure 2.3**: 3D view of Gasification System proposed for the Eleuthera Power plant*

LNG Storage Tanks

Based on average 6MWh demand capacity, 10 days storage tank with total volume of 500m³ is to be used.

2.2 Description of Alternatives

2.2.1 The "No-action" Alternative

With these type developments, there is always the "No Action" Alternative. In these circumstances, the "No Action" alternative would keep Hatchet Bay area in the same undeveloped position currently, unless sold to another buyer. With no new constructions under consideration, this would eliminate the intended purpose for acquiring the property. Any economic activity, employment opportunities on the Island gained through construction jobs, permanent jobs, investment injections, increased tourism opportunities would be missed and lost.

2.2.2 Proposed Alternative

The site is crown land, with minimal development footprint.

The site selection was based on:

- the land was available for purchase.
- the size of the project made it ideal to accommodate the project components.
- The area is ideally located just 5 minutes by road from the mainland Settlement of Lower Bouge, Eleuthera, and is a fair distance away from commercial and residential areas.

3.0 Agency Consultation and Public Involvement

3.1 Agency consultation activities and results

An important consideration that must be factored into the planning process for the Hatchet Bay Power Station project is to have in place an effective public relations/communication strategy. This is necessary to adequately inform, and to gather feedback from residents living in proximity to the power plant. To advise them on the socio-economic and environmental impacts, and how any adverse impacts will be mitigated.
Discussion have been held with the DEPP with respect to the Public Consultation process. A public meeting will be held on the Island of Eleuthera at a date and time facilitated by the DEPP, to provide the public with the opportunity to review the project activities and associated environmental impacts and mitigation strategies.

4.0 Baseline Description of Affected Environment

4.1. Geographical Location and Boundaries

Eleuthera is located just 50 miles (80 km) east of Nassau, and 110 miles southeast of Great Abaco. The island is in a northwest to southeast orientation, lying along the eastern edge of the shallow Great Bahama Bank.

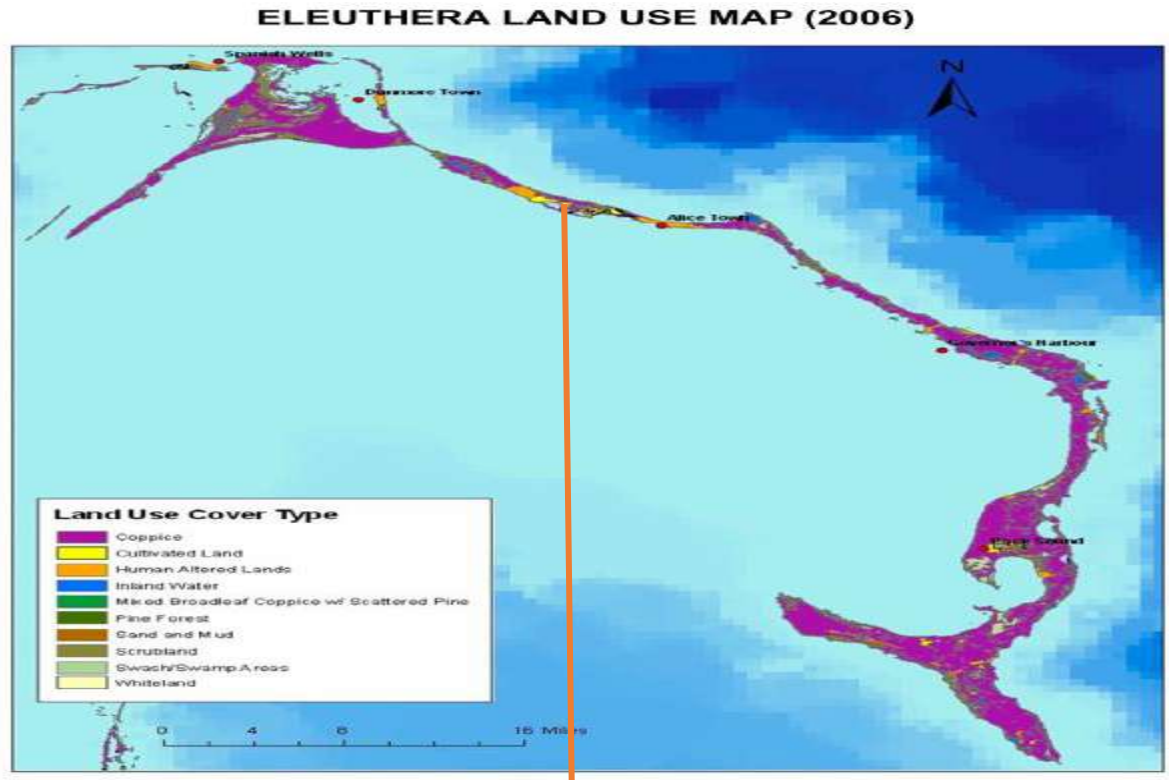


***Figure 4.1a**: General map of Eleuthera showing land cover types*

***Figure 4.1b**: Map Imagery of existing BPL power plant at Hatchet Bay and by extension the location for the new power plant, due North if existing plant*

4.2 Physical Environment

4.2.1 Climate

The Bahamas' climate is classified as subtropical, influenced by the sea, in particular the Gulf Stream to the West. Cooler winters and higher amounts of rainfall are experienced more in the Northern Islands compared to the Southern islands, with drier conditions. According to Sealy (2006), temperatures are mild throughout the year and the average varies from the low 70s ^{o}F during the winter to the low and high 80s ^{o}F during the summer. Prevailing winds come from the Northwest in winter and from the Southeast in Summer, lending a cooler influence, with average wind speed recorded at eight (8) knots.

A significant rise in the tidal level is possible | expected due to climate change for the entire Commonwealth of The Bahamas but not detailed within this hydrological report. In the general vicinity of the island of New Providence, the tides are semi-diurnal with an average range of 2.46-Ft (0.75 meters) and a tidal period of approximately 12.4-hours. The anticipated Mean High-Water Spring (MHWS) Tide is +1.30-Ft (+0.40-m), and Mean Low Water Spring (MLWS) Tide is -1.64-Ft (-0.50-m), for New Providence. Tidal predictions for Eastern Eleuthera and Eastern Abaco are quite similar; notably with a delay/lag for tidal response(s) between the locations. The consideration for future predicted elevated tidal levels has been factored into the design height of the proposed solar structures. The proposed site elevations are at +20Ft (minimum) above the mean high-water levels. Future flooding potential of the site on Eleuthera is not an immediate concern.

Like the other Bahama Islands, Eleuthera enjoys a sub-tropical climate, with relatively warm, wet summers and drier, cooler winters. Persistent easterly trade winds predominate in the summer, which brings warm humid air to the island. The influence of a high-pressure cell in the winter produces drier continental air and is marked by the presence of cold fronts, which can bring occasional rainfall. The island is not subjected to freezing temperatures.

The Bahama Islands lie within the North Atlantic Hurricane Belt, where hurricanes pose a significant threat during the period 1st June to 31 November and can result in catastrophic damage to the natural and built environments and human mortality. The islands of New Providence, Andros and Grand Bahama were impacted by Hurricane Matthew in 2006 causing severe damage to coastal areas. In 2017, Hurricane Erma impacted the islands of Great Inagua and Crooked Island. No hurricanes impacted the islands in 2018. However, in 2019 significant areas of Abaco and Grand Bahama were devastated by Hurricane Dorian, with estimated damages amounting to US$3.4 Billion (IDB, 2019), significantly impacting the economy of those islands, and by extension the Bahamian economy. No storms impacted the islands in 2020 and 2021. Based on these datasets, there is the possibility that the Island of Eleuthera will experience a direct hit from a hurricane event in any given year.

4.2.2 Topography

The Islands of the central Bahamas [Zone-2] are covered by broad-leaved vegetation similar to that of the exposed coastal strip of the northern Bahamas [Zone-2]. This vegetation type is dominant on all islands in the central zone. Mangroves similarly cover protected, leeward, and coastal flats of the central Bahamas. A mixture of broad-leaf coppice with an increasing amount of drought resistant species progressively further southeastward covers the islands of the drier Southeast Bahamas [Zone 3]. Vegetation on Eleuthera fits the zone – 2 category. Vegetation of this zone is of lower drought resistant species progressively further southeastward. Vegetation of the zone is of lower stature, becoming scrub-like with an increasing number of xerophytic types. As with the previous two zones, mangroves are present on protected coastal flats.

4.2.3 Hydrogeology and soils

The Geological, hydrological and water resources of the Bahamas are directly linked, due to the lack of any rivers. Consequently, the only natural means of recharge for the underlying freshwater resources is via rainfall. Thus, the groundwater resources of the Bahamas comprise fresh, brackish, saline, and hypersaline waters, located in the subsurface, in lakes, ponds that intercept the land surface. In the Bahamas, the physical geology, hydrogeology, water resources, and coastal zone are diametrically linked, as there are no true rivers in The Bahamas.

BAHAMAS WATER RESOURCES

For The Bahamas, all freshwater is by way of rainfall, which percolates and collects as groundwater. The general movement of the groundwater is toward the coastline (typically during a falling tide), with very gradual movement inland (during rising tide conditions). Salinity levels of water are expressed in parts per million (ppm) or milligrams per litre (mg/l) of the chloride content in the water, which is a constituent of the total dissolved solids. The total concentration of dissolved solids or salts (TDS, expressed in mg/L or ppm) is utilized as a water quality indicator.

The three main classes of water distinguished are: fresh, brackish and saline (salt | saline) water. For the purposes of the particular site(s), the conservative range of salinity follows:

Water Description Dissolved Solids
Fresh……..…Less than 1,000-mg/l
Brackish…...….1,000 – 3,000-mg/l
Salt……..…More than 3,000-mg/l
Saline…….More than 30,000-mg/l

Surface Water

“Eleuthera Island is narrow, with hills, especially in the north. The island has substantial cliffs on both the eastern and western shorelines. Total annual rainfall averages over 110 cm (43 inches). Surface water bodies

most prevalent in Eleuthera include (a) topographic lows, (b) blue holes, (c) man-made lakes and ponds, and (d) lagoons. Ponds between The Bluff and Current Settlements occupy topographic lows and the water table is locally above ground level. These ponds are saline during the dry winter months. Man-made lakes and ponds, resulting from the removal of limestone for building and road materials, may appear to contain fresh (surface) water, however, these are areas where the water table has been exposed to the surface (i.e. fresh ground water that has been exposed to the surface). Shallow lagoons, such as Hatchet Bay Pond and Sweetings Pond, are brackish to hypersaline and the water may appear red due to the presence of algae. None of the lagoons on Eleuthera contain freshwater, and 6 comprise 4% and 5% of the total island area respectively. Large-scale chemical or biological contamination of the surface water has not been reported***." (Bowleg, 2025)***

Ground Water

"Very small to small quantities of freshwater are available from the Lucayan limestone aquifer lenses on the Island of Eleuthera. Lenses vary in thickness, with the thickest lenses occurring on North Eleuthera (21 m or 69 ft). The remaining lenses have thicknesses of 3 to 9 m (10 – 30 ft). The water table is within a meter or two of the surfaces. This unit accounts for 22% of the total island area."

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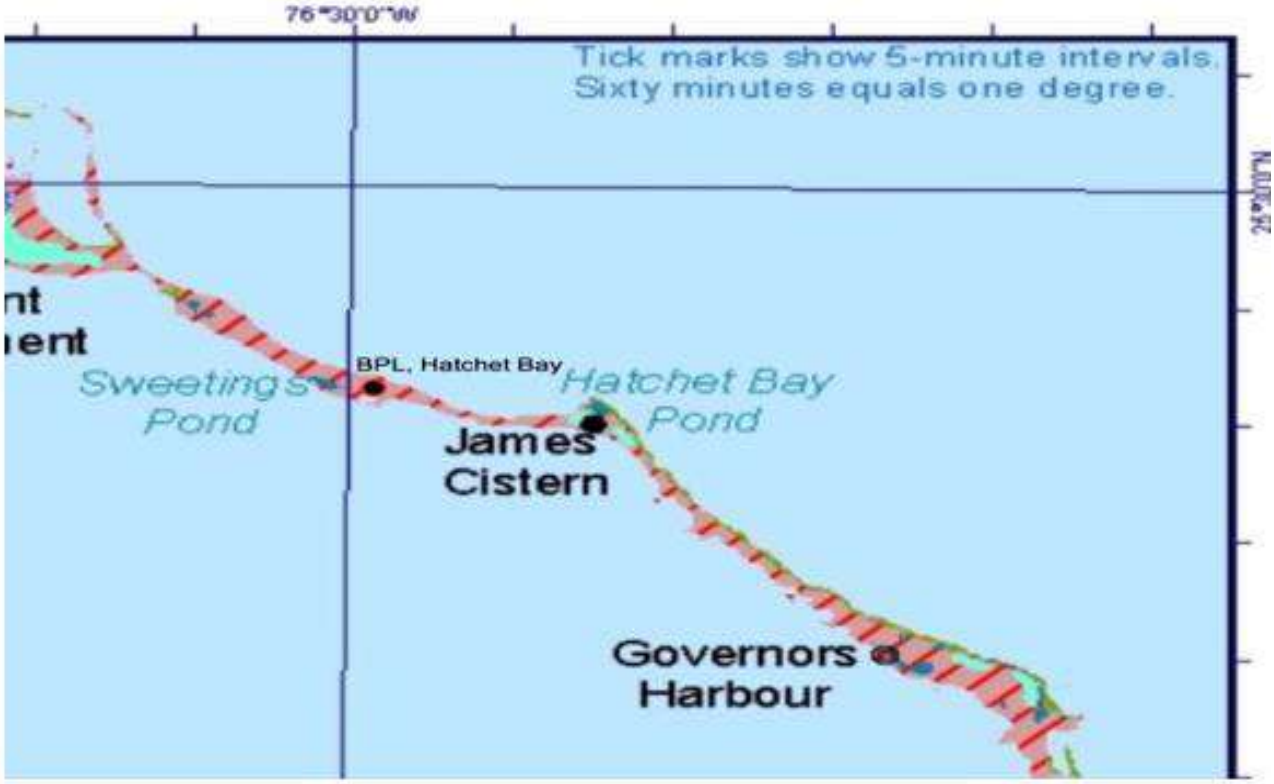


Source: USACE Water Resources Assessment of The Bahamas (Dec-2024)

4.2.4 Air Quality

No issues or sources of air pollution, or air quality presently on the project site was identified, as the site is currently undeveloped, With the development of a new power plant, air quality parameters would require constant monitoring.

4.2.5 Noise

Presently there is no issue of noise pollution. The only source of noise pollution is that of existing power plant (i.e., diesel generator) located at a reasonable distance away from the nearest residential community of Gregory Town. Once construction activities commence, noise levels are expected to be raised, albeit temporarily as construction commences. Noise levels will return to pre-construction levels once development activities cease.

4.2.6 Geotechnical Findings (A Summary)

Subsurface Soil Conditions

Typically, the site(s) geology consists of sandy soil conditions with a 'weathered to fractured hard limestone' rock subsurface, and further suggest that recharge of any freshwater resources is very limited. Site geological features further suggest that rainfall is quickly lost as runoff, due to combined elevation / hard natural limestone surface / the sandy coastal erosion conditions of the landform. Geotechnical Test Pits (10-Total), excavated to 15 Feet in January-2025 reveal: For Hatchet Bay, Eleuthera – Land parcel to the North has the largest bearing capacity. Average of 445.34-psi, Maximum of 745.55-psi (@ Test Pit 'A'), Minimum of 159.57-psi (@ 'J'); all with a Core Sectional Area of 11.75. ***(See Appendix – B).***

Based on the results of our soil probing and test pit excavations, the site subsurface soil profile consists of approximately 3 inches of relatively loose sand TOPSOIL underlain by the LIMESTONE formation to the explored depths.

Based on the experienced rate of excavation depth), the encountered LIMESTONE formation is sound and hard. In addition, the pocket soil penetrometer test results indicated values in excess of the instrument's highest measurable compressive strength of +5.0 ton/ft2 at each tested location. The soil penetrometer test results throughout the entire site reads over +5.0 ton/ft2

Key Geotechnical Evaluations and Recommendations

Building Structure

The encountered subsurface soil conditions are suitable to support the structures on a system of shallow foundations bearing on the existing LIMESTONE or engineered fill material.

The site preparation should consist of the entire removal of vegetation/TOPSOIL and subsequent placement of approved fill material to raise/level the resulting grades to the elevations, if required. Inspection of the entire site, by our geotechnical engineer or a representative, is advisable after the removal of vegetation/TOPSOIL and prior to raising/leveling the resulting grades to assure sound, competent subgrade conditions are attained (i.e. removal of surficial weak, weathered LIMESTONE might be required).

Design the footings using a maximum allowable bearing pressure of 6,000 lb/ft2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE) after completion of a site preparation.

The approved fill material should consist of granular soil with a maximum nominal size of 3 inches, no more than 12% of fines and no organic matter placed in 12-in thick lifts compacted to at least 95% of the material's Maximum Dry Density (ASTM Dl557) is expected to be 120 lbs/ft3. An active earth pressure coefficient of 0.35 and a passive earth pressure coefficient of 3.0 shall be used. ***(See Appendix – B).***

Slab on Grade

The slabs can be supported on-grade on either competent LIMESTONE or approved engineered fill with the upper 12 inches compacted to the materials' Maximum Dry Density (ASTM Dl557).

A modulus of subgrade reaction of 250 lb/in3 can be used for design of the slab-on-grade.

The use of the full passive pressure should be done with caution as significant wall movements are necessary to mobilize the full passive resisting force. Also, any excavations for permanent utility installations performed in front of the retaining walls (i.e. on the passive soil resisting side) would prevent the use of passive pressures as utility damage would likely occur with excessive movement.

For unyielding walls (i.e. restrained retaining walls), an at-rest earth pressure coefficient of 0.5 should be used. Relief of hydrostatic pressures by placement of appropriate drainage measures behind the walls should be provided if water pressure is not included in the design of the walls.

Care should be exercised when placing fill and performing compaction in proximity to retaining walls. Fill compaction in proximity to the walls should be performed with small vibratory plates and to at least 92% of the material's Maximum Dry Density (ASTM D1557).

4.3 Natural Environment

Studies with respect to botanical, avian and biodiversity was undertaken over an initial five-day period (20 – 24 January 2025). The objective, to map and assess the flora diversity, (including a protective tree species survey), identify any invasive species, fauna and abundance and identify associated biodiversity.

4.3.1 Terrestrial Surveys Methodology

The entire project site acreage (32 acres) was ground truced (walking) along the entire property boundary, and trails within the interior upland vegetation areas. Using Areces et al. (1990), all vegetation types were recorded and used to compile a species list. Corell and Corell (1982) and the website for the Leon Levy Plant Preserve (Eleuthera) http://www.levypreserve.org/_m1810/Plants-Scientific-Name was used for Plant taxonomy. Invasive species encountered was referenced and identified, in accordance with the National Invasive Species Strategy (2013) for control or eradication. The presence and abundance of protected trees was undertaken, listed in accordance with the Forestry (Declaration of Protected Trees) Order 2021.

Using survey plan of proposed property, a systematic grid approach was adopted. A total of 4 computer generated sample plots were established with (4) quadrants sampled in each plot for the purposes of botanical data collection and analysis. Each sample plot center chosen for data collection was georeferenced (GPS coordinates), with a fixed radius of 8 meters established. Tally counts were made of all flora species identified (diversity) and categorized as trees, shrubs, and herbs. Overall estimation of species abundance of protected trees was determined (an expansion factor was used with calculations extrapolation over the 32 acres). Firstly, the tally count for each plant species was totaled per plot, then averaged over the four plots for an overall plot average per acre, next the plot average per species was extrapolated to the property acreage. **Figures 4.3 through Figure 4.25** depicts the location of the sample plots from which field data was collected, along with a summary of the findings for the plant species identified, with summary totals.

4.3.1.2 Terrestrial Ecosystems

One distinct categories of terrestrial ecosystem were identified, and this was the Interior Upland (IU) ecosystem.

4.3.1.2.3 Interior Upland

The Upland Interior was of the Dry Broadleaved Evergreen Formation (DBEF), and related shrublands, of varied species composition and height. Areas exposed to the wind, and salt spray (windward side) were less than 6 feet in height (tight-knitted dwarf vegetation). Dominant species include, *Jacquinia keyensis* (Joewood), and *Coccoloba uvifera* (sea grape) and *Bursera simaruba* (Gum elemi)

4.3.2 Vegetation Map

A Vegetation map at ***Figure 4.26*** below highlights the distinct vegetation types found on the project site. The dominant type of vegetation found consisted of the Dry Broadleaf Evergreen Formation.

n

***Figure 4.2**: Vegetation Map depicting the distinctive vegetation type (Upland Broadleaved Evergreen Ecosystem) found on the project site (DBEF)*

4.3.3 Vascular Plant Diversity

Based on survey analysis, a total of sixty-eight (68) species was identified from the site ***(Table 4.1).*** There is a high probability that this number does not represent all the species on site, nor the ornamental plants. One can conclude however, that the list is a fair representation of the extent of the diversity on the property.

TABLE KEY:	
Nativity	**Regulation**
N = Native	P = Protected
I = Invasive	U = Unprotected by local legislation

Table – 4.1: Vascular plant species recorded on property

Botanical Name	Common Name	N	NN	P	I
Bidens alba	Shepherd needle		√		
Bursera simaruba	Gum Elemi			√	
Caladium bicolor	White spindle flower		√		
Cassytha filformis	Love vine	√			
Rhynhcospora floridensis	White-top sedge		√		
Sabal palmetto	Sabal palm			√	
Salvia greggii	Native sedge	√			
Schinus terebinthifolia	Brazilian pepper				√
Sideroxylon salicifolium	Willowbustic	√			
Casuarina equisetifolia	Causarina				√
Ipomoea indica	Morning Glory		√		
Leucanthemum vulgare	Wild Oxe-Eye Daisy	√			
Mucuna pruriens	Monkey Tamarind		√		
Ricinus communis	Castor Bean Plant		√		
Senna bicapsularis	Sennas (Christmas Bush)		√		
Toxicodendron radicans	Poison Ivy	√			
Petitia domingensis	Wild Guava	√			
Trema lamarckiana	Pain-in-the-back	√			
Priva lappulacea	Cats Tongue	√			
Lantana involucrata	White Sage	√			

Carex polystachya	Caribbean Sedge		√		
Urochloa mutica	California Bay Grass		√		
Adiantum capillus	Maiden Hair Fern		√		
Eugenia axillaris	White Stopper		√		
Tabebuia bahamensis	Five Finger	√			
Coccoloba uvifera	Hawaiian Sea Grape		√		
Simarouba glauca	Paradise Tree			√	
Pteridium aquilinum	Bracken Fern	√			
Pithecellobium keyense	Rahms Horn	√			
Pilocereus millspaughii	Wild Fig		√		
Chrysobalanus icaco	Cocoa Plum	√			
Passiflora edulis	Passionflower Vine	√			
Agave millspaughii	Agave			√	
Smilax havanensis	Chainey Briar		√		
Vachellia choriophylla	Cinnecord	√			
Strumpfia maritima	Mosquito Bush		√		
Senna occidentalis	Wild Coffee	√			
Stachytarpheta jamaicensis	Rats Tail		√		
Guapira discolor	Short Leaf Blolly			√	
Echites umbellatus	Devils Potato		√		
Leucaena leucocephala	Jumbay		√		
Coccoloba diversifolia	Pidgeon Plum	√			

Bromeliaceae spp.	Bromiliad		√		
Smilax havanensis	Chaney Briar		√		
Chiococca alba	Snowberry		√		
Metopium toxiferum	Poison Wood		√		
Opuntia cochenillifera	Prickly Pear		√		
Tara vesicaria	Brasiletto			√	
Mucuna pruriens	Monkey Tamarind		√		
Ficus maxima	Fig Tree		√		
Radermachera sinica	China Doll		√		
Guapira obtusata	Long Leaf Blolly	√			
Phyllanthus epiphyllanthus	Rock Bush		√		
Lasiacis divaricata	Bamboo Grass		√		
Thouinia discolor	Silver Leaf		√		
Alvaradoa amorphoides	Alvaradoa		√		
Salvia arborescens	Caribbean Sage		√		
Waltheria indica	Sleepy Morning		√		
Heliotropium angiospermum	Cat Tongue	√			
Ficus aurea	Golden Wild Fig		√		
Picramnia pentandra	Snake Root		√		
Pisonia aculeata	Haul Back	√			
Melicoccus bijugatus	Guinep Tree		√		
Carica papaya	Papaya Tree		√		
Ipomoea pes-caprae	Railroad Vine			√	
Leucothrinax morrisii	Thatch Palm			√	

Pseudophoenix sargentii	Buccaneer palm			√	
Scaevola taccada	Hawaiian sea lettuce				√

Figure???

4.3.4 Protected Tree Species Identified

A total of nine (9) protected species were identified from field surveys, including endemic or endangered, threatened, cultural. Historical and economic significance. ***(Table 4.2).***

Table – 4.2: Protected Species Recorded on Property

Botanical Name	Common Name	Status
Agave millspaughii	Agave	EET
Bursera simaruba	Gum Elemi	CHE
Cocothrinax argentata	Silver top palm	CHE
Guapira discolor	Small Leaf Blolly	CHE
Ipomea-pes-caprae	Railroad vine	CHE
Pseudophoenix sargentii	Buccaneer palm	CHE
Leucothrinax morrisii	Thatch Palm	CHE
Sabal palmetto	Sabal Palm	CHE
Tara vesicaria	Brasiletto	CHE

Key: EET = Endemic, Endangered or Threatened. CHE = Cultural, Historical and Economic

SUMMARY OF PLOT DATA

KEY:
A **DAFO** score method **(D=dominants, A=abundant, F=frequent, O=occasional, R=rare)** was recorded for each species presence. Species cover (%) were recorded within each quadrat (plot).

Plot 1 – (25°21'30"N 76°29'04"W) Consisted of a coppice forest with rocky terrain (honeycomb rock) on a high slope, covered with tree litter.

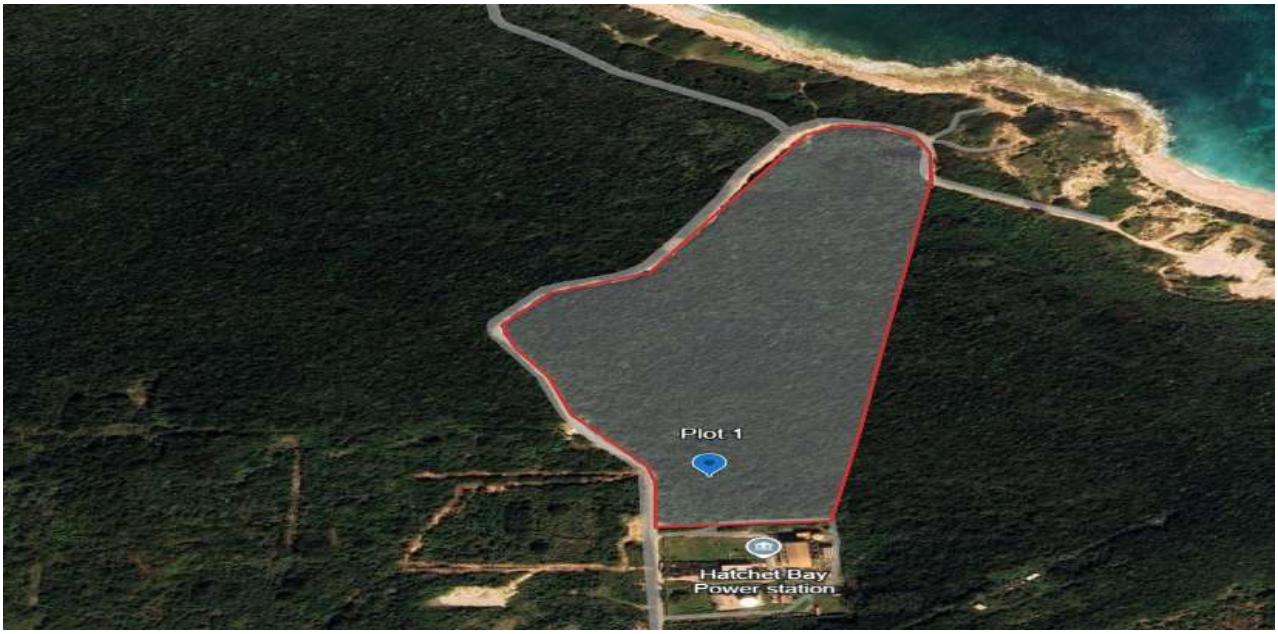


***Figure 4.3**: Showing Location of Plot 1*

Species Name	Species Presence	Species Cover
Gum Elemi	D	80%
Sabal Palm	F	10%
Silver Palm	F	10

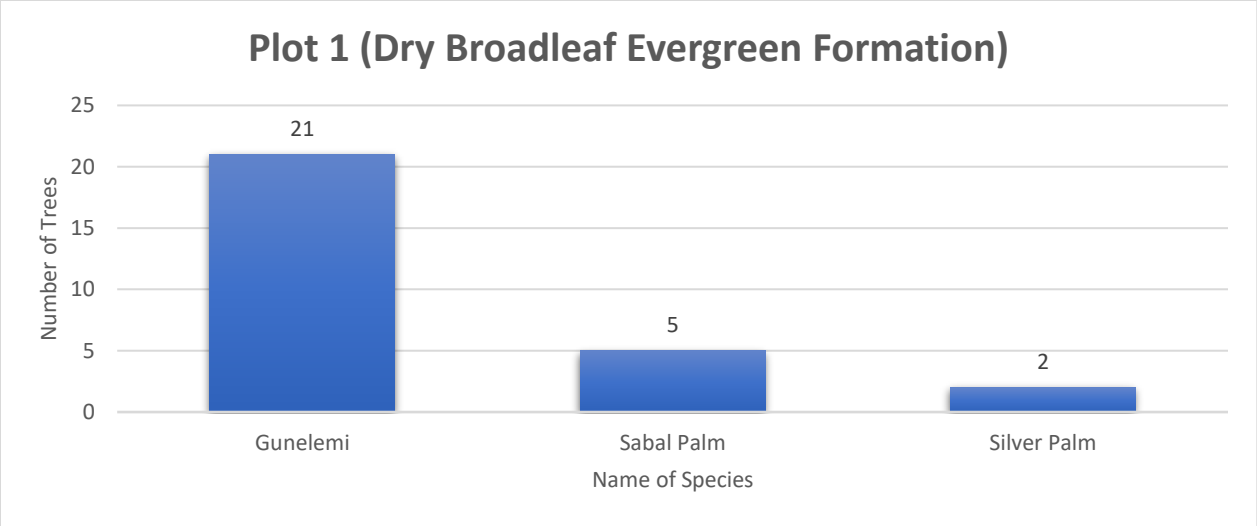


Figure 4.4: Graph of protected species found

Figure 4.5: Thatch palm

Figure 4.6: Air Plant

Figure 4.7: Leaf Litter on Topography

Figure 4.8: Honeycomb rock found on terrain.

Plot 2 – (25°21'34"N 76°29'04"W) Consisted of a coppice forest filled with dead standing Haul Back (*Pisonia aculeata)* trees. Terrain consisted of honeycomb rocks and tree litter on the ground.

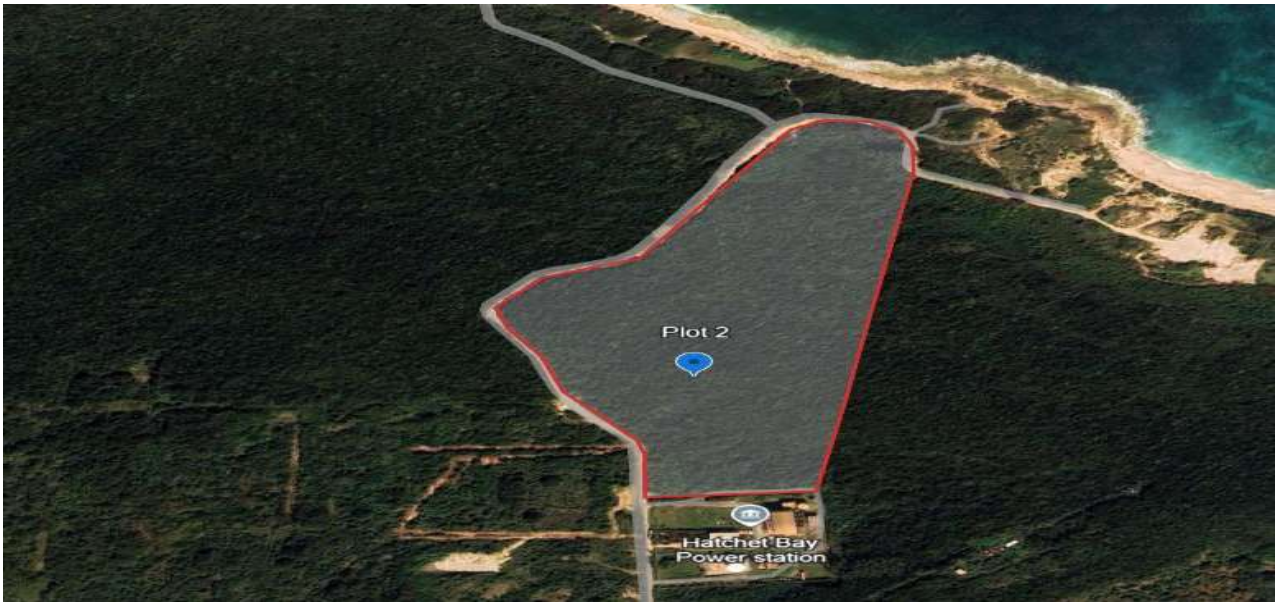


Figure 4.9: Showing Location of Plot 2

Species Name	Species Presence	Species Cover
Thatch Palm	D	80%
Silver Palm	O	5%
Gum Elemi	O	5%
Mahogany	F	10%

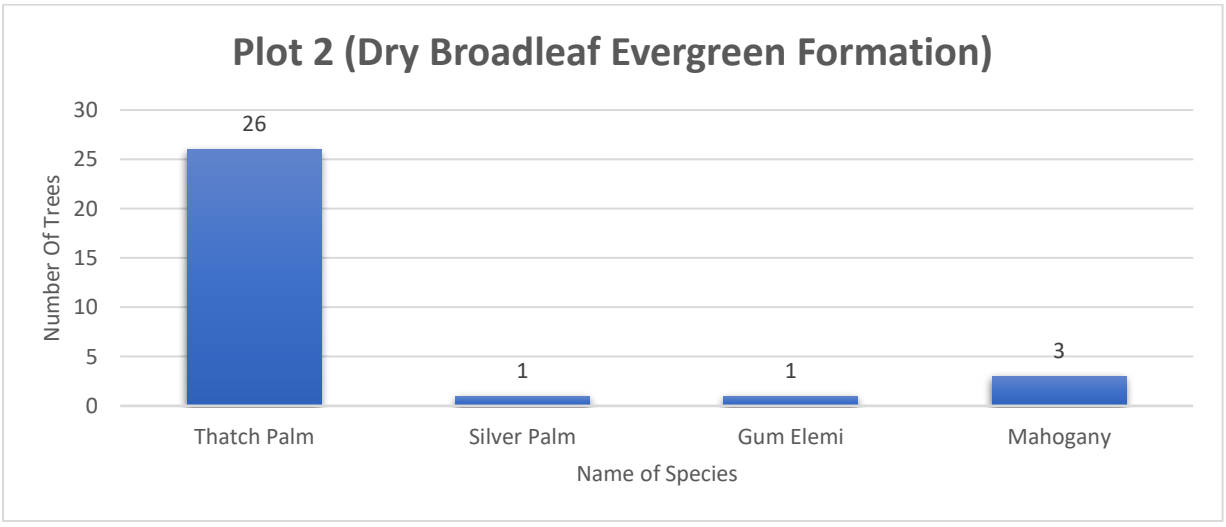
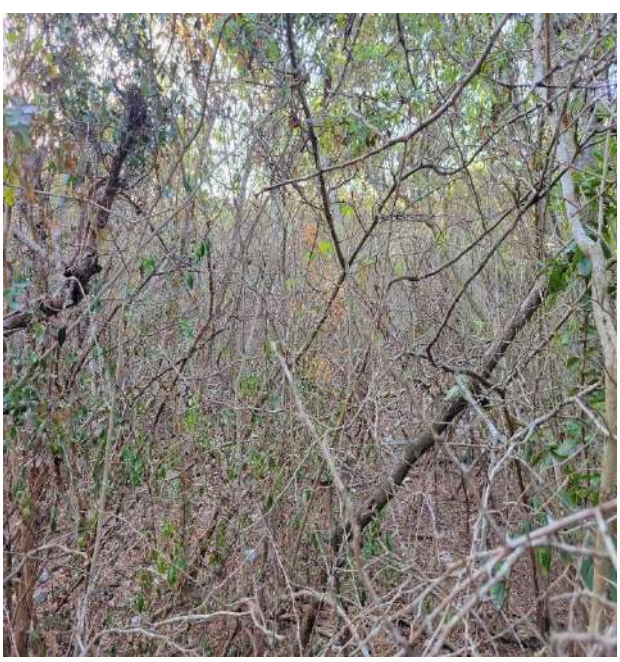


Figure 4.10: Graph of Protected Species found




Figures 4.11a & b: Showing Haul Back Dominated Plot.


Figures 4.12a & b: Showing juvenile thatch palms scattered on forest floor.

Plot 3: (25°21'40"N 76°29'01"W) Consisted of a coppice forest with Gum Elemi trees dominating the overstory with high canopies. Leaf Litter on the floor was abundant and little undergrowth was present.

Figure 4.13: Showing location of Plot 3

Species Name	Species Presence	Species Cover
Gum Elemi	D	70%
Thatch Palm	A	20%
Buccaneer Palm	F	10%

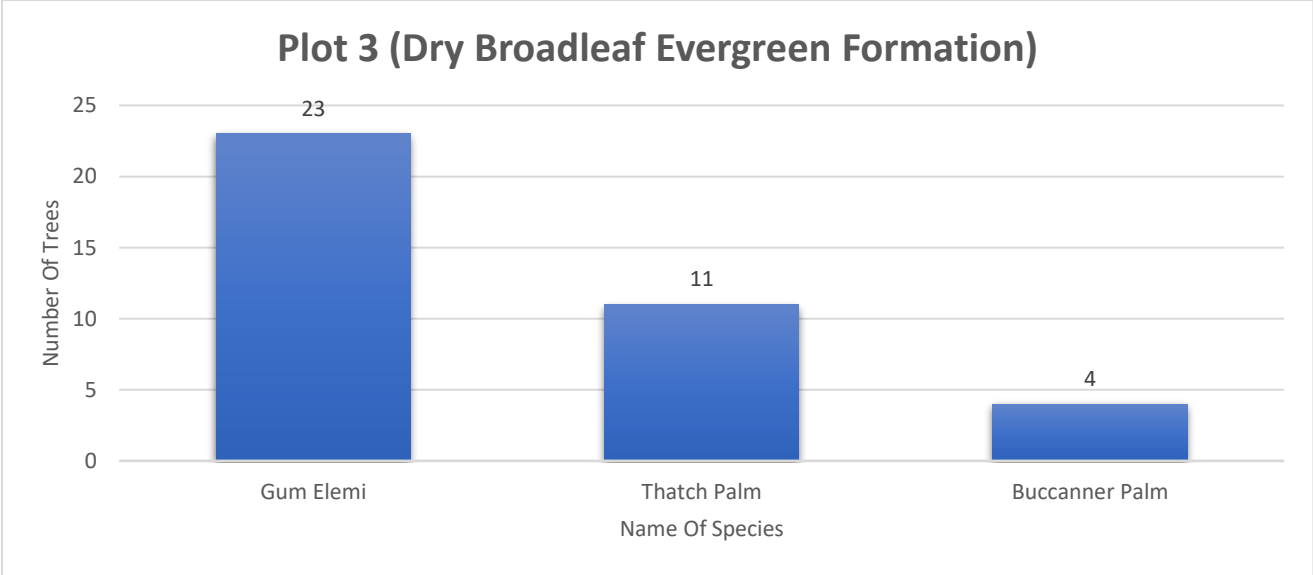


Figure 4.14: Showing Graph of Protected Trees

Figure 4.15: Showing Gum elemi in tree canopy

Figure 4.16: Showing interior of plot

Figures 4.17: Showing leaf litter topography

Figure 4.18: Showing Agave Plant

Plot 4 – (25°21'44"N 76°29'00"W) Consisted of a coppice forest on a high elevation with diverse species. Floor is covered in tree litter and honeycomb rocks are abundant along with sinkholes.

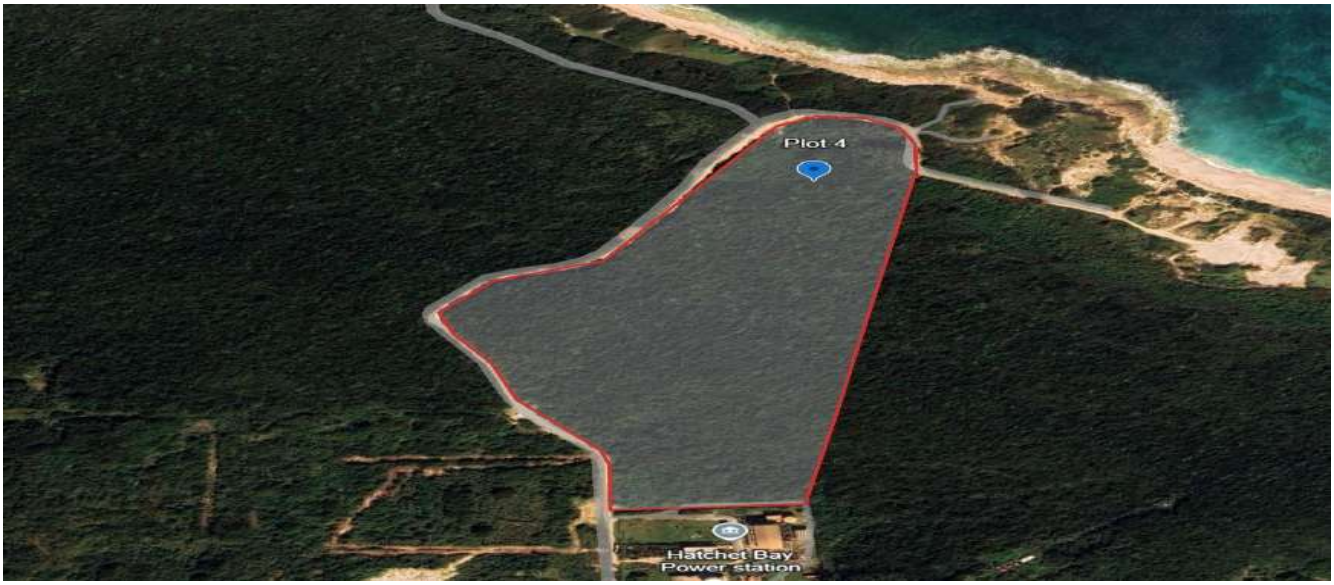


Figure 4.19: Showing location of Plot 4

Species Name	Species Presence	Species Cover
Gum Elemi	D	70%
Thatch Palm	F	15%
Buccaneer Palm	O	5%
Sabal Palm	O	5%
Silver Palm	R	5%

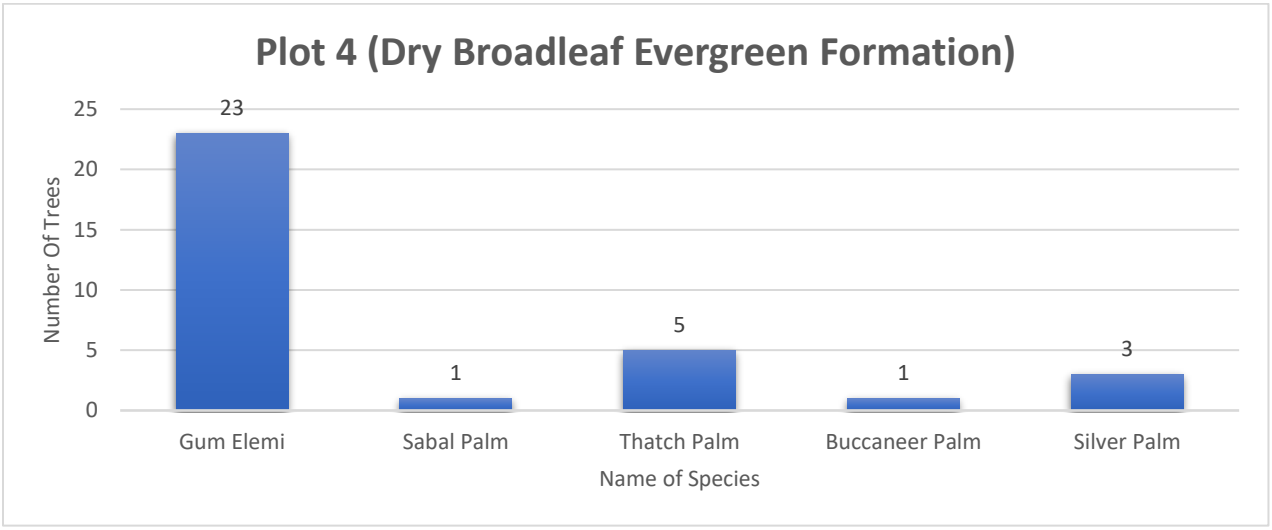


Figure 4.20: Showing Graph of Protected Trees

Figure 4.21: Air Plant on Gum Elemi

Figure 4.22: Prickly Pear

Figures 4.23a & b: Honeycomb Rock Formation

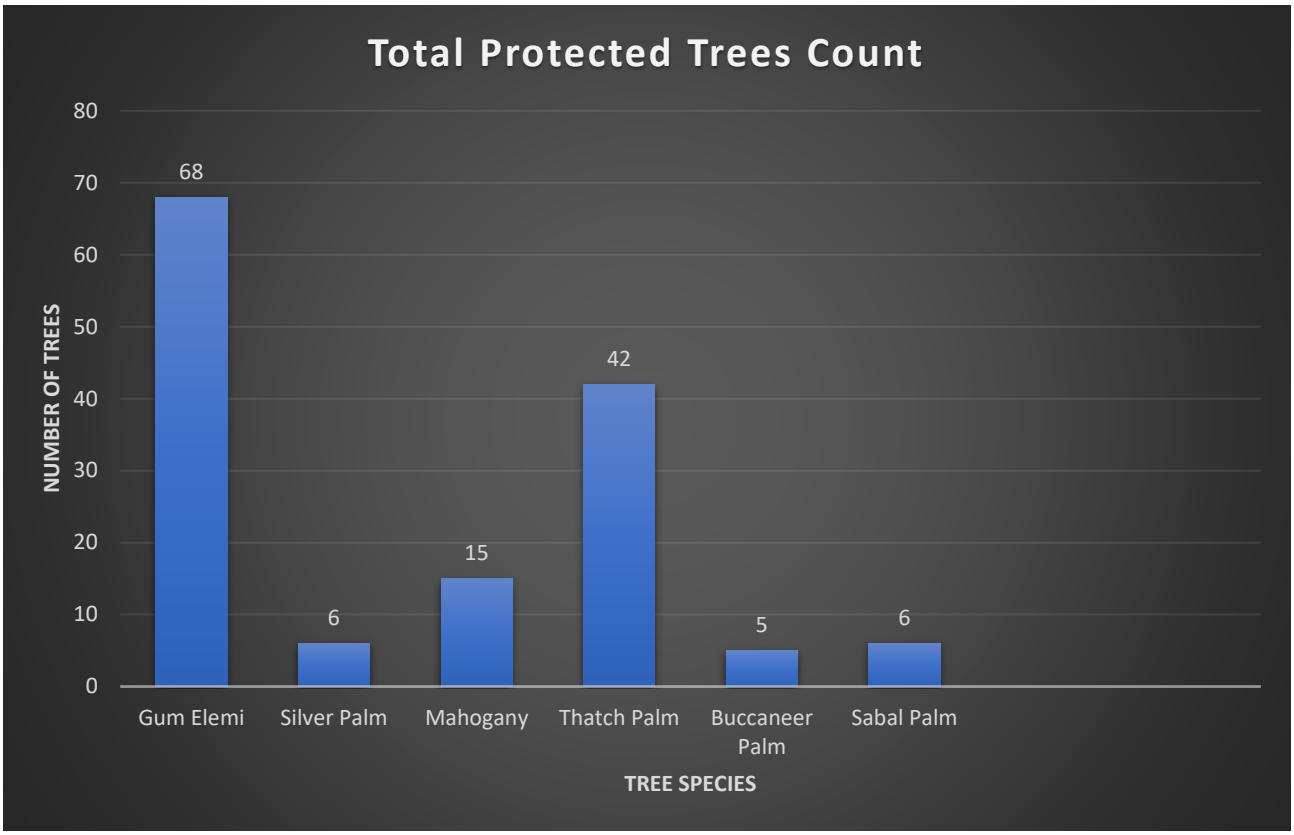


Figure 4.24: Graph Showing Total Protected Tree Tally

Conclusion

Based on the data collected, the **total** number of protected trees for the total 32 acres is projected at **19,095.**

	Total	Average Number of Trees
Gum Elemi	340	10200
Silver Palm	17	495
Mahogany	15	450
Thatch Palm	210	6300
Buccaneer Palm	25	750
Sabal Palm	30	900
Total	**637**	**19095**

4.3.5 Invasive Species

A total of three (3) invasive species was observed and listed ***(Table 4.3)***. The National Invasive Species Strategy (2013) outlines recommendation for effective management of all invasive species.

Table 4.3: Invasive species listed and found on the project site

Botanical Name	Common Name	Presence on Site	Recommendations for Control *
Casuarina equisetifolia	Causarina	A few individuals within the interior upland area.	Control
Scaevola taccada	Hawaiian sea lettuce	Numerous individuals along the perimeter edge	Eradication
Schinus terebinthifolia	Brazillian Pepper	Found in patches throughout the parcel	Eradication

Figure 4.25: *Australian Pine (Casuarina equisetifolia) found on the northern upland of project site.*

4.4 Avian Assessment

Five avian surveys were conducted on 20 – 24th January 2025 to identify the presence, abundance and habitat utilization of the avian species found within the boundaries of the project site.

4.4.1 Methodology

The assessment comprised five days of active avian observations, commencing at 7am to 4pm each day. The number of species were recorded in the abundance categories, Single (1), Few (2 – 10) and Many (11 – 100).

Final abundance estimates were compiled. The IUCN categories were used to determine the Status of each species identified. **Table 4.4** below shows the comparison of species observed for the Winter survey sessions periods, respectively.

4.4.1.1 Avian Survey Results

A total of ten (10) species was recorded during the summer session, and a total of Eleven (11) species recorded during the winter session. **(Table – 4.4)**

Table – 4.4: Avian observations – (Winter Sessions)

TABLE KEY		
Range	**Status**	**Habitat**
PRB = Permanent Resident Breeding	**LC** = Least Concern (Conservation – IUCN)	**FW** = Freshwater
WRN = Winter Resident Non-Breeding	**NT** = Near Threatened (Conservation – IUCN)	**IU** = Interior Upland
SRB = Summer Resident Breeding	**E** = Endemic	**HA** = Human Altered
	I = Introduced	**FO** = Fly Over
		CS = Coastal Shore
		RS = Rocky Shore
		SS = Sandy Shore
		TF = Tidal Flats
		W = Wetlands
		S = Saline

Common Name	**Scientific Name**	**Range**	**Status**	**Observation Winter Session – 20-24th January2025**	**Habitat Utilization**	
Cat bird (Gray)	*Dumetella carolinensi*	PRB	LC	M	FO/IU	
Ground dove	*Colombina passerine*	PRB	LC	M	FO	
Bahama Mocking bird	*Mimus gundlachii*	PRB	LC	M	IU/FO	
Palm warbler	*Dendroica palarum*	PRB	LC	M	IU	
Prarie Warbler	*Setophaga discolor*	PRB	LC	M	IU	
Smooth billed Annie	*Crotophaga ani*	PRB	LC	M	IU	
Bananaquit	*Coereba flaveola*	PRB	LC	M	IU	

Yellow Rumped Warbler	*Setophaga coronata*	WRN	LC	F	FO	
Osprey	*Pandion haliaetus*	PRB	LC	F	FO	
Red Legged Thrush	*Turdus plumbeus*	PRB	LC	M	FO/IU	

Figure 4.26: Bahama Mockingbird

Figure 4.27: Red Legged Thrush

Figure 4.28: *Osprey*

Figure 4.29*: Yellow Rumped Warbler*

4.4.1.1.1 Range

The geographical area where birds are consistently found is referred to as its Range. Birds classified as Migrant have seasonal range, whereas restricted species on some islands or in a region year-round.

- **Permanent Resident Breeding (PRB)**: refers to resident refers to species that live and breed all year round throughout the Bahamas. On the project site the predominant avian species identified included the Gray Cat Bird (*Dumetella carolinensi)* Smooth Billed Annie (*Crotophaga ani)* and Bananaquit (*Coereba flaveola).* Nine of the ten species found were PRB.

- **Winter Resident Non-breeding (WRN):** refers to the annual non-breeding fall/winter (generally October to April) migrants to the Bahamas from North America. The majority of the WRN birds leave by the end of April to their home states during spring or summer. One species (Yellow Rumped Warbler) was observed during winter session survey.

- **Summer Resident Breeding (SRB)**: refers to species that breed in the Bahamas during the summer months (April to October) then return to other regions the rest of the year. SRB include both land and the sea birds. No SRB species were observed during the survey.

4.4.1.1.2 Endemic Species

Birds found in the Bahamas are referred to as Endemic. The Bahama mockingbird *(Mimus gundlachii)* was the sole endemic species observed.

4.4.1.1.3 Conservation Status

a. **Protected species**: All species observed are protected under the Wild Birds Protection Act Chapter 249 (Statue Law of The Bahamas).

b. **Endangered:** None of the species recorded are classified as endangered.

c. **Species of Concern**: Near Threatened (NT) by the IUCN classifies a species that may be considered threatened with extinction soon, although presently not qualified for the threatened status. No species recorded were identified as threatened.

4.4.2 Habitat Utilization

a. Interior Upland

All land birds were recorded in the upland vegetation, where food sources appear to be more in abundance, including bird species that are insectivore species, fruits, and seed eaters.

4.4.2.1 General Discussion

The dominance of the PRB species during Avian surveys confirms the adaptation of the species to sites of high biodiversity, abundance of food resources and the varied vegetation types for roasting and breeding purposes. Species abundance is correlated with size of the site, where on larger sites greater abundance of species is likely, versus small sites. The variation in habitat, supports the varied species normally associated with shorebirds, wading birds, waterfowl, and land birds. The avian species found on the project site are indicative to what was expected on the mainland of Eleuthera.

4.5 Biodiversity Assessment

In addition to the Botanical and Avian studies, any animals, insects, reptiles, amphibians, and other living creatures observed, were recorded as either Single (1), Few (2 – 10) or Many (11 – 100). **Table 4.5** provides a summary of the observations. **Figures 4.35 to Figures 4.38** below depicts photos captured of observed species.

Table 4.5: Summary of observed wildlife from project site

Common Name	Scientific Name	Abundance
Orange Butterfly	*Colias sp.*	M
Black Dragon Fly	*Trames sp.*	M
Blue Tailed Lizard	*Leiocephalus sp.*	M
Crab Spider	*Thomisidae sp.*	M

Brown Anole	*Anolis sagrei*	F
Common Snail	*Cornu aspersum*	F
Feral Cat	*Felis catus*	M
Cow	*Bos taurus*	M
Racoon	*Procyon lotor*	F
Bahamian Brown Racer Snake	*Cubophis vudii*	F
Termite	*Isoptera sp.*	M
Hermit Crab	*Paguroidea sp.*	M
Paper Wasp	*Polistes dominula*	M

***Figure 4.30**: Brown Anole Lizard*

***Figure 4.31:** Cow Grazing*

***Figure 4.32**: Crab Spider*

***Figure 4.33**: Brown Wasp Nest*

4.6 National Parks and Protected Areas

There are numerous and highly significant National Parks and Protected areas within Eleuthera.

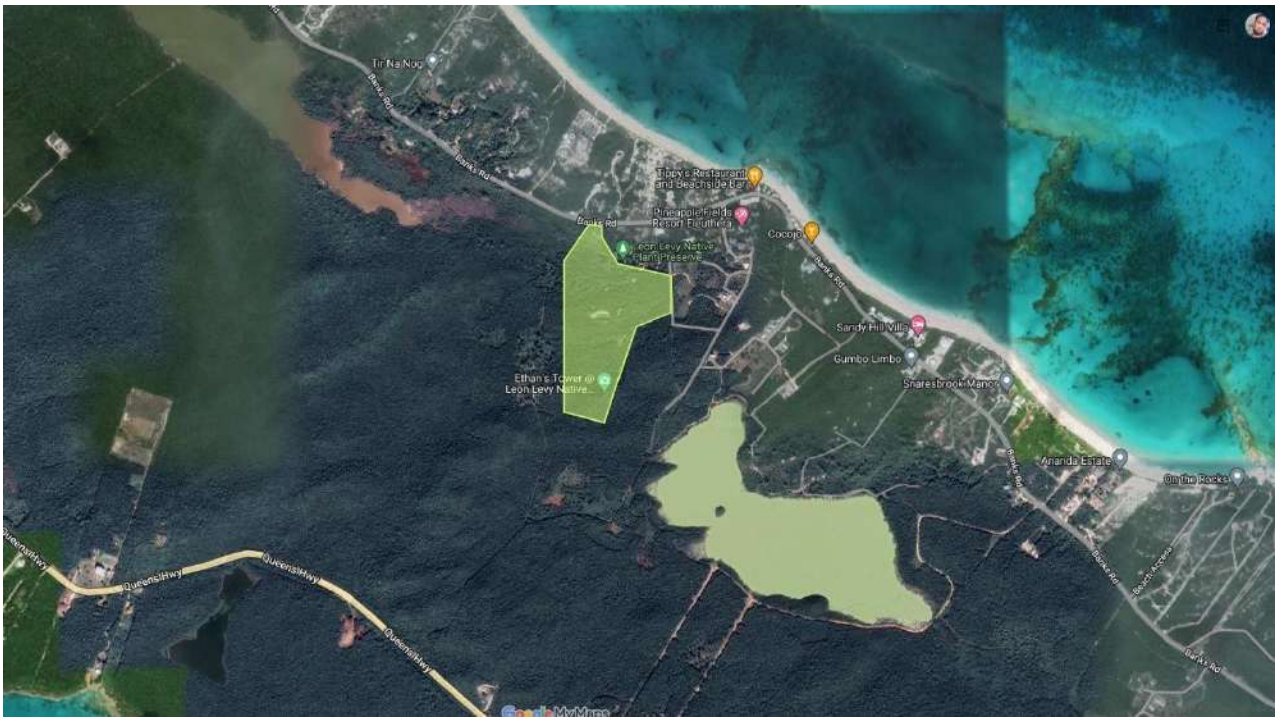


Figure 4.34: *Depicts the location of the Leon Levy National Park and its boundaries (Source: BNT General Management Plan – MHCNP, 2019).*

4.6.1 Leon Levy (LLNP)

Hatchet Bay Eleuthera (Project site) is situated near various National Parks and Protected Areas. The Leon Leavy National Park as well as Botanic Garden comprising some 30 acres, was established in 2009, as part of the Bahamas National Trust (BNT) system of national parks, to protect the intrinsic value of the terrestrial environment surrounding Governor's Harbor Eleuthera.

Key elements of the park showcase ecological diverse habitats and activities such as visiting bird hotspots, attractions, freshwater wetland, mangrove boardwalks and trails, so that all who visit can be fully immersed within the environment

Other notable National l Parks and Protected areas situated in Eleuthera are summarized in **Table 4.6.**

Table 4.6: Protected Areas within Eleuthera, and their extent.

Name	Island	Acres	Type	Managing Entity
Leon Levy National Park	Eleuthera	2o	Terrestrial and Plant Reserve	BNT
Cedar Cay	Eleuthera	5	Wild Bird Reserve	Min. of Env. & Natural Resources
Finley Cay	Eleuthera	12	Wild Bird Reserve	Min. of Env. & Natural Resources
Water Cay	Eleuthera	7	Wild Bird Reserve	Min. of Env. & Natural Resources
Wood Cay	Eleuthera	15	Wild Bird Reserve	Min. of Env. & Natural Resources

Edwin's Turtle Lake Marine Reserve	Eleuthera	NA	Marine Reserve	Min. of Env. & Natural Resources

4.7 Socio-economic Aspects

The Hatchet Bay power plant site is currently undeveloped property consisting of natural dry broadleaf evergreen formation stands which are homogenous throughout. Access to the property is by land transportation (motor vehicle) to the existing Hatchet Bay Power Plant, and by foot. The existing road network is of gravel construction. The remainder of the site is in its original natural vegetative state.

4.7.2 Population

According to the Bahamas (2022) Census, the population of Eleuthera is approximately 9,104, with North Eleuthera (location of proposed site) holding about 3,247.

4.7.3. Economy

Eleuthera's economy is based on a combination of industries, including agriculture and tourism (the main form of economic stimulus)

4.7.4 Transportation

To move around in Eleuthera and its many cays there are multiple taxi services, and water taxis for tourist attraction sites. Eleuthera is also served by various air carriers, such as Bahamas air, Western Airlines, and other charters services. Residents may also have access to their own cars and tourists can rent a car to drive.

4.8 Cultural Resources

Cultural resources represent the national patrimony and are of interest, and include:

- Archaeological sites of pre-European native people
- Archaeological sites of European and recent cultures
- Ruins
- Historic structures
- Cemeteries and any human burial sites
- Landscape features and sites of traditional cultural importance

There are significant cultural aspects of the Bahamas that Eleuthera residents enjoy. Eleuthera has significant cultural landmarks and includes the famous glass window bridge, preachers cave, Spanish wells heritage site, plantation ruins, St Patrick's Anglican Church, Wesley methodist Church, Lighthouse Point and Ocean Hole and Anchor Bay. These sites have a historical significance that builds the culture of the Bahamas as we now know today.

The Lucayan Indians, the indigenous people of the Bahamas, left behind their presence in the form of living sites (villages), and sacred burial grounds (including caves). There was no evidence that these types of sites existed or were observed during site surveys to project site.

4.9 Touristic and Recreational Areas

The major tourist attractions that occur in Eleuthera are the annual Family Island Regatta where locals, and visitors migrate into North Eleuthera for a few days to watch the boat races, socialize and have a good time with friends and family. Along with the regatta, Eleuthera hosts a fish fry every Friday on Anchor Bay at Governors harbor.

Other tourist attractions in Eleuthera are the Pineapple Fest which occurs annually in Gregory Town. The annual Pineapple Festival is a celebration and appreciation to all of the farmers who work and toil so hard to harvest sweet, juicy, delicious pineapple every year. This event is a time for descendants and visitors to come together and enjoy good company, and entertainment.

4.10. Waste Streams

It is important to reference the fact that the sustainable management of waste requires an understanding of all sources of waste (i.e., solid and liquid).

4.10.1 Solid Waste streams

Project waste streams must be identified, and provisions made for timely removal. Work areas should be free from litter and construction debris. This will call for the erection of a designated dumpster or bin, with fixed schedules for disposal at a facility designated by the Department of Environmental Health Services (DEHS).

Sanitary receptacles should be emptied at regular intervals by a reputable sewage disposal company. Any hazardous waste, if identified, to be stored and disposed of in accordance with DEHS standards. All solid waste streams are directed to the Eleuthera landfill located on Palmetto Point, Eleuthera, The Bahamas.

4.10.2 Liquid Waste streams

All Liquid Waste Streams are collected via sewage and is directly managed by the Water and Sewerage Corporation (WSC) located in Governors Harbor, Eleuthera.

4.11 Utilities

4.11.1 Potable water

Potable water in Eleuthera is distributed and maintained by the Bahamas Water and Sewerage Company. It is anticipated that water supply for the power plant will be derived from ground water resources via deep wells.

4.11.2 Electricity

Overhead electrical lines will be erected to provide for tie into the main electrical grid system, with electrical supply by the Bahamas Power & Light Company. Once constructed and commissioned, the new power station will provide electricity onsite.

4.11.3 Fuel storage and distribution

There will be LNG storage, even where SPP is in use.

4.11.4 Construction & Material Sources

Whereas building materials (sand, limestone, etc.) are available in Hatchet Bay, to a limited extent, it is anticipated that most of the construction materials will be imported from the USA, China, to be stored and brought in by 40 - 80ft containers, prior to finally assembly on site.

5.0 Legal Aspects

All projects developed within the boundaries of the Commonwealth of the Bahamas are subject to compliance with national laws, regulations, international conventions, and guidelines. Additionally, Developers must consider, when relevant, mitigation measures, international financial guidelines, and world bank environmental, health and safety (EHS) guidelines

5.1 Local Legislation and Policies

Tables 5.1 and 5.2 depict the local legislations and policies that are relevant to the physical and natural environment and may apply to the project.

Table 5.1 highlights local legislations

Environmental Law, Regulation and Policy	Summary
Antiquities, Monuments and Museum Act, 1998	"An Act to provides for the preservation, conservation, restoration, documentation, study and presentation of sites and objects of historical, anthropological, archaeological and paleontological interest, to establish a national Museum, and for matters related therewith…"

Disaster Preparedness and Response Act, 2006	"An Act to provide for the effective organization of the mitigation of, preparedness for, response to and recovery from emergencies and disasters…"
Road Traffic Act, 1962	"An Act to declare, amend and codify the law relating to motor vehicles, and to provide for the regulation of traffic on roads and of motor vehicles…"
Agriculture and Fisheries Act, 1964	"An Act to provide for the supervision and development of agriculture and fisheries in the Bahamas…"
Fisheries Resources (Jurisdiction and Conservation) Act	An Act to make provision with respect to the conservation and management of the fishery resources of the Bahamas and to extend the limits of the jurisdiction of the Bahamas over such fisheries resources and for matters connected therewith…"
Water and Sewerage Corporation Act, 1976	An Act to establish a Water and Sewerage Corporation for the grant and control of water rights, the protection of water resources, regulating the extraction, use and supply of water, the disposal of sewage and for connected purposes…"
Building Regulations, 1971	An Act to regulate the construction, altercation and repair of buildings, provide for the re-instatement or removal of dangerous or dilapidated buildings, to authorize the publication of a building code and for purposes connected therewith…"
Environmental Planning and Protection Act, 2019	An Act to establish the department of environmental planning and protection; to provide for the prevention or control of pollution, the regulation of activities, and the administration, conservation, and sustainable use of the environment; and for connected purposes"
Environmental Planning and Protection (Extension of Application) Order, 2020	An Order to extend the Environmental Planning and Protection Act, 209 throughout the territory of the Bahamas, including every island and cay and to define procedures for proposed projects, monitoring and compliance, and the certificate of environmental clearance.
Environmental Impact Assessment Regulations, 2020	The regulations describe the procedure for proposed projects and requirements to apply and receive a Certificate of Environmental Clearance from the Department of Environmental Planning and Protections.
Bahamas Protected Areas Fund Act 2014	The Act establishes the BPAF as a Fund to ensure sustainable financing for protected areas in the Bahamas. The Fund allows for the solicitation of funds and donations from the Caribbean Biodiversity Fund, to fund protected areas in the country.
Conservation and Protection of the Physical Landscape of the Bahamas Act, 1997	An Act to make provision for the conservation and protection of the physical landscape of the Bahamas. The Act contains pats regarding administration, regulation of excavation and landfill operations, provisions governing dangerous excavations, landfill operations, quarries or mines, zoning of the Bahamas for the purposes of quarrying and mining operations, and general entries.
Environmental Health Service Act, 1987	"An Act to promote the conservation and maintenance of the environment in the interest of health, for proper

	sanitation in matters of food and drink and generally, for the provision and control of services, activities and other matters connected therewith…"
Environmental Health Services (Collection and Disposal of Waste) Regulations, 2004	Section 18 speaks to removal of construction waste and section 19 speaks to industrial waste disposal.
Forestry Act, 2010	An Act to provide for the conservation and control of forests and for matters related thereto;
Forestry Regulations, 2014	Provides for the application for a permit to harvest protected trees
Forestry (Amendment) Regulations, 2021	Amends the Forestry Regulations, 2014 to provide for reduced to be payable for royalties for the granting of licences, permits for the salvaging of damaged forest due to natural disasters, hurricane, or tornados.
Forestry (Declaration of Protected Trees) Order, 2021	An Order which increase the list of trees protected from a previous eleven (11) to some one hundred and twenty seven (127) trees/plants.
Planning and Subdivision Act 2010	The Act governs development and planning, both from a terrestrial and marine landscapes. It applies to both New Providence and the Family Islands and the Port area of Grand Bahama. While the Act is comprehensive, no formal land use plans have been developed
Wild Animals Protection Act 1968	The Act prohibits the taking, capturing, or hunting of any wild animal without a permit.
Bahamas Public Parks and Public Beaches Authority 2014	The Act allows the authority to control, plan, design, develop, administer, manage and maintain public parks and public beaches; to conserve their natural beauty and topography, propagate, protect, and preserve animals, plants and other organisms in those areas.
Bahamas National Trust Act 1959	The Act provides the BNT the mandate to promote the preservation of lands, buildings, underwater areas, and areas of natural interest. The Act also empowers the BNT to identify sites for protection and to administer areas declared protected; and manages national parks.
Wild Birds Protection Act 1959	The Act prohibits the taking, capturing, and hunting of any wild bird without a permit. It protects birds and eggs during the closed season. The Act also permits the Minister to establish wild bird reserves.

Table - 5.2. National Environmental Policies

Relevant National Environmental Policies	Summary
National Policy for Adaptation to Climate Change 2005	The policy outlines a framework to meet the goals and objectives of the United Nations Framework Convention on Climate Change (UNFCCC). Where the Bahamas committed itself to reducing greenhouse gases and address the impacts of climate change
National Invasive Species Strategy for the Bahamas, 2013	The initial policy was drafted in 2003, but subsequently updated in 2013, as part of a GEF funded project (MITIASIC) Mitigation the Threats of Invasive Alien Species in the Insular Caribbean; and sets out a

	management strategy for the control and eradication of invasive species
National Biodiversity Strategy and Action Plan, 1999	The Action plan calls the Bahamas to conserve biodiversity and pursue sustainable development. It further highlights the role of biodiversity in the social and environmental context and recommends measures to ensure its compatibility with future developments.

5.2 International legislation and Conventions of relevance

Table 5.3 depicts international conventions that are of relevance to the project, and regards must be made.

Table 5.3 International Conventions enforced in the Bahamas

International Convention/Organization	Summary
Cartagena Convention. Ratified: June 24, 2010	The Convention provides for the legal framework for cooperation in the wider Caribbean region. Three technical agreements apply: ● Protocol for co-operation in combating oil spills. ● Protocols for specially protected areas and wildlife (SPAW); ● Protocol concerning pollution from land-based sources and activities (LBS).
Convention on Biological Diversity. Signed: June 12, 1992	The convention has three main goals: ● Conservation of biodiversity. ● Sustainable use of components of biodiversity. ● The fair and equitable sharing of the benefits arising out of the utilization of genetic resources (ABS)
Convention on Wetlands of International Importance (RAMSAR Convention) Signed: June 7, 1997	Known as the RAMSAR convention. The convention provides the framework for the international protection of wetlands as contributors for avifauna which do not adhere to international borders.
Convention to Combat Desertification and Drought. Signed November 10, 2000	The Convention provides for sustainable development by addressing social and economic issues that directly impact land degradation.
United Nations Framework Convention on Climate Change. Signed: June 1992 Kyoto Protocol Signed: April 9, 1999 Paris Agreement Ratified: August 22, 2016	The Bahamas is a signatory to this convention. It establishes a framework with the aim to stabilize atmospheric greenhouse gases. The Kyoto Protocol was developed under the UNFCCC to provide emissions targets and timelines for developed countries. The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit

	global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

5.3 Government Institutions

Table 5.4 summarizes the key government and non-government policy and statutory agencies, their responsibilities relevant to the project with respect to aspects of approvals and permitting, and the EIA Process.

Table - 5.4: Key Governmental and Non-governmental Agencies with responsibilities

AGENCY	SUMMARY OF RESPONSIBILITIES
Bahamas Investment Authority (BIA)	● A "one-stop shop" agency to reduce bureaucratic delays for domestic and international investors, seeking Government approval for development projects in the Bahamas
Ministry of the Environment and Natural Resources (MTENR)	● To manage, protect and conserve all land, water, and other tangible resources of the Bahamas, and have regard to the environmental, economic, and social benefits that may confer on the Bahamas. ● Give advice on proposals from the private and public sectors that would significantly affect the Bahamas. ● Overseas conservation of wild animals, birds and plants, and forests. ● It administers the Wild Birds and Wild Animals Protection Acts.
Department of Environmental Planning and Protection (DEPP)	● To promote best practices in environmental management and to minimize harm to the

	environment. ● Administer the EIA process, coordinate the public review of EIAs, and various national plans for natural resource management. ● Promoting and enforcing compliance with the Environmental Planning and Protection Act, 2019
Forestry Unit (FU)	● Sustainable management, conservation, control, and development of the natural forest resources on state lands. ● Promotion and regulation of forest industries. ● Regulate the commercial utilization of the natural forest resources. ● Protection of trees that are rare and of historical significance.
Department of Environmental Health Services (DEHS)	● Environmental control, solid waste collection and disposal of domestic, commercial and construction waste ● enforcement of industrial regulation, public health guidelines, enforcing public sanitation. ● Evaluate the effectiveness of pollution control measures to protect the health and safety of workers. ● Issuance of effluent discharges and emission permits
Department of Fisheries (DOF)	● Oversees and enforces fisheries regulations and the establishment of Marine Reserves and Marine Protected Areas (MPAs)
Department of Local Government (DLG)	● Implements the provisions of the local government Act, thus ensuring sound and sustainable family island development
Ministry of Tourism and Aviation (MTA)	● Promotion of the tourism industry of the Bahamas

	• Encourage visitor arrivals by air and by sea throughout the Bahamas
Ministry of Public Works and Utilities (MPW)	• Overseas and maintains physical infrastructure in the country. • Responsible for building controls and Regulations
Disaster Recovery Authority (DRA)	• "Ensures that adequate preparedness and mitigation measures and response and recovery mechanisms are established to counteract the impact of natural, man-made and technological hazards…"
Department of Physical Planning (DPP)	• Administers the Planning and Subdivision Act, 2010, which includes the preparation of land use plans for the islands. • Controls development of the natural and built environments, via zoning.
Water and Sewerage Corporation (WSC)	• optimizes the development of the country's water resources and the water quality control. It shares with DEHS the responsibility for monitoring water quality. • Issue water supply franchises to developers, especially where the supply of water is impractical for the government or its agencies
Department of Labour	• Regulates Health and Safety under the Health and Safety at Work Act, 2002. • conducts inspections at workplaces to ensure adequate worker safety and regulations compliance
Bahamas National Trust (BNT)	• Established as a non-government entity (non-profit) by the BNT Act 1959. • To manage national parks and protected areas, historic preservation, public awareness, and environmental outreach

6. 0 Anticipated Environmental Impacts of the Proposed Project

6.1. Impact Assessment Methodology

It is important to recognize that development on small islands require a process of risk and impact assessment that is standardized and objective. These tools are accepted for impacts that involve:

- degradation of terrestrial and marine species
- Where land-based sources of pollutants are introduced, and
- freshwater and nutrients are introduced to the island hydrology

The appropriate tool in this circumstance will involve a series of questions and appraisal, ranking and then prioritizing the potential risks and hazards.

6.1.1 Assessment Criteria Tool

Qualitative Assessment Criteria will be used to rank a source of activity for its environmental impact. With each phase and component described, evaluated for impacts, then mitigation measures are outlined **(Tables 6.1, 6.2 and 6.3)**. Significance level overall will be measured as:

- **Significant** – high impact, sufficient intensity, and duration to generate significant change(s), predominantly irreversible naturally. Site affected in the long term.
- **Moderate** – an effect for a limited time over the affected area, site condition is temporary altered, naturally reversible in the medium term.
- **Negligible** – effect is barely evident, short duration, site not altered, naturally reversible in the short term.

6.1.2 Severity Criteria Tool

Severity of an environmental impact is another tool used to measure the magnitude of impact an event has on the environment. Severity is usually given the numerical rating of 1 for low impact, 3 for medium impact and 5 for high impact. Factors that are measured for severity would include negative effect on flora and fauna, impact on wildlife, effects on air and water, noise, visual, and short-term vs long term recovery of the environment, among others **(Table 6. 4).**

Table 6.1 Qualitative Assessment Criteria for Impact Assessment

Qualitative Criteria	Choices	Description
Nature	• Direct • Indirect	Does origin/source activity Directly or Indirectly act on the environmental target (species or natural community)

Type	• Positive • Negative	Positive implies species or natural community will have a higher likelihood of persistence with increase viability Negative implies the opposite
Likelihood	• Not Likely • Potential • Certainly	Not Likely – 10% chance of impact occurring. Potential – 10 to 70%. Certainty – impact has greater than 70% chance of occurring.
Scale	• Specific habitats • Island environs • Regional • National or internationally	Restricted to specific habitats. Impact that impacts the entire Island of Eleuthera. International Impacts refer to CITIES species
Duration	• Temporary • Long-term	Temporary – impacts that last less than three years. Long-term – more than three years
Reversibility	• Reversible or • Irreversible	Reversible – impacted species or natural communities will recover. Irreversible – species or natural communities lost to project site, and impact should be mitigated

6.2. Impacts to the Physical Environment

Pre-construction/construction activities and project operation activities being reviewed as part of the impacts are outlined below:

1.0 *Pre-Construction/Construction Phase*:

- Site preparation and construction of Infrastructure:
  - Clearing of vegetation
  - Basic infrastructure solar panels for electricity generation
  - Installation of water and sewage infrastructure.
- Construction of building foundations, walls structure, etc.

2.0 Project Operation Phase:

- Property Management
  - Landscaping maintenance
  - Invasive species management
  - Pest control

6.2.1. Impact Assessment for Site Preparation and Infrastructure Development and Power Plant Assembly

Table 6.2: Summary of impact matrix developed for site preparation and infrastructure development (Hatchet Bay Power Plant, Eleuthera Island)

Qualitative Criteria	Choices	Description
Nature	Direct	Direct impact on 32 acres for new road infrastructure, power plant infrastructure and solar panels erection
TYPE	Positive	With loss of some protected species (broadleaved), overall impact of site preparation will be negative for extended period. ➢ Application for permit waiver to harvest protected trees will be made to the Forestry Unit, Ministry of the Environment and Natural Resources.
	Negative	Significant areas of natural upland vegetation will be lost during site preparation and construction of plant infrastructure.
Likelihood	Certainty	Impacts and benefits will be the result once actions outlined are completed
Scale	Habitat – broadleaved evergreen forest.	Restricted to local area of power plant. Protected tree species will be loss. Relocation of protected species is recommended where practicable.
	Island Environs	Removal of Invasive Species (Australian Pine – casuarina, and Hawaiian scaevola), will reduce seed sources on the island
Duration	Long Term	Native plant communities will be stabilized in the adjacent area, outside area of impact in the long term
Reversibility	Irreversible	Natural ecological processes will not be restored. Mitigation measures will be necessary.
Overall Significance	Negligible	Site conditions are altered to a significant extent.

Table 6.3 summarizes the environmental impacts that are likely to occur for the Hatchet Bay Power Plant project, based on the Severity of Impact Criteria

Table - 6.3: Summary of Environmental Impacts based on Severity

Factor	Severity of Impact	Impact Description
Terrestrial	5	Removal of 90% of existing vegetation and nine (9) protected trees species for infrastructure, building footprint, will impact the natural

		landscape, resulting in the loss of existing vegetation.
Biodiversity (wildlife)	5	Due to the high footprint of the project development, the associated biodiversity (i.e., land animals, birds nesting sites) displacement impact is high. Hence biodiversity impact is expected to be high, given the significant change in land use for construction footprint of buildings, solar panels and other related infrastructures.
Avifuana	3	Noise levels generated by project activities may deter birds from utilizing sites temporarily, and birds and animals may return once construction activities are completed.
Visual and Aesthetics	3	Construction of the power plant will enhance the visual and aesthetics of the Hatchet Bay Power plant project, given the low density of the nearby community and their locations, and eventual removal of all construction waste. Debris not removed adequately and timely, impairs the visual and aesthetics of the site for extended periods.
Hydrological	1	Fuel, chemical spills, improper use of hazardous waste on project site can pollute groundwater resources. Proper spill management procedures are in place to remediate this. The completed structures are not expected to have an adverse impact to the water resources. Based on the projected land use the impact of the project on the groundwater resources is determined to be LOW | LONG TERM.
Erosion/Sedimentation	1	Whereas there will be foundational footing for the power plant and associated structures there is the potential for some soil erosion and sedimentation at these footings. However, the risk of higher levels of erosion will be minimized, as such, the current drainage and runoff characteristics will not be changed. Retention of vegetation buffers around periphery of site will reduce likelihood of soil erosion and sedimentation.
Air Quality	3	Construction activities and use of associated equipment can generate significant volumes of dust that impair the air quality, and impact human health. There will be need to employ adequate management techniques to reduce impact to human health.
Noise	3	Noise levels tend to rise during construction activities, that disturb birds and animal species. Birds are likely to be displaced and leave the area, particularly where there nesting sites are disturbed. Human health is impacted by elevated noise levels. According to the CDC (2019), prolonged loud noise level exposure above 70dB may cause hearing damages.
Solid & Hazardous Waste	3	Solid waste that is not adequately disposed of can be an eyesore. In the case of hazardous waste, these can pose a threat to wildlife, and human health through attracting pests which are disease vectors.

		Hazardous waste not properly managed can also result in penetration into the soil, groundwater resources and marine environment (pollution).
Occupational Health and Safety	5	There are the risks of workers not wearing protective personal equipment (PPE). Additionally, the risk is high for the improper use of equipment and materials and non-compliance to standard safety protocols and procedures. Consequently, there could be physically damages and potential loss of human lives.
Fire & Hurricane	5	Hatchet Bay (project site) comprises predominantly of dry broadleaved evergreen formations, and silver thatch palms, which naturally shed leaves. Hence the forest floor can be covered with leaf litter and provide fuel in the event of a fire. Further, once humans are introduced to uninhabited areas, the risk for fires is likely to increase, especially when fires are intentionally lit, not controlled, or managed properly. As the Bahamas falls within the North Atlantic Hurricane Belt, with the season commencing June 1 to November 31. The risk of the Elizabeth Island (Ki'ama project) being affected by a hurricane in any given year is relatively high. Hence the need for a Hurricane Preparedness and Recovery Plan.

6.3 Socio-economic Impacts

Table 6.4 below summarizes the socio-economic impacts that are likely to occur from the power plant project, based on the Severity of Impact Criteria

Table - 6.4: Summary of Socio-economic Impacts based on Severity Criteria

Factor	Severity of Impact	Impact Description
Land Use	5	Any development that brings change to the natural landscape will impact that landscape to a certain degree. The existing land use for the project site is undisturbed. The development of the Hatchet Bay Power Plant project will require the removal of 90% of the natural vegetation.
Economic (beneficial)	3	EA Energy Limited through the Hatchet Bay Power Plant Project anticipates contributing to the revitalization of Eleuthera as one of the world's top touristic destinations, as a place for vacation, but also a conduit for economic growth and development. They will do this by prioritizing local job creation through

		employment and indirect services to be retained and skill development with Bahamian talent central to long term operations. Projected investment in the Hatchet Bay project is pegged at forty-five million dollars ($45,000,000.00). Employment of 45 to 60 Bahamian construction workers for one to two years. The overall economic impact on Eleuthera will be significantly positive and will contribute to a positive turn around in the tourism sector.
Cultural	1	No cultural resources were identified during field studies, and hence no impacts.

7.0 Proposed Mitigation Measures

Mitigation is how negative impacts identified are minimized, offset, or averted. This can be achieved through project design, restoration of disturbed areas, operational techniques, preventative management plans, and compensation for unavoidable impacts.

Table 7.1 below summarizes the mitigation measures recommended to minimize or eliminate any negative environmental impacts that may arise during power plant project development cycle.

Table - 7.1: Summary of Environmental Mitigation Measures

Factor	Mitigation Measures
Terrestrial	➢ Establish a buffer 25 to 50 feet wide of natural vegetation along the boundary of site to serve a windbreak (in the event of a tropical storm/Hurricane event) ➢ Removal of all the invasive casuarina species Australian Pine (*Casuarina equisetifolia*) and Hawaiian Sea Lettuce *(Scaevola taccada)* ➢ In areas where landscaping is being undertaken to plant native and endemic species. ➢ Staff will be trained in the identification of protected trees.
Biodiversity	➢ Retention of vegetation buffer zone to serve as biodiversity corridor for wildlife species. This action will minimize negative impacts to adjacent vegetation and associated biodiversity.
Avifuana	➢ Once all construction activities are completed, with reduced noise levels, it is expected that birds will return.

	➢ Adequate natural vegetation areas exist in the vicinity of project site where birds can forage and roast. ➢ Staff will be trained in the importance of birds, and not to interfere or harm the species in their natural environment.
Visual and Aesthetics	➢ Proper management and timely disposal of solid waste. ➢ Ensure land clearing is keep to a minimum (footprint of buildings). ➢ Use only native and endemic plant and tree species within landscaped areas of the development. No invasive plant species to be established on property.
Hydrological	➢ Adequate fuel and chemical management practices on site would ensure ground water resources are not negatively impacted. ➢ Baseload plant requires treated water for the closed cycle water cooling system. Water for this cycle will be gathered from artesian wells on site or from the connection point of existing power plant border. ➢ Water treatment capacity will not be higher than 2m3/h. Regarding any required drainage well structures: standard 150-foot drainage wells may be utilized, once sufficient hydraulic head is present to transfer flows down the well. The depth to the water table is typically 12 to 15-Ft below ground level (BGL), and minimal hydraulic head is required for the flows down the cased well. Sufficient hydraulic head should exist for natural drainage purposes, using 8 to 10-Inch well casing***. (Bowleg, 2025)*** ➢ Storm surge effect to the solar structures is considered to be LOW - MODERATE | LONG TERM. All structures proposed to be set at a minimum elevation of +20Ft above the existing high sea water elevation. However, design calculations should confirm both the minimum wind load exposure, and orientation for all structures (e.g. Solar panels).
Erosion/Sedimentation	➢ Retention of vegetation buffer around the site boundaries would limit risks of soil erosion and sediment washout once land clearing activities commences. ➢ Flooding due to extreme rainfall events | excessive surface runoff, along with storm surge can be deemed a minor concern for the project area(s) [LOW – MODERATE | LONG TERM]. An optional mitigation mechanism for the potential flood hazard / to minimize surface runoff, is to maintain a natural vegetative cover – thus, assisting to prevent runoff to the marine zone.
Air Quality	➢ Employment of BEST practices with regards to construction methods, to minimize emission of dust that can impair air quality. ➢ Maintain construction equipment to ensure air quality is not

	impaired. ➢ Parameters for air quality monitoring will need to be determined, once plant is up and running, to ensure air quality meets national and internation standards.
Noise	➢ Construction workers will wear appropriate PPE (i.e., earplugs or earmuffs). ➢ High Noise levels will cause animals and birds to migrate elsewhere, however once construction activities are completed the animals and birds will return.
Solid and Hazardous Waste	➢ Solid waste generation will be limited to construction waste, and vegetation removal from road and residence footprint. ➢ Vegetation removed will be reused/mulched for landscaping purposes ➢ Solid and hazardous waste will be placed in containers and properly disposed of (removed to the mainland of Eleuthera Landfill Site) in accordance with Department of Environmental Health Services (DEHS) regulations and standards. ➢ Invasive species debris along with construction waste to be disposed to avoid inadvertent spread to other parts of Eleuthera.
Fire and Hurricane	➢ Prepare a Fire Control and Prevention Plan, with detail steps to prevent, contain and control fires during construction and operation the residential resort (to include firebreaks and no smoking areas). ➢ All residences and associated buildings will follow fire requirements of the Bahamas Building Code. ➢ A Hurricane Preparedness and Contingency Plan will be developed in the event the island is impacted by a storm or hurricane (to include evacuation protocols, emergency and health provisions and recovery strategies).
Occupational Health and Safety	➢ All workers will be provided appropriate Protective Personal Equipment (PPE). ➢ All workers will receive training in the proper handling of equipment, before starting work on property. ➢ There will be regular enforcement of occupational health and safety protocols on a weekly basis.

8.0 Public Consultation Process

Public Consultation exercise will be conducted under the auspices of the Department of Environmental Planning and Protection, and in accordance with the EIA Regulations, 2020

9.0 Environmental Management Plan (EMP)

An EMP will be prepared for the project (drafted as a Standalone Document) and will cover the mitigation measures and monitoring. A draft outline and components are cited below. The EMP will be fully developed following No Objection to the EIA. Upon receipt of the No Objection to the EMP, the project will be issued a Certificate of Environmental Clearance (CEC) by the Department of Environmental Planning and Protection (DEPP). The CEC issuance would allow construction activities for the project to commence.

Executive Summary

A summary of the development project and proposed mitigation measures outlined

1.0 Introduction

Overview of project and location. Objectives of the EMP and scope with respect to mitigation measures

2.0 Project Description

Project is described, with location, inclusive of project master plan

3.0 Organization Chart and Communication Plan

4.0 Register of Significant Environmental Aspects

5.0 Environmental Legislation

6.0 Proposed Mitigation Measures

Mitigation measures are detailed as in project EBA, specifically in relation to the following:

6.1 Coastal
6.2 Hydrological
6.3 Erosion/Sedimentation
6.4 Air Quality
6.5 Noise
6.6 Solid and Hazardous Waste
6.7 Fire and Hurricane
6.8 Terrestrial
6.9 Ecology & Biodiversity
6.10 Occupational Health and Safety

7.0 Environmental Monitoring

7.1. Environmental Monitoring Checklist

7.2. Environmental Reporting

8.0 Conclusions

Conclusions remarks on implementing recommended mitigation measures

9.0 References

Citation of reference materials used in EMP preparation

10.0 Emergency Response Plans

10.1. Hurricane Preparedness and Recovery Plan

10.2 Health and Safety Plan

10.3. Fire Control Plan

10.4. Invasive Species Control Plan

11.0 Appendices

10.0 Conclusions Regarding Environmental Acceptability of the Proposed Project

Detailed and comprehensive baseline studies were undertaken in the assessment of the existing botanical, avian and biological resources of the Hatchet Bay Power Plant Project site on Eleuthera. The result is an environmental baseline assessment (EBA) document which details the impacts the development and associated infrastructure will likely have on the natural pristine environment.

With a projected capital investment of $45,000,000, it is anticipated that the economic impact for Eleuthera will be boosted significantly. This boost will include new construction jobs, new, and new permanent jobs on the Island. The long-term sustainable effect will be a positive impact for the economy of Eleuthera

It is anticipated that with proper planning, application of BEST management practices, and Mitigation Measures outlined in the EBA, incorporated within a comprehensive Environmental Management Plan (EMP), if conscientiously implemented, will minimize in the short-term any negative impacts identified from project development through to operations.

11.0 Recommendations

The following recommendations are highlighted below to underscore and reinforce the significance of understanding the measures necessary at minimizing the negative impacts on the existing environment, from the project development stages on to the operational phase.

a) Ensure that BEST management practices are employed during the construction phases, including practices that prevent soil erosion and sediment runoff.
b) The water resources (and groundwater lens configuration) in the vicinity of the project site(s) can best be described as fresh to brackish water. Additional hydrological assessments may be required for the varied phases of the development, to ensure that no possible contaminants from the existing (adjacent) fossil fuel generation sites can possibly migrate to the proposed solar sites (via conduits, trenches, pipelines, etc.).
c) Flooding due to extreme rainfall events | excessive surface runoff, along with storm surge can be deemed a minor concern for the project area(s) [LOW – MODERATE | LONG TERM]. An optional mitigation mechanism for the potential flood hazard / to minimize surface runoff, is to maintain a natural vegetative cover – thus, assisting to prevent runoff to the marine zone.
d) Ensure permit/waiver to harvest protected tree species is applied for and received from the Forestry Unit (Ministry of the Environment and Natural Resources), prior to any on site land clearing activities.
e) Planting and establishment of only native species within new landscape areas.
f) Maintenance of the 25 – 50 feet natural vegetation buffer around property boundary thus ensuring continued biodiversity conservation and enhancement
g) Remove invasive species (Australian pine and Hawaiian sea lettuce) from the human altered areas and the shorelines, in accordance with the National Invasive Species Strategy.

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13.0 Appendices

Appendix – A

Eleuthera Island Concept Design Report – Power Plant

ILTEKNO ADVANCED TECHNOLOGY - POSITIVE ENERGY	Bahamas Family Islands Project	CONSUS	
PROJECT CODE: ENGG24007	Eluethera Island Concept Design Report	Rev.: 03	Page 1 of 25

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Appendix A - Eleuthera Hourly Load 2022-2023_vF_Consus

Appendix B: General Layout of the Plant

Appendix C: Layout of Baseload Power Plant and Section View

Appendix D: General Flow Diagram of the Plant

Appendix E: Electrical Single Line Diagram of the Plant (Eluethera Power Plant SLD)

Appendix F: Automation Topology

Appendix G: The Bahamas Family Islands Grid Code-1-29-25

Appendix H: Grid Code Deviation List (including Grid Code Simulation of Genset)

Appendix I: Detailed Single Line Diagram of BESS

1 PROJECT AIM AND INTRODUCTION

This report outlines the concept design of Eluethera Island for provision of a baseline for the Power Purchase Agreement between Consus Energy and The Government of the Commonwealth of the Bahamas the Ministry Energy & Transport ("MoE") and Bahamas Power and Light Company ("BPL").

1.1 Project Location

Project to be performed on Eluethera Island belonging to Commonwealth of the Bahamas which lies 80km east of Nassau. It is long and thin island with 180 km (110 miles) long and in places little more than 1.6 km (1.0 mile) wide.

1.2 Selected Project Area

There are two alternative locations provided by BPL for the Eluethera site location which are located in Hatchet Bay and Rock Sound Areas. As the main electric production activities are performed in Hatchet Bay and the main load demand in the island is met from this location, the Hatched Bay has been selected as the Project area.

Reference Document BPL Site Report dated 27 May 2024

The Project area is next to the existing Hatchet Bay power station and this is also evaluated that the operational flexibility would be higher compared to Rock Sound area.

For the Hatchet Bay area, total area of 32 acres is provided by BPL. The project location has been shown as below;

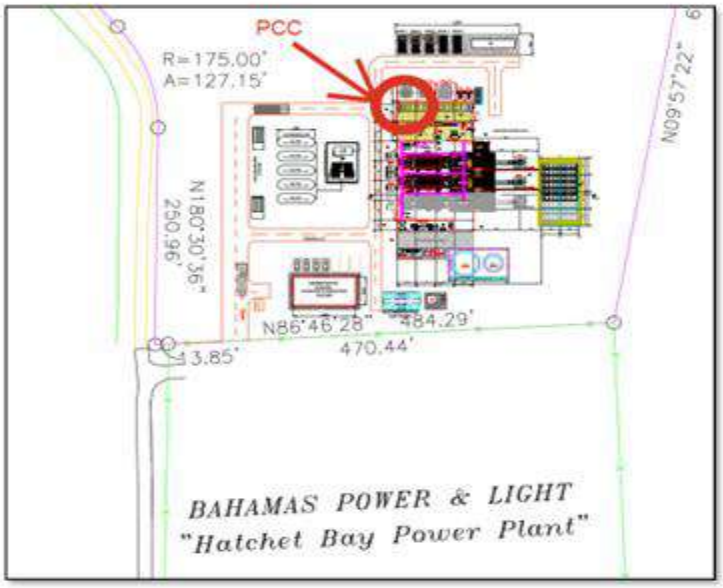
1.3 Water Resource and Soil Conditions

According to the existing information by Consus Energy, the water would be supplied to the Power Plant by artesian wells to be drilled within Project location or the water could be supplied BPL from the existing power plant. The supply of water and the terminal point with the water parameters shall be discussed with MoE during the PPA signature stage.

Soil investigation study will be performed together with the topographical survey in order to verify the soil condition.

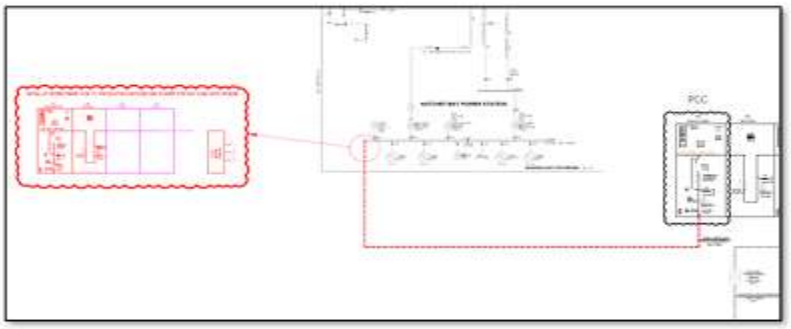
1.4 Grid Connection

The Project's Point of Common Coupling (PCC) will be the outgoing cubicle of the Plant, where the location of the PCC is shown in below figure;



Plant's measuring will be done in the measuring MV cell located in the PCC and protection systems will also be located in the same location.

Point of Interconnection (POI) to the existing Hatchet Bay Power station to be performed by others where the connection is shown in red below.



Gensets design to follow BPL Grid Code 2019 (reference Appendix G) except for the grid code deviations specified in the "Grid Code Deviation List" document Appendix H.

1.5 LNG Supply

Based on the decision by Consus Energy for operational health and safety considerations, LNG storage will not be performed on Project area with ISO containers. Instead of ISO containers storage, permanent LNG storage tanks is to be considered on the concept design with 10 days stock capacity according to the daily average electricity supply requirement.

However, as this is a concept design, the details of LNG supply shall be further discussed with LNG supplier. The supply and storage of the LNG shall be further clarified and subject to change based on the health and safety regulations and/or CAPEX and OPEX costs.

1.6 Emission Requirements

Specification provided by Consus Energy does not contain the requirements for the exhaust gas and effluents.

Reference Document : RFP Micro Grids Family Island FINAL Draft 4 Dec 23

As per the information by Consus Energy, the Environmental Impact Assessment report to be performed for the Project based on the approval of concept design. In this regard, exhaust and effluent emissions to be evaluated in later stage.

However selected Genset's exhaust gas emissions are in accordance to the World Bank 2007/2008 guidelines issued by IFC / World Bank with the "Environmental, Health, and Safety General Guidelines" in April 2007 and "Environmental, Health, and Safety Guidelines for Thermal Power Plants" in December 2008.

1.7 Noise Requirements

Together with the EIA report, noise requirements will also be established.

1.8 Fire-Fighting Requirements

Local fire-fighting requirements will be checked during the implementation stage of the Project. For the existing concept design, 250m³ fire water tank considered together with one diesel and one electrical fire-fighting pumps with redundancy.

1.9 Waste Water System

The following waste water systems are to be treated on-site before discharged;

a. Oily Water – After separation collected oil & waste sediments to be discharged and/or treated by Others

b. Domestic Water (Sewage) Treatment – After biological treatment waste sludge to be discharged and/or treated by Others

2 PROJECT CAPACITY SELECTION

Capacity selection studies have been performed based on the hourly production rates of Hatchet Bay, Rock Sound and Harbour Island power plants.

Reference Document Abaco Hourly by MoE

For the capacity selection one year hourly data is considered to be evaluated. In this regard, production data has been studied and some months hourly data was missing (April, May, June and September). For these months correlation study has been performed and provided in the

Appendix-A of this report. According to the correlation study, yearly demand has been foreseen as 78,935 MWh and the production rates summarized below;

Eluethera Hourly Demand Analysis (MW)	
Avarage Generation (MW)	9.0
Maximum Generation (MW)	26.2
Total Generation Hours smaller than 1 MW	86
Total Generation Hours between 1-4 MW	445
Total Generation Hours between 4-8 MW	1904
Total Generation Hours between 8-10 MW	3477
Total Generation Hours between 10-12 MW	2071
Total Generation Hours between 12-14 MW	583
Total Generation Hours between 14-16 MW	177
Total Generation Hours between 16-20MW	12
Total Generation Hours between 20-24MW	2
Total Generation Hours between 24-30MW	3

For the initial configuration studies, the requirement from MoE specification outlined below considered;

"Renewable Energy Component: Each proposed system must incorporate a renewable energy component of 30% to 50% or more."

Reference Document : RFP Micro Grids Family Island

For the selection of configuration, analysis performed according to below operation criteria;

a. MAN Gensets low load operation is taken as the 10% of the capacity
b. In case Solar production available, the produced energy will supply the grid
c. In case the Solar production is not sufficient for covering the demand, the Gensets will start to operate to supply grid. After having the load on one Genset, if the demand is higher than one Genset's 90% load, second Genset will start to operate and these Gen-sets will be operated on load sharing mode.
d. In case the Gensets and Solar Plant's capacity is not enough to support the grid, exist-ing battery capacity will be utilized for supporting the grid for emergency cases.
e. Based on the selected configuration and hourly demand, the required battery running hours and capacity selection performed.

f. Under normal operation, batteries will be utilized as spinning reserve in order to keep the frequency of the Gensets constant.

The primary reason for selecting a baseload power plant is that, as the sole power producer on Eleuthera Island, it must ensure that the baseload capacity can meet the demand even during both planned and unplanned outages of the generators.

In this regard the baseload plant has been selected with 2 x 9,976kWe net output MAN 20V35-44 G model with total capacity 19.95kWe.

As per the requirement by the MoE specification for the renewable energy, following configuration selected;

1. 10 MWp Solar PV selected with AC output of 8.7 MWe
2. 1 x 5MWe (settable) AC usable power @ POI and 10.539 MWh AC usable power capacity @ POI Battery System

Battery storage system has been selected in 10MWe 0.5C (5MWe/10MWh) due to below reasons;

i. During any unplanned outage of any genset at baseload plant, in order to cover the response time of gas engines

ii. For covering the 5MWe of island demand alone for approximately two hours in case of any unplanned outage at the baseload plant

iii. In order to cover load steps of Genset due to the instant load profile change in the Island

In this regard the Plant configuration studied as follows;

19.5MWe Baseload + 10MWp Solar + 5 MWe Battery Storage Eluethera Power Plant

Via PVsyst software, hourly generation study performed for Solar Plant and according to the load profile provided by MoE for the 78,935MWh yearly production value, below results have been gathered;

i. Solar Power → 16,787 MWh production directly to the grid and capacity usage 22% whereas the surplus amount of energy to be utilized for filling the batteries depending on the load demand and forecast

ii. Gensets → 62,014 MWh production with 35.49% capacity usage

iii. Remaining 134 MWh demand will be covered with batteries where the demand is lower than the Gensets' low load limit

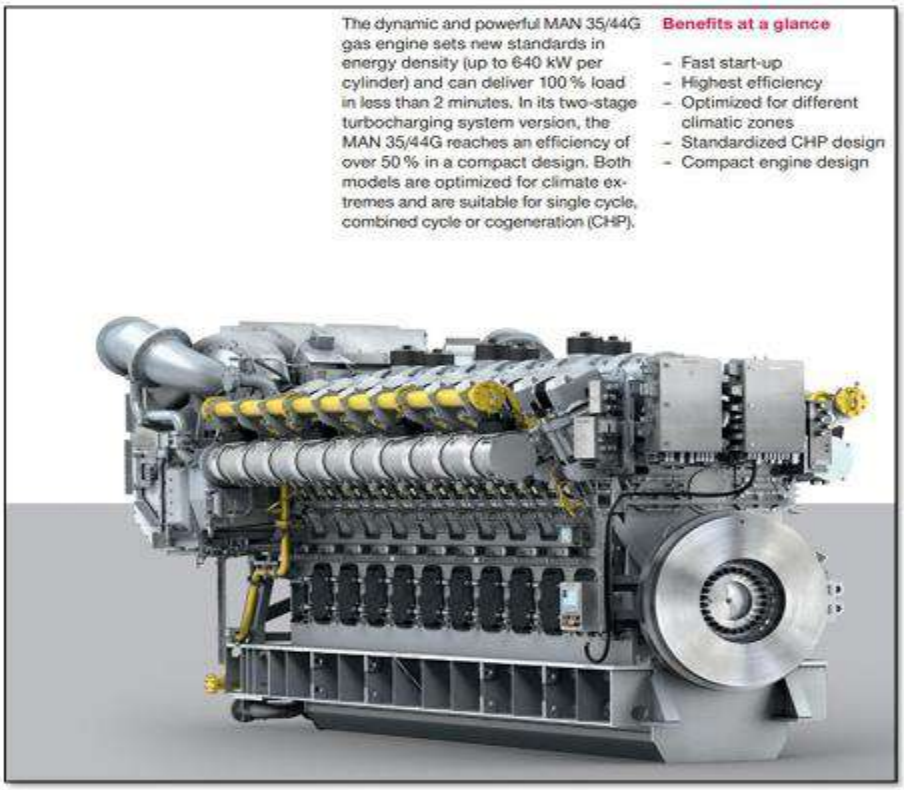
iv. Running hours of batteries is calculated as 214 hours

Based on the hourly production values provided by MoE, the selected capacity will be sufficient to provide reliable and constant electricity to the Island.

On top of that, to be able to meet the demand in future years, an additional one reserve Genset area will be considered in the layout studies together with its electrical and mechanical auxiliaries.

3 PROJECT TECHNOLOGY SELECTIONS

3.1 Gas Engines



According to the site-specific study of the MAN 35/44 Gensets' efficiency will be 48.5% at full load.

3.1.1 Main Benefits of MAN Gensets

- ✓ Higher efficiency compared to most Gensets
- ✓ Higher reliability and lower maintenance due to the low speed operation
- ✓ Via lean burn concept low NOx production and higher output with avoiding knocking

- ✓ Short power ramp up time 100% load within 8 minutes
- ✓ Continuous low load operation allowance up to 10% load
- ✓ High part load flexibility

3.1.2 Part Load Flexibility

Gensets are occupied with part load flexibility which can increase/decrease the load up to 30% within 5 seconds allowing operational flexibility in distributed power plants. Before an additional load step will be applied, at least 20 seconds waiting time after initiation of the previous load step needs to be considered.

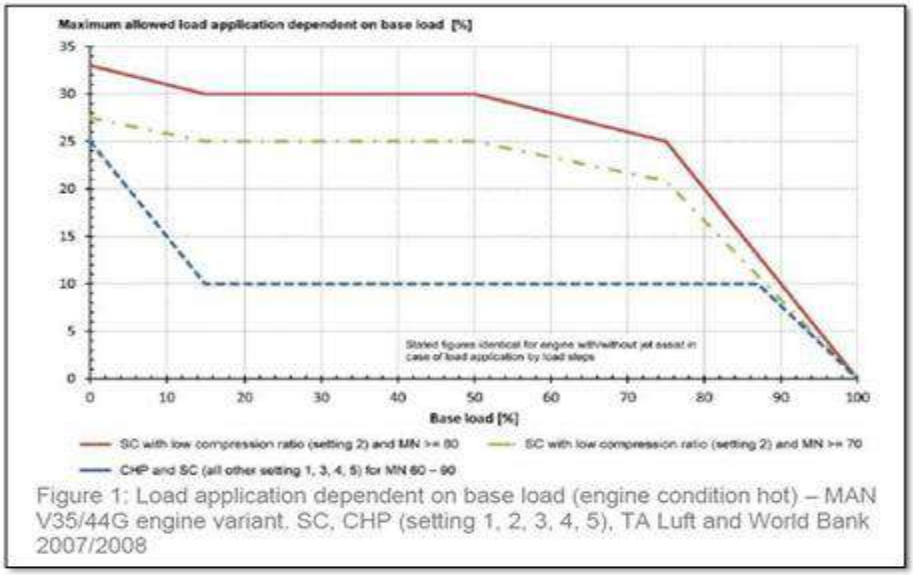


Figure 1: Load application dependent on base load (engine condition hot) – MAN V35/44G engine variant, SC, CHP (setting 1, 2, 3, 4, 5), TA Luft and World Bank 2007/2008

3.1.3 Maintenance Periods of Gensets

Gensets' stoppage periods for planned outages are as follows;

Maintenance Interval	No of maintenance until 48k	No of maintenance until 90k	No. of scheduled maintenance in the period	Maintenance duration in days	
				- engine - 1 shift work	- TC - 1 shift work
3,000			27	1	-
6,000	3	10	13	1	-
9,000	3	5	13	3	-
12,000	2	4	10	2	-
18,000	1	2	6	18	8
36,000	1	1	2	31	8
48,000	1	1	4	2	-
72,000		1	2	35	8
90,000		1	1	22	8
144,000			1	44	8
180,000			1	35	8

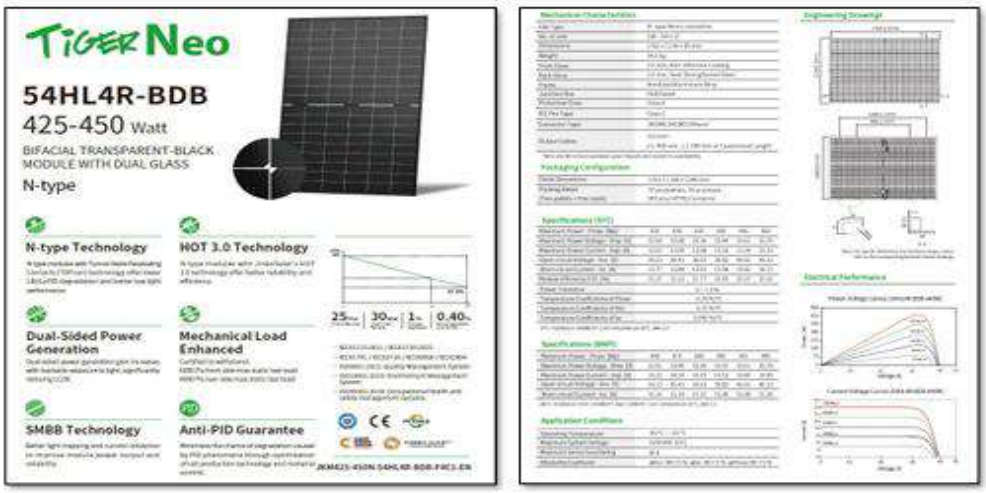
3.1.4 References of MAN 35-44 Engines

MAN Order Name	Power by installation total MW	kW norm per engine	No. of Engines	No. of cylinders	Engine Version	Engine Type	Fuel	Country of installation	Order year
ARMENIA	51.20	12,800	4	20	V	35/44GTS	Gas	Armenia	2022
SIPITANG	74.20	10,600	7	20	V	35/44G	Gas	Malaysia	2022
HI STEEL	81.60	10,200	8	20	V	35/44G	Gas	Iraq	2022
SEKUPANG	53.00	10,600	5	20	V	35/44G	Gas	Indonesia	2022
HKW KREUZSCHLAG	7.88	7,880	1	12	V	35/44G TS	Gas	Germany	2022
ISCHIGO	25.60	12,800	2	20	V	35/44GTS	Gas	Italy	2022
STADTWERKE SCHWÄBISCH HALL 2	7.88	7,880	1	12	V	35/44G TS	Gas	Germany	2020
EL MORON	106.00	10,600	10	20	V	35/44G	Gas	Bolivia	2019
HKW FRANKFURT (ODER)	53.00	10,600	5	20	V	35/44G	Gas	Germany	2019
MHKW CHEMNITZ NORD	25.80	12,900	2	20	V	35/44G TS	Gas	Germany	2019
MHKW CHEMNITZ NORD	64.50	12,900	5	20	V	35/44GTS	Gas	Germany	2019
MHKW ALTCHEMNITZ	25.80	12,900	2	20	V	35/44G TS	Gas	Germany	2019
MHKW ALTCHEMNITZ	38.70	12,900	3	20	V	35/44GTS	Gas	Germany	2019
MHKW JENA siehe auch 5305046 +LT	12.90	12,900	1	20	V	35/44G TS	Gas	Germany	2019
MHKW JENA siehe auch 5305046 +LT	51.60	12,900	4	20	V	35/44GTS	Gas	Germany	2019
STATERA SALTHOUSE SITE I	51.60	12,900	4	20	V	35/44GTS	Gas	United Kingdom	2019
STATERA SALTHOUSE SITE II	51.20	12,800	4	20	V	35/44GTS	Gas	United Kingdom	2019
NUTRIEN	77.40	12,900	6	20	V	35/44GTS	Gas	Canada	2019
STADTWERKE SCHWÄBISCH HALL	7.88	7,880	1	12	V	35/44GTS	Gas	Germany	2017
PRONAL	10.20	10,200	1	20	V	35/44G	Gas	Mexico	2017
ENBW GAISBURG	31.80	10,600	3	20	V	35/44G	Gas	Germany	2016
WYKES EXTENSION	10.60	10,600	1	20	V	35/44G	Gas	United Kingdom	2016
VW BRAUNSCHWEIG	10.60	10,600	1	20	V	35/44G	Gas	Germany	2012

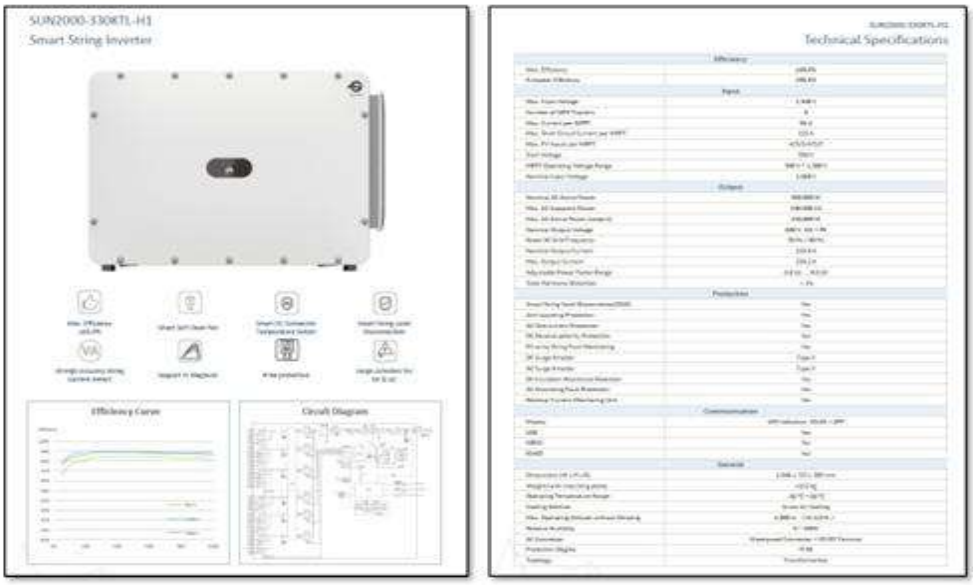
3.2 Solar Plant

The Solar Power Plant will consist of 22,272 x 450 Wp Half Cut Bifacial PV modules. These PV modules will be grouped into 1392 tables, each with 32 modules-1string. These strings will transmit the direct current generated by the solar panels to the inverters. 300 kWe inverters will be used in the project and these inverters will convert the incoming energy into alternating current at 800 Volts and transmit it to 4 main distribution panels. The main distribution panels will be positioned near the transformers and connected to 4 each 2750 kVA transformers. The voltage of 0.8 kV will be stepped up to 13.8 kV and the system will be connected to the distribution center.

"PV panels can be updated in the detailed design phase according to the detailed design of the SPP according to the structural analysis to be performed."



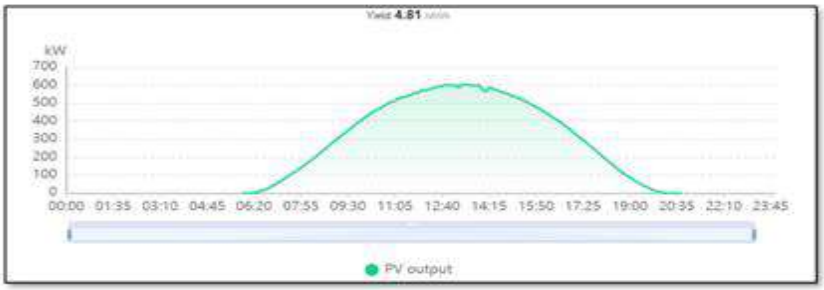
PV Modules: 22,272 x 450 Wp Half-Cut Bifacial PV Modules



Inverters: 29 x 300 kWe String Inverters

Bifacial PV modules that have transparent backsheets produce additional energy from the backside thanks to reflected solar irradiance. The PV Modules will be mounted with the optimum azimuth and tilt angles to maximize efficiency.

The system can be monitored instantly via Data Logger devices and any faults in the field can be detected quickly.



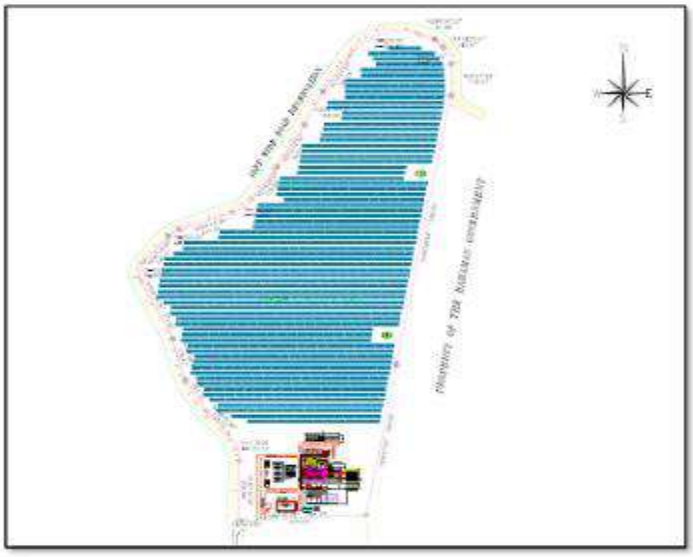
Daily Production Graph

Ground Mounting System: 1392 tables with 8x2 PV modules steel construction system

- Maximum strength resistance with double columns
- Suitable for vertical and horizontal design
- Applicable to all types of surfaces
- All connection elements are stainless

No	Product	Brand	Model	Quantity	Unit
1	PV Module	Jinko/JA/HT	450 Wp	22272	pcs
2	Inverter	Huawei/Sungrow	300 kW	29	pcs
3	Solar Mounting System	ISOTEC/STA/GMR	Ground Type - Steel	600	tons
4	Main Distribution Panel	ABB/Schneider/Siemens	800V	4	pcs
5	Transformer	Astor/Best/Eurospower	13.8/0.8 kV 50Hz 2750 kVA	4	pcs
6	DC Cable	Prysmian/Nexans/HES	1x6 mm2, 1x10 mm2 H1Z2Z2	121000	m
7	AC Cable	HES/Öznur/Hasçelik	1x150 N2XH	7830	m
8	AC Cable	HES/Öznur/Hasçelik	1x240 N2XH	720	m
9	AC Cable	HES/Öznur/Hasçelik	1x95/16 N2XSY	1650	m
10	AC Cable	HES/Öznur/Hasçelik	1x95/16 N2XSY	180	m

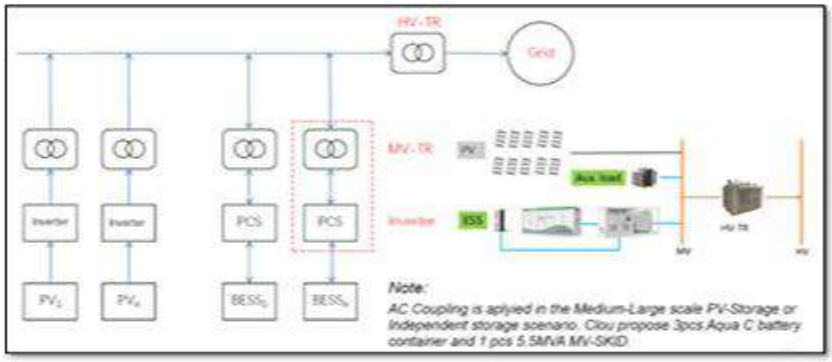
The solar plant is to be located closer to the base load plant in order to minimize the electrical cabling costs. According to the layout studies the allocated area is sufficient to provide 10MWp solar power plant.



General Area Allocation of Solar Plant

3.3 Battery Storage System

Solar and Battery system will be connecting to the PV Solar and BESS 13.8kV Distribution Busbar. AC coupling will be considered for the MV connection.



BESS Connection

4 units of battery pack and 2 units of PCS with relevant Transformers and MV cubicles are to be manufactured in containerized skids. Via the integrated battery and energy management system, grid frequency control will be established for solar and baseload side.

BESS manufacturer is considered to be Clou Midea Industrial Tech. as of the concept design engineering which would be subject to change during the detailed design and procurement stage.

Initial Configuration				
Eleuthera	PCS-MV Skid (20' container)	3.2 MVA	2 pcs	Each skid includes 2 units 1.6MW (AC power shall be set as 1.5MW or lower, it shall compatible with 0.5P C/D ratio of BESS) PCS, 1 unit **4 MVA** pad-mounted transformer, and other accessories;
	Aqua-C1 BESS (20' container)	2.98 MWh	4 pcs	Each BESS includes 8 battery clusters, and each cluster have 8 packs in total; 0.5CP Charge/discharge ratio is the key limitation condition for PCS operation

BESS Configuration

Features of the skid solution is provided below;

- ✓ Renewable Power Plant Integration (Ramp rate control, energy shifting)
- ✓ Grid Ancillary Control (Frequency regulation, peak shaving)
- ✓ Distributed Network and Micro-grid (Peak shaving, autonomous operation)

Performance

- ✓ Advanced three-level technology, max. efficiency reaches 98.8%
- ✓ Effective forced air cooling
- ✓ High DC voltage up to 1500V
- ✓ Support two independent DC inputs
- ✓ Bidirectional power conversion system
- ✓ Battery charge & dis-charge management and black start function integrated

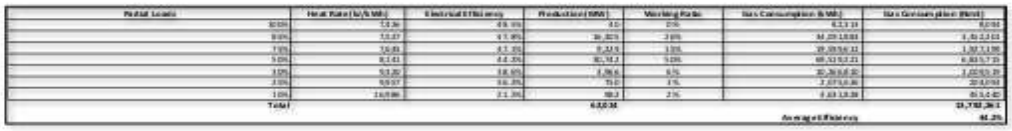
EASY O&M

- ✓ Integrated monitoring function and fast trouble shooting
- ✓ Integrated auxiliary power supply panels for external devices
- ✓ Low transportation and installation cost
- ✓ GRID SUPPORT
- ✓ Compliant with UL1741, IEEE1547
- ✓ L/HVRT, L/HFRT, specified power factor control and reactive power support

3.4 LNG Supply and Gasification System

LNG supply will be performed with LNG trucks and/or LNG ISO containers. The Project will be occupied with LNG unloading station (pump requirement details will be also verified with LNG supplier) and truck scale.

According to the hourly data provided by MoE, below gas consumptions calculated yearly;



For Eleuthera Island, the port of entry to be utilized will be Alice Town Port, attributable to its proximity of c. 1 km. to the project site. However, due to the constraints of the ports entrance, a smaller Ro-Ro vessel will be conducting the transfer operations with its ten 40 ft. ISO-Trailer carrying capacity.

The above figure of gas consumption in the amount of approximately 13.8 million m3 of gas corresponds to 23.000 m3 of LNG approximately. By taking into account that this figure and ISO and/or LNG tanker capacity as 44m3, yearly 420 trucks to be dispatched to the power plant in order to cover the electricity demand which corresponds to almost twice filling in a day.

Remaining regasification system will consist of liquid natural gas storage tanks, atmospheric vaporizers, electric heater and regulation station.

LNG Storage Tanks

Based on average 6MWh demand capacity, 10 days storage tank with total volume of 500m³ is to be used. Calculation is as follows;

	Average Demand (MW)	Efficiency	Average Hourly Consumption (m3)	Average Hourly Consumption (m3) with 5% Margin	10 Day Required Capacity (m3)	LNG Tank Capacity (m3)	Tank Capacity Selected (m3)
Eluethera	6.0	48.0%	1,229	1,291	309,735	516	500

LHV kWh/Nm3	10.17
LHV kCal/Nm3	8,746

Vaporizers

The liquid natural gas transferred to the plant will be gasified in atmospheric vaporizers and then heated using an electric heater to achieve the required gas temperature at the point of consumption. The gasified and heated gas will be regulated to the required pressure levels of 150 mbar in the pressure conditioning station.

For the system atmospheric vaporizers with capacity of 750kW is to be considered. In order to prevent performance losses due to snow formation on atmospheric evaporators, atmospheric evaporators will be supplied redundantly and operated with the principle of co-aging.

Electrical Heaters

In order to prevent the natural gas temperature at the requested flow rate from the atmospheric vaporizers from falling below +5°C at the point of use, an electric heater with appropriate thermal capacity, certified according to Atex and PED directives, will be supplied. The heater inlet-outlet temperatures will be monitored and operated by the control system with on/off, stepped or analogue control principles. The electrical heaters in the design is mostly considered for redundancy since the ambient temperature is not expected to fall below +15°C in Eluethera island.

Gas Regulation Units

Production and supply of a regulation station with an inlet pressure of 6 bar and an outlet pressure of 150 mbar with a backup line to meet the technical requirements of the plant. All radiographic welding and pressure tests will be carried out under the supervision of a third party authorised body, and personnel certificates and equipment certificates will be submitted to the relevant quality document. Directives and standards such as 2014/68/EU (Pressure Equipment Directive PED), 2006/42/EC (Machinery Directive), EN 13480 (Metallic industrial piping), ISO 15614 (Specification and qualification of welding procedures for metallic

materials), ISO 9606 (Qualification testing of welders) will be taken as reference for mechanical design criteria and post-production quality tests.

Piping and Equipment

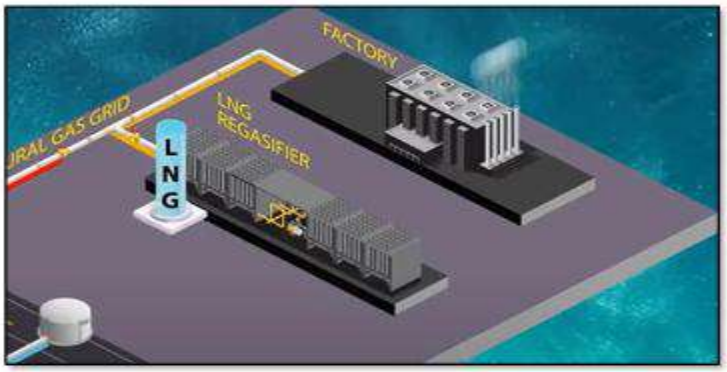
Technical calculations will ensure that the equipment and installation elements to be used meet the system requirements and comply with safety standards. Directives and standards such as 2014/68/EU (Pressure Equipment Directive PED), 2006/42/EC (Machinery Directive), EN 13480 (Metallic industrial piping), EN 10216 (Seamless Steel Tubes for Pressure Purposes), ISO 15614 (Specification and qualification of welding procedures for metallic materials), ISO 9606 (Qualification testing of welders) will be taken as reference for mechanical design, production and tests. Control valves will be certified in API standard. All electrical equipment and connection elements will be in Atex class in accordance with Atex zone standards determined according to 2014/34/EU (Atex directive) and EN 60079 (Explosive atmospheres) directives and standards.

Safety equipment and functions

Precautions to be taken for environmental and personnel health will be provided throughout the facility. Gas emission will be monitored with gas detectors to be installed at locations to be determined after site exploration. Personnel safety will be ensured with manual emergency buttons to be mounted.

The temperature and pressure values of the liquid to be transferred at low temperature throughout the facility and the gas to be pressurized in the closed system will be monitored instantaneously. Within the scope of equipment and personnel safety, possible anomalies will be automatically prevented and relevant audible and visual notifications will be made.

The equipment will be evaluated within the scope of IEC 61508 (Functional safety of electrical/electronic/programmable electronic safety-related systems) according to functional safety verification and function-logic structures will be established.



3D View of Gasification System (Only for Reference)

3.5 List of Major Equipment and Suppliers for Base Load Plant

a. Gas Engine Sets MAN 35-44 G
b. Engine Cooling System with Friterm or equivalent brand
c. Starting Air System with Dalgakiran or equivalent brand
d. Ventilation System with Boreas or equivalent brand
e. Genset Lube Oil System with Fresh and Waste Oil Tanks
f. Firefighting System with 250m3 Capacity Fire Water Tank
g. Oily Water System with Veolia or equivalent brand
h. Water Treatment System Likya or equivalent brand
i. Domestic Water Treatment System
j. Waste Water Treatment System
k. Raw Water Supply System with 100m³ Capacity Storage Tank Capacity
l. Step-up Transformers with Astor or equivalent brand
m. MV Distribution system with ABB or equivalent brand
n. LV Distribution system
o. Fire detection system

p. Blackstart diesel generator

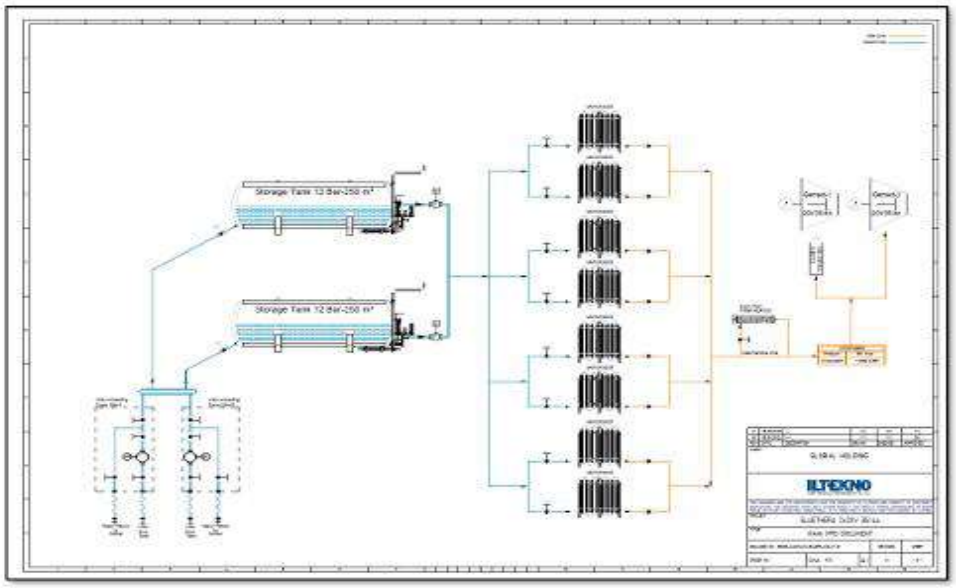
q. Plant control system

4 Main LNG to Gas Flow Diagram of Project

Main considerations are as follows;

i. Two LNG 10 days storage tanks have been considered according to the average demand of the Island

ii. By taking into account that the gas will be supplied with ISO containers and/or LNG tankers to the plant with 6 bars and the gas inlet pressure at MAN engines are 6 bars as well, pump skid will be considered at the inlet of vaporizers in order to ensure the pressure at the inlet of the gas regulating skids of Gensets as 6 bars



General Flow Diagram of Plant

5 MAIN SINGLE LINE DIAGRAM OF PROJECT

Two MV Switchgear Groups are foreseen, first is Main MV Switchgear which includes gas engine generator power plant and the second is Renewable MV Switchgear which includes solar power plant and battery energy storage system.

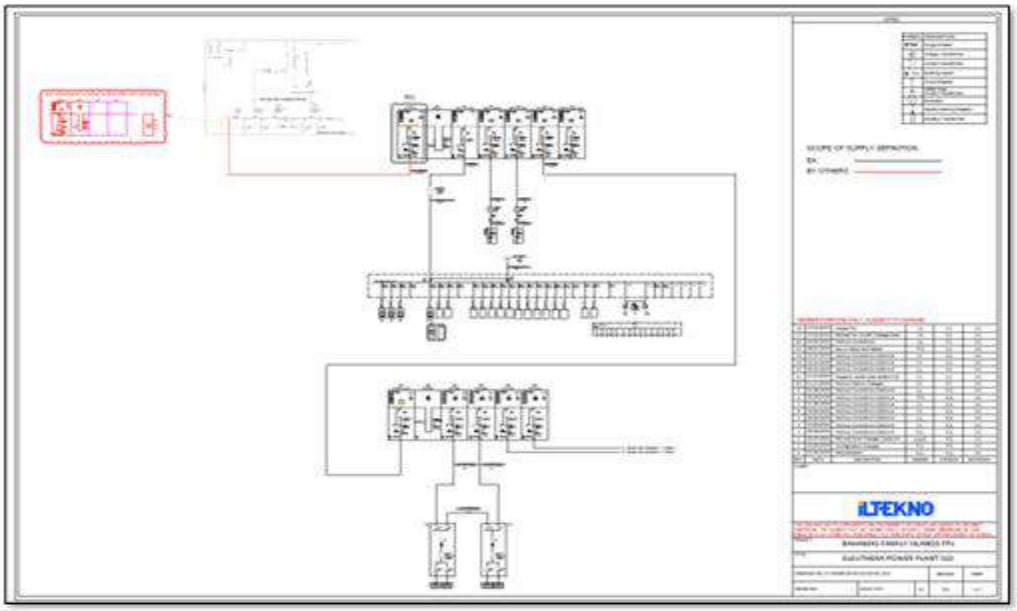
13,8kV gensets are connected directly to the Main MV Switchgear. Grid Outgoing Feeder is also considered in this MV Switchgear. Neutral point of the alternators are grounded via neutral earthing resistors which limits the earth fault short-circuit current to a specific value which will be determined by the local authorities and alternator capability

Solar PP inverters are connected via 13,8/0,8 kV step up transformers than to Local Solar MV Switchgear and BESS PCSs are connected via 13,8/0,63 kV MV System skids to the Renewable MV Switchgear. It is considered that the Main MV Switchgear and the Renewable MV Switchgear will be connected to each other via underground MV cable.

MV switchgears are going to be designed for an initial symmetrical short-circuit current according to the existing networks, new generator's and renewable power plant's short circuit power.

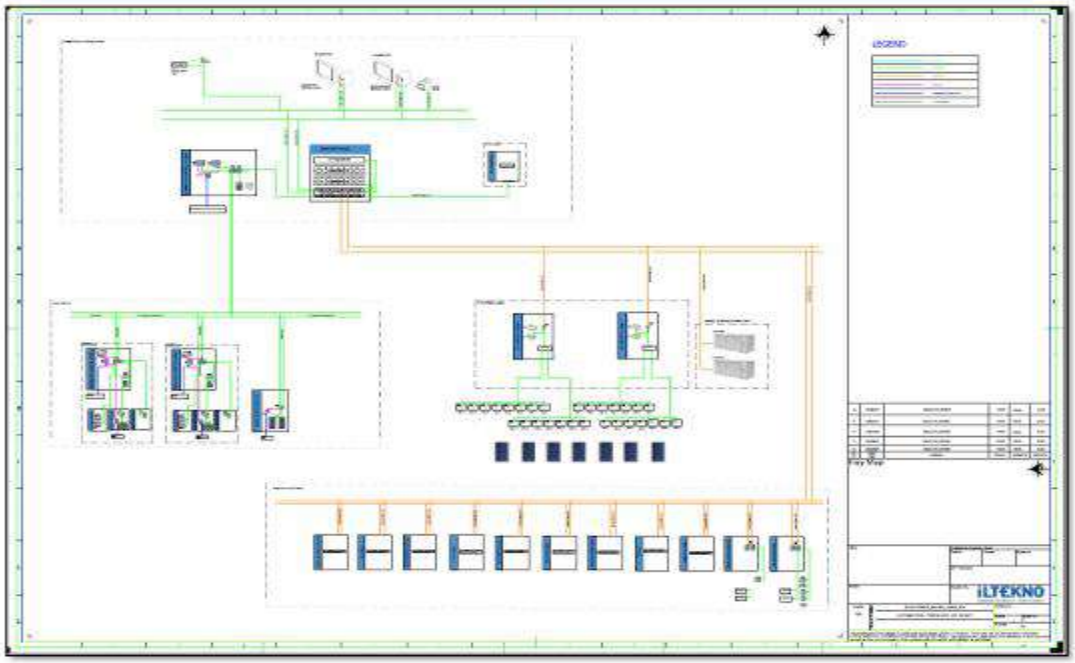
For the baseload plant, one auxiliary service transformer is designed and an emergency diesel generator is considered for black start operation.

Grid outgoing cubicle of the Main MV Switchgear is connected to the 13,8kV main busbar in the Hatchet Bay Power Station which to be performed by others.



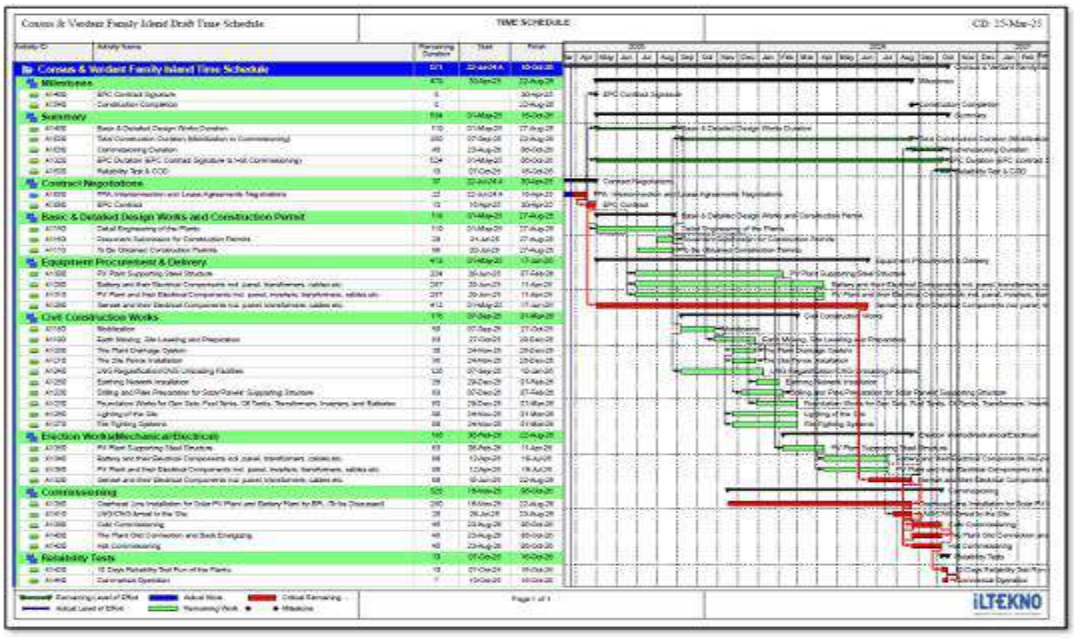
General MV and LV Single Line Diagram

6 System Automation Topology



Automation Topology of Plant

7 BASELINE TIME SCHEDULE OF PROJECT



Baseline Schedule

Appendix – B

Geotechnical Engineering Exploration Report _CTLI

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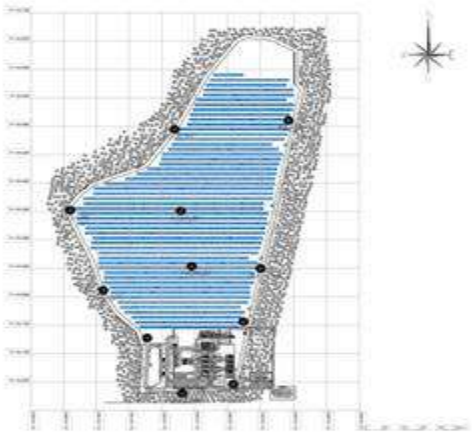
Geotechnical Engineering Exploration Report



Bahamas Power and Light Hatchet Bay Eleuthera, Bahamas

Prepared For:
Javon T. Rolle,MCSE,OSHA,SAP
Program Coordinator
IDDC Bahamas

Prepared By:
Certified Testing Laboratories International

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March 22nd , 2025

Javon T. Rolle,MCSE,OSHA,SAP
Program Coordinator
IDDC Bahamas

:

Per your request, Certified Testing Laboratories International (CTLI) has completed the Geotechnical Engineering Exploration for Bahamas Power and Light Hatchet Bay in Eleuthera, Bahamas.

This report presents the results of our subsurface soil exploration and provides geotechnical engineering recommendations in regards to the site preparation and foundation support required for design and construction of the proposed Bahamas Power and Light Hatchet Bay.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please feel free to contact us.

Sincerely
CTLI Bahamas Ltd.

CERTIFIED TESTING LABORATORIES INTERNATIONAL COMMON SEAL OF

[redacted]
Whittington S. W. Brown
Chief Technologist
March 22nd, 2025

Certified Testing Laboratories International

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1.0 SITE AND PROJECT INFORMATION

Based on information in the drawings you provided to us and observations during our field work, the project site consists of an approx. 32 acres portion of land within Eleuthera. The existing ground surface is covered with low-lying vegetation/bushes and pine trees elevations vary.
No drawings were available for preparation of this report.

2.0 FIELD EXPLORATION

Our field exploration was conducted from December 18, 2024 to January 20, 2025. determination of the soil compressive strength, at various depths with a pocket soil penetrometer and rock cores. In addition, a steel soil probe rod was used to do the probing of the soil resistance to penetrate throughout the acreage .

Representative samples of the excavated soils were stored in airtight containers and delivered to our laboratory in New Providence for further review and classification by our geotechnical engineer.

The geology of the area consists of "Karst" (or soluble limestone / carbonate / evaporite) geologic features. In karst areas, the groundwater and surface water are highly interconnected - all aquatic coastal karst basins are open-systems with subterranean connection to the ocean, unless otherwise empirically proven in individual cases. Topographically, the islands of The Bahamas are typically flat with elevations of less than 32-feet (9.75-meter). A higher coastal ridge may occur, usually located along the exposed side of most islands. Islands of the southeast and central Bahamas are generally of higher elevation than in the northern Bahamas. The islands are usually long and narrow oriented from northwest to southeast with central ridges extending to a maximum height of 200 feet (60.96-meter).

Typical geological conditions prevail, where there is "late Holocene carbonate deposition and sea-level effects on development and spatial distribution of coastal environments. Three lithofacies occur here, as elsewhere in the Bahamas, and represent foreshore, backshore, and dune environments. Progradational beach-ridge strandplains, composed of eolian rather than wave-formed ridges, are common and are particularly well developed throughout the region." [Proceedings of the 16th Symposium on the Geology of the Bahamas & Other Carbonate Regions: San Salvador, Gerace Research Centre (Reprint), 'Origin of Late Holocene Strandplains in the Southern Exuma Islands, Bahamas: Progradation, Ephermeral Highstands, and Storminess', M. Savarese + H. Allen Curran, 2016]

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3.0 SUBSURFACE SOIL CONDITIONS

Subsurface Soil Profile

Typically, the site(s) geology consists of sandy soil conditions with a 'weathered to fractured hard limestone' rock subsurface, and further suggest that recharge of any freshwater resources is very limited. Site geological features further suggest that rainfall is quickly lost as runoff, due to combined elevation / hard natural limestone surface / the sandy coastal erosion conditions of the landform. Geotechnical Test Pits (10-Total), excavated to 15 Feet in January-2025 reveal: For Hatchet Bay, Eleuthera – Land parcel to the North has the largest bearing capacity. Average of 445.34-psi, Maximum of 745.55-psi (@ Test Pit 'A'), Minimum of 159.57-psi (@ 'J'); all with a Core Sectional Area of 11.75

Based on the results of our soil probing and test pit excavations, the site subsurface soil profile consists of approximately 3 inches of relatively loose sand TOPSOIL underlain by the LIMESTONE formation to the explored depths.

Based on the experienced rate of excavation depth), the encountered LIMESTONE formation is sound and hard. In addition, the pocket soil penetrometer test results indicated values in excess of the instrument's highest measurable compressive strength of +5.0 ton/ft^2 at each tested location. The soil penetrometer test results throughout the entire site reads over +5.0 ton/ft^2

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Groundwater

Groundwater was not encountered during field exploration in the 10ft test pits.

The physical baseline aspects for the hydrology/hydrogeology includes water resources, surface water, drainage, and any flood prone areas. A site hydrogeological (with geotechnical test pits conducted by CTLI) | water resources review (by AEES) was conducted to evaluate information & data achieves. Further assessment made for the limits of any possible freshwater lens, note any existing hydro geological features, and also to determine influences between the landform and the marine environment. Existing potential contamination of the upper soils and groundwater is a concern for both solar sites (on Eleuthera and Eleuthera), as both are adjacent to 'in service' generation facilities (operated by BPL). The sites are elevated, so flooding is not particularly a concern. There is a relatively loose 3 to 5-inch top soil layer with underlying hard limestone. The low to medium porosity of the limestone does not result in quick drainage, but voids may serve for the rapid movement of any surface water and contaminants into the subsurface.

"Based on my combined review of the driller logs, geophysical (gamma) log, and pump test data: Confident that a consistent relative clean/cool source of water up to 800 USGPM is achievable from cavernous zones between 300 to 450-Ft below ground level (BGL), with minimal drawdown on the lens." "Regarding supply and reinject for chiller water use (only). Suggested supply depth of 480 to 500-FT BGL, cased to 380-FT (+/- 20-FT). Suggested reinject depth of 350 to 400-FT BGL, cased to 250-FT (+/- 20-FT). Abstraction/Injection zone of 50 to 100-FT BGL per well, based on final size of casing. A minimum horizontal separation of 100-FT between any wells recommended. Minimal vertical separation of 20-FT is recommended between the supply and reinjection wells. This vertical separation can be larger, based on the temperature of the reinjected water. Be advised that the recommended "shallow" reinjection depth is "only" for return from the chiller and not any effluent sources." "Note: Recommendations based solely on given hydrological and geophysical data. No knowledge of water requirements or the specifications of proposed generation facility. Assumed that appropriate water temperature and not quality is desired for cooling purposes."

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4.0 GEOTECHNICAL EVALUATION & RECOMMENDATIONS

Building Structure

Based on the information obtained from our field exploration and the heavily loaded nature of the proposed engine foundation. and miscellaneous features, the encountered subsurface soil conditions are suitable to support the structures on a system of shallow foundations bearing on the existing LIMESTONE or engineered fill material.

As the dimension of foundation elements are expected to be controlled by providing adequate dead weight to resist wind pressures, the net bearing pressure under dead and live load is expected to be relatively low. Therefore, we recommend to design the footings using a maximum allowable bearing pressure of 6,000 lb/ft^2 and sliding coefficient of 0.35 (0-4 if bearing on LIMESTONE) after completion of a site preparation as recommended in the following paragraph.

The site preparation should consist of the entire removal of vegetation/TOPSOIL and subsequent placement of approved fill material to raise/level the resulting grades to the elevations, if required. Inspection of the entire site, by our geotechnical engineer or a representative, is advisable after the removal of vegetation/TOPSOIL and prior to raising/leveling the resulting grades to assure sound, competent subgrade conditions are attained (i.e. removal of surficial weak, weathered LIMESTONE might be required).

The approved fill material should consist of granular soil with a maximum nominal size of 3 inches, no more than 12% of fines and no organic matter placed in 12-in thick lifts compacted to at least 95% of the material's Maximum Dry Density (ASTM Dl557) is expected to be 120 lbs/ft3. An active earth pressure coefficient of 0.35 and a passive earth pressure coefficient of 3.0 shall be used

The footings should be excavated to the depths specified in the structural drawings or deeper till sound competent limestone is encountered. Inspection of the footing subgrades by the geotechnical engineer or a representative prior to concrete placement is advisable.

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Wells providing fresh water supply will be drilled, instrumented and tested on the site. The well has to provide a long-term source of fresh water. The design of well and its operational regime should prevent the up-coning of saline water, encountered in the deeper aquifer. The following recommendations are proposed to provide a long-term fresh water supply for the power plant:

o 10" diameter open hole well will be drilled on site. Top 15' will be reamed to the diameter 15", 10" PVC Schedule 40 casing will be installed and grouted to provide the protection from surface impact.

o The depth of well would be 20', thus providing approximately 7' water column in the well. Water table was encountered at 13'. 5 OF 8 Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas. Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia ADDITIONAL HYDROGEOLOGICAL REFERENCE DATA

o Saline water was encountered on site at the depth of approximately 35' at well 'A' location.

o The location of the well will consider the location of an administrative building and location of power plant and tank farm. It is recommended to locate water supply well upgradient of the facility, to prevent the impact from potential oil spill. Assumed groundwater flow direction is toward southeast.

o Submersible pump with the pumping rate of 2 USGPM is proposed to be used for the operational period. Low-rate pumping should minimize the drawdown in the well and prevent the up-coning of the saline water at that location. Use of water storage tank is recommended.

o It is noted that drawdown in the well should never exceed 0.11 m (4.5").

o 6-hour pumping test is proposed to simulate long term use of water supply well. Pumping rate would be 2 USGPM.

o Proposed design of water supply well is attached. Fresh water aquifer protection is paramount during the construction and operation of a power plant. Proposed design of water supply well and recommendations for the operation are aimed to minimize the impact on the fresh water aquifer. Source: John Bowleg – Hydrologist, WSC Water Resources Management Unit (WRMU), WRMU Email exchanges with WESA, Inc (Canada) – Engineering Consultants, Per Hydrogeological Data Review, Aug-2008 All hydrogeological recommendations from 2008 for the BEC/BPL Hatchet Bay Power

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Generation Facility are relevant to date for the Hatchet Bay, Eleuthera Area. Comparably the concerns for Hatchet Bay, Eleuthera are also relevant to Hatchet Bay, Eleuthera. At Hatchet Bay, Eleuthera freshwater is not as readily available from the groundwater resources as they exist on the island of Eleuthera. Regardless, due care is required for the abstraction of groundwater on Eleuthera.

Slab on grade

The slabs can be supported on-grade on either competent LIMESTONE or approved engineered fill with the upper 12 inches compacted to the materials' Maximum Dry Density (ASTM Dl557).

A modulus of subgrade reaction of 250 lb/in^3 can be used for design of the slab-on-grade.

The use of the full passive pressure should be done with caution as significant wall movements are necessary to mobilize the full passive resisting force. Also, any excavations for permanent utility installations performed in front of the retaining walls (i.e. on the passive soil resisting side) would prevent the use of passive pressures as utility damage would likely occur with excessive movement.

For unyielding walls (i.e. restrained retaining walls), an at-rest earth pressure coefficient of
0.5 should be used.

Relief of hydrostatic pressures by placement of appropriate drainage measures behind the walls should be provided if water pressure is not included in the design of the walls.

Care should be exercised when placing fill and performing compaction in proximity to retaining walls. Fill compaction in proximity to the walls should be performed with small vibratory plates and to at least 92% of the material's Maximum Dry Density (ASTM D1557).

Underground Utilities

All utilities should be installed per the Civil Engineer's design drawings and specifications as well as the manufacturer's recommendations. When backfilling over utility lines, the approved fill should be placed in maximum 12-in thick lifts compacted to at least 95% of the material's Maximum Dry Density (ASTM D 1557)

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LIMITATIONS

Information on subsurface profile, groundwater level and Limestone strength represent conditions encountered only at the locations indicated and at the time of the exploration. If different conditions are encountered during construction, they should be immediately brought to our attention for evaluation as they may affect our recommendations.

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ctlbahamas.com
Hatchet Bay, Eleuthera
Core Sheet

Core Location	Depth	Test Date	Cross Sectional Area of Core	Weight of Core (LBS)	Density of Core (PCF)	Max Load (LBS)	KSF	DIAMETER (in)	HEIGHT (IN)	PSI
1A	2ft.	1/6/2025	11.793	4.000	68.757	8560	108.70	3.875	4.00	754.86
1B	4ft.	1/6/2025	11.793	4.100	70.475	9180	118.10	3.875	4.00	765.41
1C	6ft	1/6/2025	11.793	4.400	75.633	11000	134.35	3.875	4.00	932.96
1D	8ft	1/6/2025	11.793	4.700	80.789	10742	131.20	3.875	4.00	911.11
1E	10ft.	1/6/2025	11.793	4.500	77.352	9693	117.86	3.875	4.00	818.45

Checked By: S. J. Brown
Approved By: W. S. Brown

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Hatchet Bay, Eleuthera
Core Sheet

Core Location	Depth	Test Date	Cross Sectional Area of Core	Weight of Core (LBS)	Density of Core (PCF)	Max Load (LBS)	KSI	DIAMETER (in)	HEIGHT (IN)	PSI
3A	2ft	1/9/2025	11.780	5.100	87.665	10854	192.57	3.875	4.00	920.61
3B	4ft	1/9/2025	11.780	4.750	81.649	8965	159.50	3.875	4.00	760.39
3C	6ft	1/9/2025	11.780	5.210	89.554	9873	120.59	3.875	4.00	837.40
3D	8ft	1/9/2025	11.780	5.165	92.220	10379	126.72	3.875	4.00	879.98
3E	10ft	1/9/2025	11.780	5.210	89.554	11047	134.93	3.875	4.00	936.98

Checked By: S. I. Brown
Approved By : M. S. Brown

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Hatchet Bay, Eleuthera
Core Sheet

Core Location	Depth	Test Date	Cross Sectional Area of Core	Weight of Core (LBS)	Density of Core (PCF)	Max Load (LBS)	KSF	DIAMETER (in)	HEIGHT (IN)	PSI
1A	2Ft	12/17/2024	11.790	5.300	90.100	10560	129.01	3.675	4.00	895.99
1B	4Ft	12/17/2024	11.790	4.600	79.071	8895	108.64	3.675	4.00	754.45
1C	6Ft	12/17/2024	11.790	5.400	92.822	11040	134.84	3.675	4.00	936.39
1D	8Ft	12/17/2024	11.790	4.700	80.789	9410	114.99	3.675	4.00	798.13
1E	10Ft	12/17/2024	11.790	5.100	87.665	9746	119.04	3.675	4.00	826.63

Checked By: S. J. Brown
Approved By: W. S. Brown

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Core Sheet

Core Location	Depth	Test Date	Cross Sectional Area of Core	Weight of Core (LBS)	Density of Core (PCF)	Max Load (LBS)	KSF	DIAMETER (In)	HEIGHT (IN)	PSI
4A	3ft	12/18/2024	11.790	4.800	82.558	9120	111.39	3.875	4.00	773.54
4B	4ft	12/18/2024	11.790	5.200	89.384	10680	129.83	3.875	4.00	901.61
4C	6ft	12/18/2024	11.790	5.000	91.655	10703	131.79	3.875	4.00	914.59
4D	8ft	12/18/2024	11.790	4.700	80.709	8905	109.50	3.875	4.00	760.19
4E	10ft	12/18/2024	11.790	5.500	94.541	11425	139.54	3.875	4.00	969.64

Checked By: S. I. Brown
Approved By: M. S. Brown

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Core Sheet

Core Location	Depth	Test Date	Cross Sectional Area of Core	Weight of Core (LBS)	Density of Core (PCF)	Max Load (LBS)	KSF	DIAMETER (in)	HEIGHT (IN)	PSI
5A	2ft	12/19/2024	11.790	5.800	91.133	10739	100.93	3.875	4.00	909.25
5B	4ft	12/19/2024	11.790	4.800	79.071	9716	118.66	3.875	4.00	829.58
5C	6ft	12/19/2024	11.790	5.400	92.822	11040	134.84	3.875	4.00	936.39
5D	8ft	12/19/2024	11.790	4.700	80.739	8816	108.82	3.875	4.00	755.73
5E	10ft	12/19/2024	11.790	4.900	84.227	9948	121.48	3.875	4.00	843.09

Checked By: S. I. Brown
Approved By: W. S. Brown

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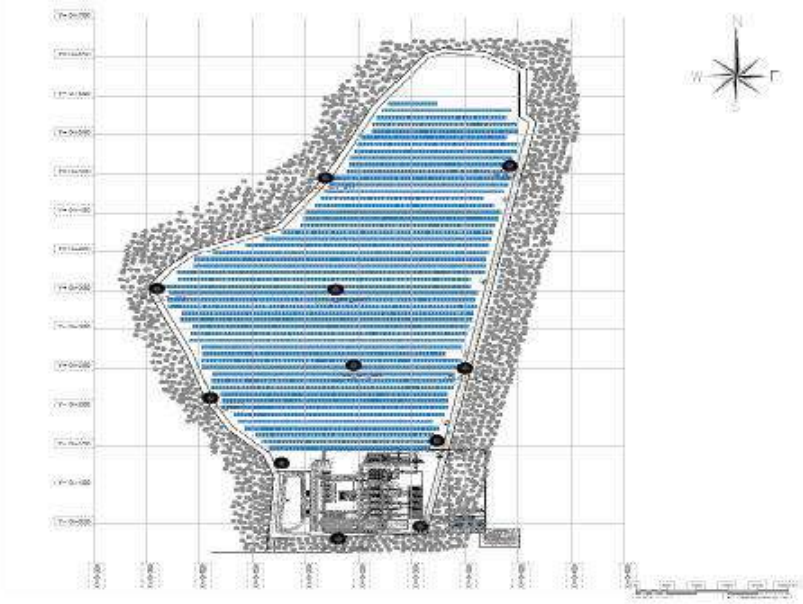

GEOPHYSICAL ELECTRO RESISTIVITY DISCOVERY EXPLORATION REPORT

Prepared For:
Javon T. Rolle,MCSE,OSHA,SAP
Program Coordinator
IDDC Bahamas

Prepared By:
Certified Testing Laboratories International

Geophysical Electro Resistivity Discovery Exploration Report
BPL Hatchet Bay, Central Eleuthera
Javon T. Rolle

1. INTRODUCTION

This report summarizes the findings of our geophysical exploration of the site lot near Bahamas Power and Light Hatchet Bay Central Eleuthera. The purpose of this geophysical study is to explore the subsurface conditions at the proposed site with electro-resistivity testing, evaluate the geological properties of the subsurface materials with appropriate field and laboratory tests, and perform geophysical analyses for developing design and construction recommendations for the site. The site assessment was conducted from December 16, 2024 to January 10,2025.

2. SITE CONDITIONS

The site is situated near Bahamas Power and Light . The site is virgin land. Vegetation has been thinned out on the site to allow access.

3. METHODOLOGY

The Electrical Resistivity Tomography (ERT) method investigates electrical properties within the subsurface. This technique involves using two current electrodes to introduce an electrical current into the ground, while two additional electrodes are used to measure the resulting drop in electrical potential. Various electrode array configurations are available to acquire data to predict changes in ground resistivity values in both horizontal and vertical directions.

ERT serves as a valuable tool for discerning geological disparities, including factors such as soil lithology (e.g., clay versus gravel), the presence of groundwater, fracture zones, variations in soil saturation, areas of heightened salinity, and, in some instances, indications of groundwater contamination. ERT is also adept at mapping bedrock levels and shapes. However, in most geological settings, techniques such as Multi-Channel Analysis of Surface Waves (MASW) or Seismic Refraction Tomography (SRT) are better suited for delineating top-of-bedrock layers. Notably, ERT excels in mapping subterranean spaces such as caves, karst formations, and evaporite dissolution sinkholes.

Much like seismic methods, electrical methods can provide 1D (vertical electrical sounding), 2D (profile), or 3D (volume) imaging. Project goals and budget constraints determine the choice between these options and the number of electrodes employed. It's worth noting that the geochemical characteristics of the subsurface, such as grain size distribution, groundwater chemistry, and the presence of contaminants, significantly influence the effectiveness of electrical methods.

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3.1 Identification of Possible Sinkhole Features Using ERT

Karst features are typically characterized by one of the following conditions on the ERT Profile:

1. **Highly Resistive Material Extending Toward the Top of Limestone:** The presence of highly resistive material extending vertically towards the top of the limestone may suggest the existence of a sand-filled depression or raveling zone.
2. **Localized Presence of Low Resistivity Material Below the Depth of Limestone:** The localized presence of low resistivity material extending beneath the interpreted limestone depth could indicate the presence of a clay-filled void or fracture within the limestone or the presence of highly weathered limestone rock.
3. **Significant Localized Depth Increase to Limestone:** A notable localized increase in depth to limestone may indicate the presence of an infilled depression (paleo-sink).

When evaluating ERT results, it is essential to consider the following factors. ERT often describes the transition from clay to limestone as gradual rather than a distinct depth change. This transition can be attributed to various factors, including:

a. **Vertical Density of Resistivity Data:** The decrease in data density with depth.

b. **Weathering of Upper Limestone Layers:** The possibility of weathering in the upper portion of the limestone, resulting in a gradual transition zone in resistivity between the clay and non-weathered limestone.

c. **Modeling Limitations:** Constraints in the modeling process can affect depth interpretation's precision.

These contemplations should be considered when interpreting and utilizing ERT data for sinkhole feature identification.

Geophysical Electro Resistivity Discovery Exploration Report
BPL Hatchet Bay, Central Eleuthera
Javon T. Rolle

4. FINDINGS

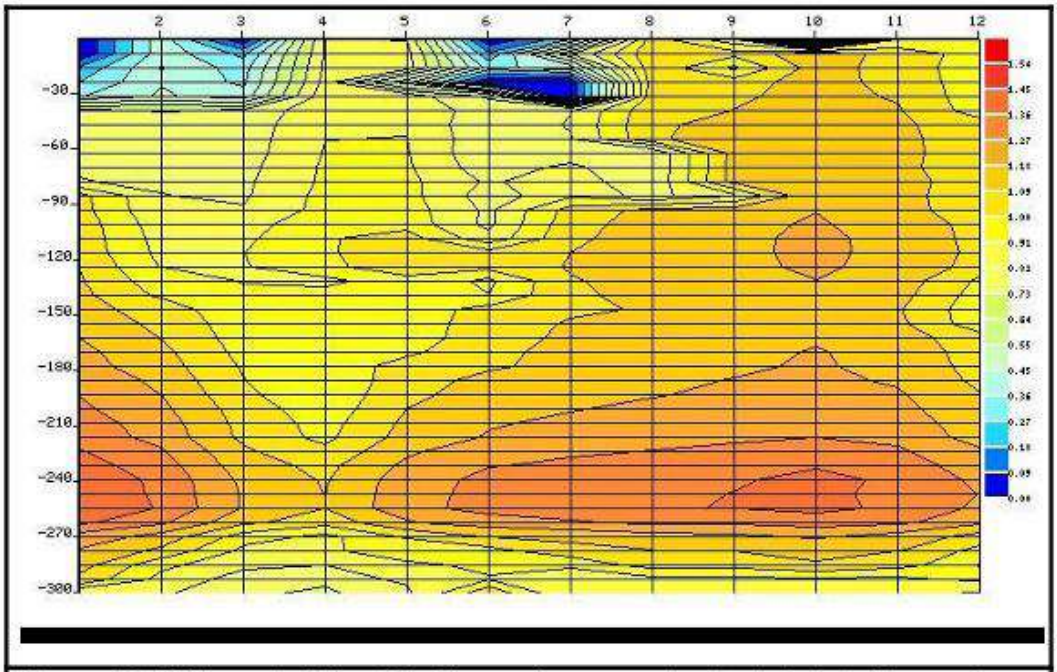

Figure 4.1: *ERT graph of Line 111. The y-axis conveys the depth in feet. The x-axis represents the horizontal distance in meters. The colors illustrate the strength of the material scanned from weathered to strong, ranging from blue to red, respectively. Potential subsurface anomaly (3,-30),(6 to 7,-30)(10,-15)*

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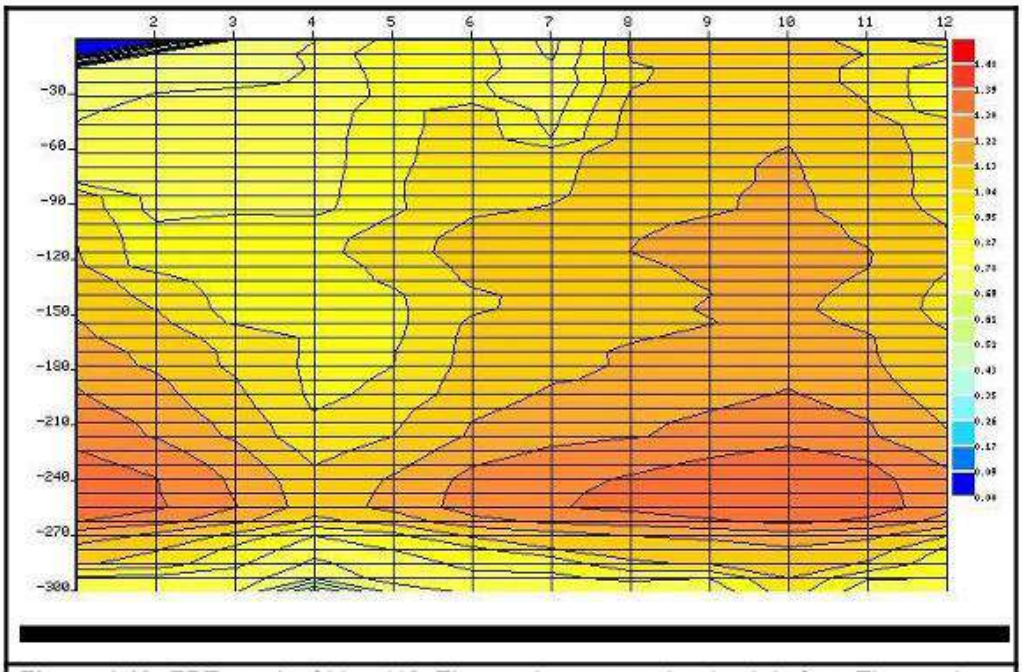

Figure 4.12: *ERT graph of Line 112. The y-axis conveys the depth in feet. The x-axis represents the horizontal distance in meters. The colors illustrate the strength of the material scanned from weathered to strong, ranging from blue to red, respectively. Potential subsurface anomaly (2,-15)*

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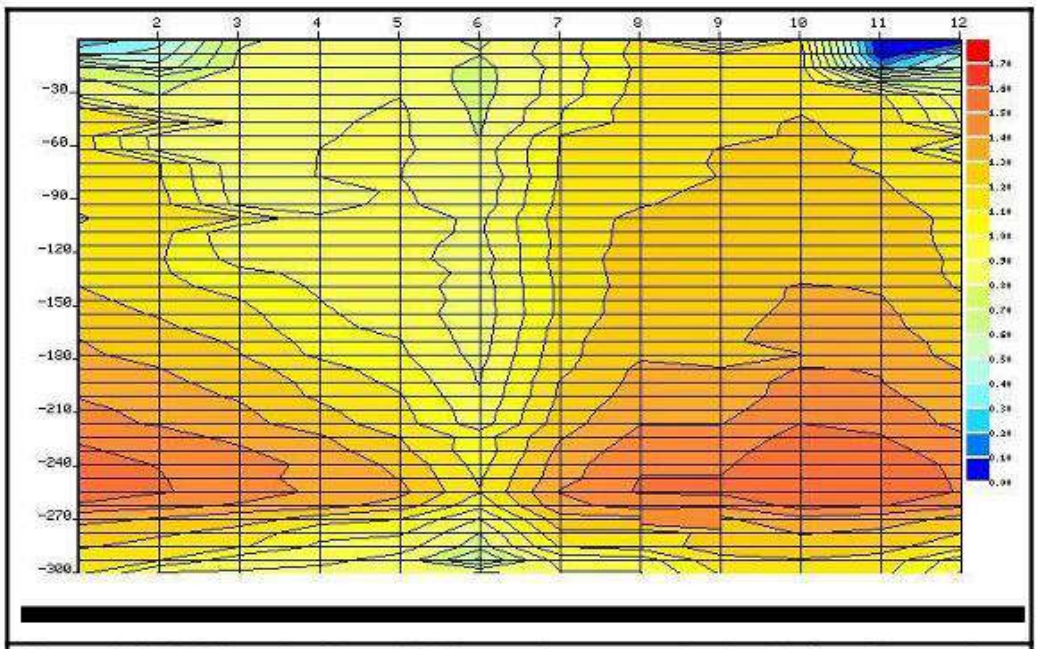

Figure 4.13: *ERT graph of Line 113. The y-axis conveys the depth in feet. The x-axis represents the horizontal distance in meters. The colors illustrate the strength of the material scanned from weathered to strong, ranging from blue to red, respectively. Potential subsurface anomaly (2,-30),(10 to 12, -30)*

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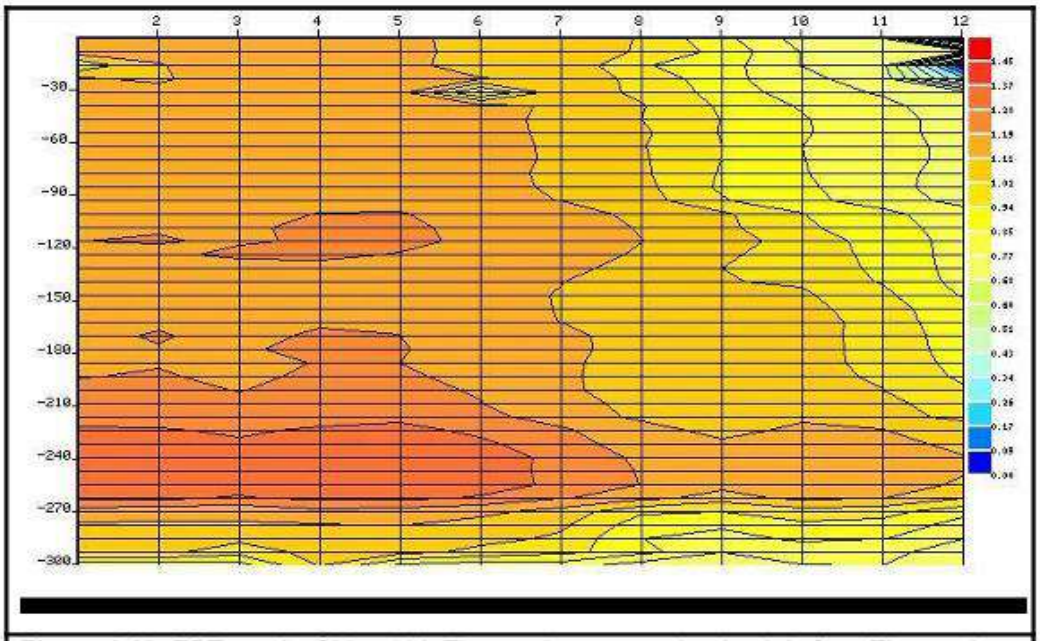

Figure 4.15: *ERT graph of Line 114. The y-axis conveys the depth in feet. The x-axis represents the horizontal distance in meters. The colors illustrate the strength of the material scanned from weathered to strong, ranging from blue to red, respectively. Potential subsurface anomaly (6,-30),(11 to 12,-30)*

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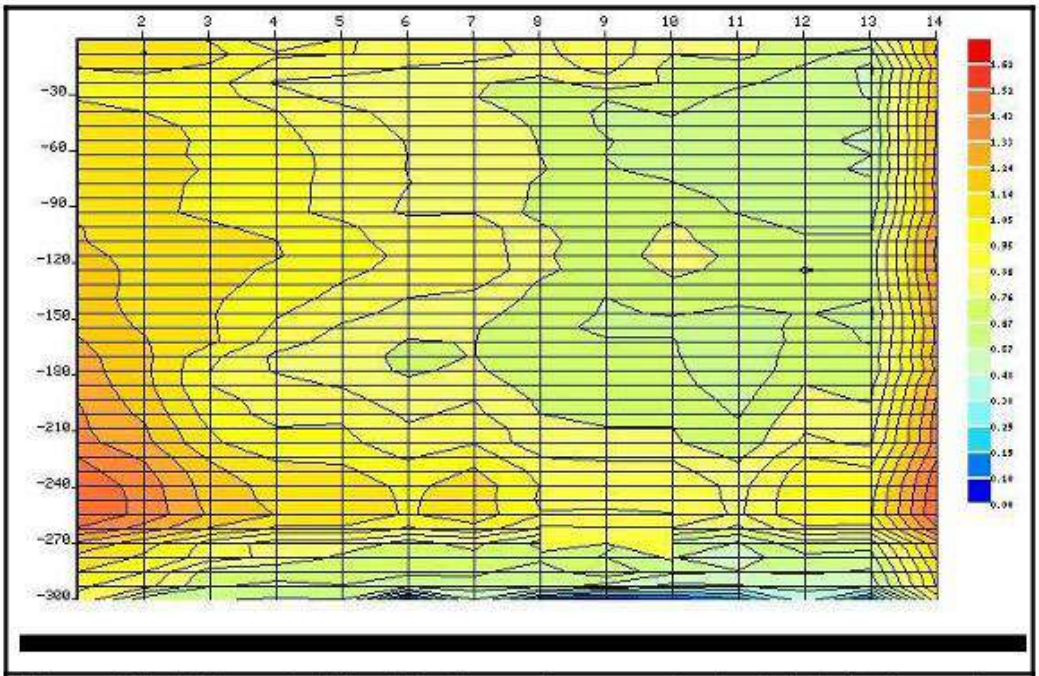


Figure 4.15: *ERT graph of Line 115. The y-axis conveys the depth in feet. The x-axis represents the horizontal distance in meters. The colors illustrate the strength of the material scanned from weathered to strong, ranging from blue to red, respectively. Potential subsurface anomaly x- axis 13 to 14, y - axis 0 to 300*

4.1 Analysis

The ERT graph shows no subsurface anomaly in the immediate building footprint impact zone. displays transitions through the subsurface soil conditions, denoted by the colors yellow, orange, and light green, suggesting the presence of denser and less weathered conditions of the subsurface soils.

Collectively demonstrate a consistent subsurface soil pattern, with limestone rock prevailing in the upper layers and a transition to denser and less weathered materials at greater depths.

In summary, the electro-resistivity testing results collectively demonstrate a consistent subsurface pattern, with weathered limestone rock prevailing in the upper layers and a transition to denser and less weathered materials at greater depths. These findings offer valuable insights for geological analysis and construction planning within the project area.

Context

The provided color-coded key assists in interpreting resistivity values encountered in a geological context. The 'Blue' designation corresponds to low resistivity values, typically associated with weathered rock or sand, registering at 0.0 ohmmeters. These low resistivity values suggest the presence of less dense or porous materials, such as sand or highly weathered rock. In contrast, the 'Yellow/Green' category signifies middle resistivity values, specifically 420 ohmmeters, indicating a high likelihood of encountering medium-dense limestone rock. This type of rock typically falls within the resistivity range of 100 to 500 ohmmeters, reflecting a balance between rock density and porosity. Lastly, the 'Red/Orange' classification denotes high resistivity values at 600 ohmmeters, signifying a high probability of encountering hard, dense limestone rock or sandstone. Due to their compact and non-porous nature, such materials typically exhibit resistivity values within the 1,000 to 10,000 ohm-meters range. This color-coded system serves as a visual aid for swiftly identifying geological characteristics and resistivity values associated with various subsurface materials, facilitating geological analysis and exploration efforts.

5. CONCLUSION

During our comprehensive electro-resistivity testing conducted our professional assessment showed no significant subsurface anomalies were observed within the project area. The electro-resistivity profiles consistently indicated the presence of weathered limestone rock near the surface, extending to a depth of approximately 30 to 60 feet. This characterization aligns with the prevailing geological conditions in the region.

Throughout the top surface consistently exhibited weathered limestone rock, as denoted by the blue coloration on the electro-resistivity graphs. Although varying in thickness, this weathered limestone layer demonstrates a uniformity of subsurface composition within the project area. Furthermore, the transition to denser materials at greater depths, marked by yellow, orange, and light green colors, reflects a natural progression of subsurface characteristics.

In summary, the electro-resistivity testing results assure that no subsurface anomalies or irregularities that could significantly impact the project were detected. The predominant presence of weathered limestone rock near the surface contributes to a stable and predictable subsurface environment for project planning and construction. These findings serve as valuable geophysical insights for the successful execution of the project.

5.1. Recommendations

CTLI, as the geophysical testing firm overseeing this project, recommends that the areas scanned for Hatchet Bay Power Plant is suitable for construction are suitable for construction. Based on our thorough ERT assessment, all subsurface anomalies are -50 feet below and will not interfere with the foundations of the power plant. The selected ERT locations exhibit favorable subsurface conditions and stability, making it an ideal choice for foundation construction. This recommendation ensures the project's structural integrity and long-term stability, aligning with the highest safety and performance standards.

6.0 Limitations

It should be noted that the GPS coordinates recorded during this assessment may not attain the same level of accuracy as those obtained using surveyor-grade handheld GPS equipment, potentially introducing a degree of positional variance in location data.

CERTIFIED TESTING LABORATORIES INTERNATIONAL
COMMON SEAL OF

Whittington S. W. Brown

President

Appendix – C: Additional Hydromet Reference DAT – EAST Eleuthera

ADDITIONAL HYDROMET REFERENCE DATA – EAST ELEUTHERA

The rapid assessment aims to identify the potential for solar photovoltaic (PV) applications on Eastern Eleuthera, relative to the natural (climatic) conditions. Other environmental protection and mitigation measures are to also be detailed, per guidance of typical Environmental Impact Assessment | Environmental Management Plan (EIA/EMP). All site plans and maps to be referenced within the EIA/EMP documents.

Per BPL, "Transforming Eleuthera's Energy Future: Bahamas Power and Light (BPL) is leading the transformation of Eleuthera's energy infrastructure through strategic upgrades aimed at improving reliability, service quality, and sustainability. Our mission is to create a stronger and more resilient power grid that meets current needs while preparing for future growth. We are committed to ensuring that Eleuthera has the energy it needs to thrive by implementing proactive maintenance, utilizing innovative technologies, and enhancing our infrastructure." Source: https://www.bplco.com/eleuthera/

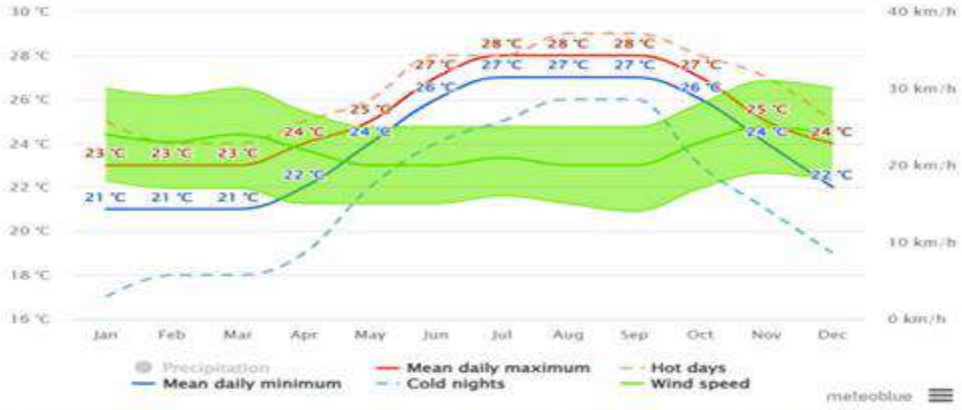
EASTERN ELEUTHERA SOLAR ASSESSMENT – THE BAHAMAS

Considerations

- Available Land – not in Forest Areas/Reserves, and not covered by significant trees or buildings.
- Land Ownership – preferred Crown Lands, to avoid any required acquisitions.
- Wind-load design requirements – Design at 180-mph (min). Ideally all designs should be able to withstand 200-mph wind speed (Cat-5 Hurricane).
- Alternative renewable energy options.

In general, The Bahamas has moderate solar irradiance.

Temperature & Wind Speed Profile @ Eastern Eleuthera



Source: Temperature & Wind Speed Profile @ E. Eleuthera (Meteoblue, 2024)

1 OF 3

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

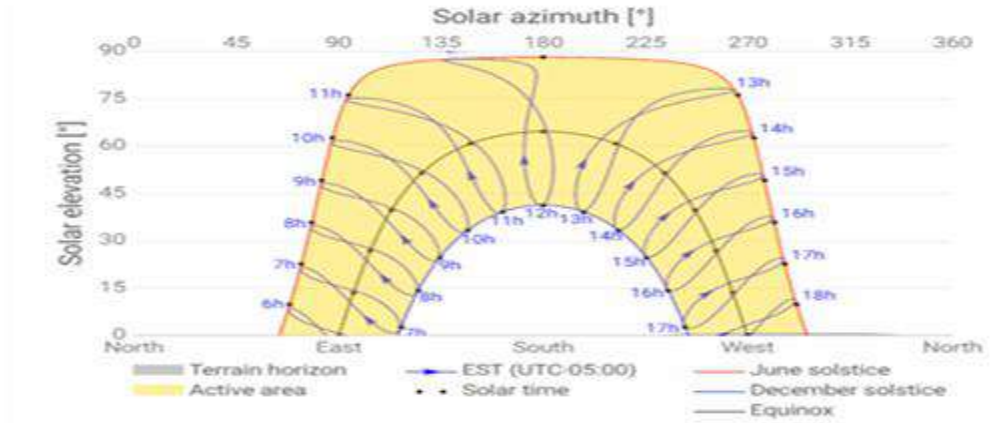
ADDITIONAL HYDROMET REFERENCE DATA – EAST ELEUTHERA

Typical Wind @ Eastern Eleuthera Site

Source: Wind Speed Animation @ E. Eleuthera (Meteoblue, 2025)

As The Bahamas is located in the Northern Hemisphere, the sun is generally positioned in a southern direction. For the East Coast of Eleuthera:

Solar Horizon & Path @ Eastern Eleuthera



Source: Solar Horizon & path for East Eleuthera (Solargis, 2024)

2 OF 3

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

ADDITIONAL HYDROMET REFERENCE DATA – EAST ELEUTHERA

Recommendations

- An alternative mechanism to alleviate any required "private land" acquisition, and also to further encourage renewable energy finance capabilities: To finance these renewable energy projects vs any required/proposed funding for private land purchase - "an alternative land lease agreement for partial provision of energy (for land use) vs. the required acquisition of the lands". The Government can possibly guarantee the partial renewable energy cost at an attractive rate, for a fixed long-term period (w/ suitable land owners).
- Solar PV panels shall have to be orientated to the South, and the prevailing winds at both moderately elevated sites (Eastern Abaco | Eastern Eleuthera) are from the Northeast. All designs (for both Abaco & Eleuthera) should be able to withstand up to 200-mph wind speeds (Cat-5 Hurricane). The angle of tilt also matters, and should be adjusted based on the latitude to optimize sunlight absorption. Proper direction and tilt help improve efficiency, reduce energy loss, and maximize the return on investment.
- Technically for PV, the energy outline for each site to ideally show the hourly profile of power generated by solar PV, energy consumption, along with the expected battery State of Charge (SoC) conditions.
- It's also suggested that during a normal day, approximately 50% of the battery capacity be utilized; other half of charge to be made available for times of bad weather, such as long cloudy or rainy days.
- Ensure that for each month, the power generated by solar PV should be sufficient to meet the entire demand.
- For The Bahamas: wherever possible, solar PV should be paired with an additional marine based renewable energy option.
- Ocean renewable energy initiatives that The Bahamas is presently engaged in are Ocean Thermal Energy Conversion (OTEC), wave energy, and tidal current flow. OTEC has been proposed for pairing with existing water desalination operations at Lower Bogue & Navel Base (Governors Harbour), on Eleuthera. The wave energy potential along the Eastern Coastline of Eleuthera (Atlantic Ocean) is very promising, and not adequately explored.
- On the island of Eleuthera; tidal/current flow @ Current Island is also a possible site for review. During both rising/falling tide conditions, the directional constant flows are recommended to be harnessed as a renewable energy source. This energy should be minimally harnessed for marine and vehicular navigation lighting in the area of each site.
- Per the National Energy Policy, all options should be explored to enhance energy security thru diversifying the energy supply mix, particularly on the Family Islands. Efficient energy use and energy conservation are required to protect the local environment and build climate resilience.

3 OF 3

Site Geotechnical Assessments by Certified Testing Laboratories International (CTLI), Bahamas.
Site Hydrological Assessments by AEES Consulting Group, LLC (AEES), Florida | Georgia

APPENDIX – D: CV for Environmental Consultant

CV - STATEMENT OF QUALIFICATIONS

Name: **Craig Christopher Russell**
B.Sc. (Hons), MRRP, MBSE, CIPM, FAAPM, FIMMM

Date of Birth: 24th April 1964

PRESENT EMPLOYMENT

2022 to present

Title: Managing Principal and Lead Environmental Consultant – Russell Craig and Associates Ltd (RCA)

- Business development
- Staff recruitment and training
- Delivery of client services
  - Environmental policy and legislation review
  - Environmental Impact Assessment
  - Environmental Baseline Assessment
  - Environmental Management Plan
  - Environmental Monitoring
  - Benthic and Bathymetric Surveys
  - Project Management, Advisory & Facilitation
  - Natural Resource Planning and Assessment
  - Forest Management and Inventory
  - Urban and Regional Planning
  - Land Use Planning
  - Trees Assessment and Valuations/Appraisals
  - Land Survey and GIS Mapping

EDUCATION:

1994-1995	University of Otago, Dunedin, New Zealand **Professional Master's degree in Regional and Resource Planning (MRRP.)**
1989-1992	Bangor University, (formerly University of Wales at Bangor), North Wales, United Kingdom. **B.Sc. (Hons.) Forestry and Wood Science**
1986-1988	Cyprus Forestry College, Republic of Cyprus **Diploma & Certificate in Forestry**

LECTURESHIPS, MEMBERSHIP AND ASSOCIATIONS

Past Adjunct Professor in Geography (100 level), Plant Biology (200 level), Comparative Geography of Small Island States (200 level), Environmental Impact Studies (EIA) (400 level) – (School of Environment and Life Sciences), University of the Bahamas (UB).
Past Council Member - Bahamas National Trust.
Past Board Member – Bahamas Public Park and Public Beaches Authority.
Past President (2005/06) – Rotary Club of New Providence – The Commonwealth of the Bahamas.

Paul Harris Fellow – Rotary International.
Member, Bahamas Society of Engineers (MBSE)
FELLOW Member: (FIMMM) – Institute of Materials, Mining and Minerals, UK
Certified International Project Management (CIPM)
Fellow, American Association of Project Management (FAAPM).

ONGOING CONSULTANCIES

- Land Use Planning Consultancy - GEF Pine Island Project, Department of Environmental Planning and Protection (DEPP), Ministry of the Environment and Natural Resources (2023 – present).
- Local Environmental Consultant Liaison for the Environmental Defense Fund (EDF) US based NGO in the Bahamas (2023 – present)
- Environmental Consultant – Cat Island Water and Road Improvement Project, Water and Sewerage Corporation (WSC - CDB), Cat ISLAND Development Company (CIDC Contractors).

Previous Employment History:

2010 – 2022 - **Director of Forestry** – Ministry of the Environment and Natural Resources

- Director and administrative head of the Forestry Unit.
- Provide technical advice to the Minister and Permanent Secretary on Forestry and Environmental matters.

2009 – 2010 - **Deputy Permanent Secretary** – Ministry of the Environment

- Assist the Minister of State for the Environment with portfolio responsibilities (i.e., policy matters relating to the management of Bahamas Electricity Corporation and Water and Sewerage Corporation)

2003 – 2009 - **Chief Housing Officer** – Department of Housing (Ministry of Housing and National Insurance).

- Administrative Head of the Department of Housing, managing the Government's affordable housing program.

1982 – 2003 **Trainee Surveyor, Assistant Forest Officer, Forest Officer, Senior Forest Officer** - Department of Lands and Surveys, Office of the Prime Minister

PUBLICATIONS, ARTICLES AND DISSERTATIONS

- Russell, Christopher. The Conservation of Biodiversity in the Natural Pine Forest of the Bahamas. *El Pitre – Journal of the Caribbean Ornithology Society.* 1993.
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- Russell, Christopher; *Environmental Management Plan (EMP) for the Carmichael Village Subdivision,* Carmichael Road, Nassau Bahamas. Department of Housing, Ministry of Transport and Housing. 2022

- Russell, Christopher*; Environmental Baseline Assessment (EBA) for Proposed Paradise Island School Project*, Paradise Island. Atlantis Resort. Nassau Bahamas. 2022.

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- Russell, Christopher. *Environmental Management Plan (EMP). Ki'ama Bahamas Project,* Elizabeth Island, Gt. Exuma Island. EcoIsland Elizabeth Ltd, 2023

- Russell, Christopher. *Environmental Impact Assessment (EIA) for Goldwynn Penthouses – II Project*, Cable Beach, Nassau Bahamas. 2024.

- Russell, Christopher. *Environmental Management Plan (EMP) for Goldwyn Penthouses – II* Project, Cable Beach, Nassau Bahamas. 2024.

- Russell, Christopher. *Environmental Management Plan (EMP) RUBIS Fuel Tank Installation,* LPIA, Nassau Bahamas. 2024.

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