

Environmental Impact Assessment (EIA)

Premier Estates I Subdivision



Sea Grape Model

Undertaken for

DEPARTMENT OF HOUSING

MINISTRY OF HOUSING AND URBAN RENEWAL

Shirley & Charlotte Streets

Submitted to

DEPARTMENT OF ENVIRONMENTAL PLANNING AND PROTECTION

MINISTRY OF THE ENVIRONMENT AND NATURAL RESOURCES

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1.0 Executive Summary

This Environmental Impact Assessment (EIA) objectives are to the identify the potential environmental impacts of the proposed Premier Estates I subdivision based on site investigations and make appropriate recommendations for minimizing or mitigating those impacts that would adversely affect the environment. Regard must be made to local legislation, international conventions, and best management practices. Guidelines for the drafting of the EIA 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 construction activities.

The Ministry of Housing and Urban Renewal proposes to develop a subdivision, and build 147 affordable residential houses on 30 acres of Government Lands (Perpall Tract) vested in the Department of Housing situated, in the Chippingham area in Nassau, New Providence, The Bahamas.

Key features of the development include:

- Investment of some **BSD\$30,000,000.00**
- Construction of 147 affordable residential homes
- Employment of up to 100 Bahamian construction workers for 2 years

Biological Baseline Studies

Assessment regarding botanical, avian, hydrological and wildlife studies were undertaken to document baseline conditions and to effectively analyze the impacts associated with the proposed development.

The botanical survey identified a dense Dry Broadleaf Evergreen Coppice Forest with some 100 vascular plants recorded on the project site. The list is a fair representation of the extent of ornamental, flowering plants, palms, and fruit trees (Mango, Dilly), versus native species on the property. Eleven (11) trees were identified as protected under the Forestry (Declaration of Protected Tree) Order, 2021, and are the Agave (*Agave millspaughii*), Silver Top Palm (*Coccothrinax argentata*), Gum Elemi (*Bursera simaruba*) Small Leaf Blolly (*Guapira discolor*), Buccaneer Palm (*Pseudophoenix sargentii*) Wild Tamarind (*Lysiloma latisiliquum*), Thatch Palm (*Leucothrinax morrisii*), Sabal Palm (*Sabal palmetto*) Brasiletto (*Tara vesicaria*), Joe Wood (*Jacquinia keyensis*), and Mahogany (*Swietenia mahagoni*). Six species are invasive, and include the Australian pine (*Casuarina equisetifolia*), Hawaiian Sea Lettuce (*Scaevola taccada*), Brazilian pepper tree (*Schinus terebinthifolius*) Cattail (*Typha domingensis*) Castor Bean (*Ricinus communis*) and Morning Glory (*Ipomoea indica*).

The Avian survey identified the presence and abundance of some 19 bird species, of which 16 were Permanent Resident Breeding (PRB) (e.g., white crown pigeons, mourning doves, Bahama mockingbirds, Cuban grass quit,), versus 2 being Winter Resident Non-breeding) (WRN) (the Warblers) and one Summer Resident Breeding (Mangrove Cuckoo). Two endemic bird species (Bahama woodstar and Bahama Mockingbird) were also observed. The dominance of the PRB species along with some WRN species confirms the adaptation of the species to sites of high biodiversity, abundance of food resources and the varied vegetation types for roosting and breeding purposes in the surrounding areas.

Biological wildlife observed on the project comprised mainly butterflies, lizards, wasps, mosquitos, and numerous anthropoids throughout the entire site.

Environmental Impacts

Impacts were viewed in the context of how the physical environment will be impacted by both the infrastructural developments (electricity, water and sewer supply, road reservation infrastructure, and home construction development, utilizing qualitative criteria (i.e., nature, type, likelihood, scale, duration, reversibility, and significance) to assess impact.

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

The most direct impact of the development of 147 homes will be the removal of 80% of the natural vegetation and any existing wildlife associated on the site. To mitigate this loss, the Ministry of Housing and Urban Renewal intend to landscape the road verges and lots with native flowering plants and transplanted protected trees to re-attract avian and wildlife back to the area. To retain 20% of the natural vegetation as natural green spaces/public park, with the development of retention ponds and construction of numerous deep disposal wells, located strategically within the subdivision. This will be augmented by a stormwater management plan, for flood water control, thus reducing impacts on ground water resources. The subdivision calls for the Installation of a waste water treatment plant as part of a central sewer system, to address sewer disposal issues. Due to the removal of 80% of the dense vegetation (Dry Broadleaf Evergreen Formation) inclusive of protected tree species, the qualitative criteria rating is **High**. Additionally, the magnitude of severity of the overall impact to the natural and physical environment was scaled as **High**. Hence, overall significance of impacts is rated as **Moderate/High** in the medium to Long Term.

Noise levels and air quality impacts are expected to increase once construction activities commence (during normal working hours), hence a **moderate** rating, but these will be temporal once construction works have ended. The hydrology and hydrogeological factors of this environment was scaled as **High**, as the development is being sited at low elevation (northern portion – lowest level), so potential for flooding and storm surges are more likely to occur, especially during heavy rains, and passing storms/hurricanes from the north.

As there will be no construction on the coastal/marine environment, it is projected that there will be No negative impact on these ecosystems in the Medium to Long Term.

Socio-economic Impacts

The project construction timeline for the Premier Estates I is anticipated to be some two years, with a total projected investment of some **BSD \$30,000,000**. This level of investment will have a far reaching, long term beneficial impact on the economy of New Providence Island, in new construction jobs. This is particularly significant, given the high demand for affordable homes will have a multiplier effect on the housing market in reducing the demand on New Providence Island.

Key Mitigation Measures and Recommendations

Terrestrial:

- Relocate, where practical, selected protected species to be replanting within road verges and green spaces.
- Remove invasive species Australian pine (*Casuarina equisetifolia*), Hawaiian sea lettuce (*Scaevola taccada*) and Brazilian Pepper (*Schinus terebinthifolius*) trees.
- Plant native flowering plants, protected species, and endemic species in landscape areas.
- Retention of 20% natural vegetation as part of green spaces/public park, incorporating home construction within natural landscapes.

Avian:

- Plant native flowering plants along boundaries of property and within landscape areas to encourage birds to continue to forage and roost, as these areas in situ adequately support avian life in area.
- The strategy for the loss of bird habitat will involve the replanting of indigenous native fruit bearing plants commonly used as food by birds (e.g., pigeon plum, gum – elemi, etc.), within landscaped areas of residences.

Hydrology:

- Ensure adequate fuel and chemical management practices on site would ensure ground water resources are not negatively impacted.
- Ensure adequate waste management practices on site are not negatively impacted.
- Implement a storm water management plan for storm water drainage control, with deep wells, preferably creation of retention ponds (*See Appendix - E*)

Air Quality and Noise:

- Employ best practices in construction methods to minimize dust emissions which impair air quality.
- Construction workers wear PPE to include earplugs in areas with construction noise is over 70dB.

Solid and Hazardous Waste:

- Solid waste and vegetation waste generated will be immediately disposed of at the New Providence Ecology Park solid waste site at Tonique Darling Highway.
- Solid and hazardous waste will be placed in containers and properly disposed of 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 of the residential housing.

- All homes will follow fire requirements of the Bahamas Building Code.
- A Hurricane Preparedness and Contingency Plan will be developed in the event of a storm or hurricane.

Occupational Health and Safety:

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

Public Consultation and Involvement

The DEPP will facilitate a Public Consultative process (virtual/In-house Town hall meeting) for public review and commentary of the EIA, at a date to be determined.

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 EIA is received from the DEPP.

Conclusions:

The Premier Estates I project site, situated in the Chippingham area offers an excellent opportunity for sustainable development of a residential housing investment. The project with its investment of some **BSD\$30,000,000.00** is expected to generate much needed economic stimulus for the New Providence (construction jobs, and much needed affordable housing for Bahamians), but has some major issues regarding its environmental impact. 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. Utilizing the mitigation measures will guarantee that any negative impacts identified are reduced/or are mitigated and is sustained.

2.0 Description of Proposed Project and Scope

2.1 Description of Proposed Project

2.1.1 Conceptual Master Plan

The Department of Housing proposes to develop an affordable housing subdivision on some 30 acres of government lands vested in fee simple to the Minister with responsibility for Housing. The subdivision is located in the northeast quadrant of the Perpall's Tract, at a lower elevation (<10 Ft above MSL), and is bordered on the North by lands vested to the BATELCO, to the East by Government lands, to the South by lands vested in the Ministry of Health and Wellness (new Hospital site), and to the West by Government

|

lands, and will comprise 147 lots (average 50ft x 100ft – 5000sq. ft.) in one phase (**Figure 2.1**) (*See Appendix – A*). Of the 147 lots designated to home constructions, two model home types A and C (**Figures 2.2 and 2.3**) were designed to be constructed on the said lots. **Figure 2.4** depicts the catch pits (basins) and drainage wells positions within the subdivision. **See Appendix – E** for greater details. Whereas, **Figure 2.5** depicts road reservations layout, the positioning of the main water lines, with laterals, the main sewer lines, and the location of the proposed waste water treatment plant (WWTP). **See Appendix – D** for great details.

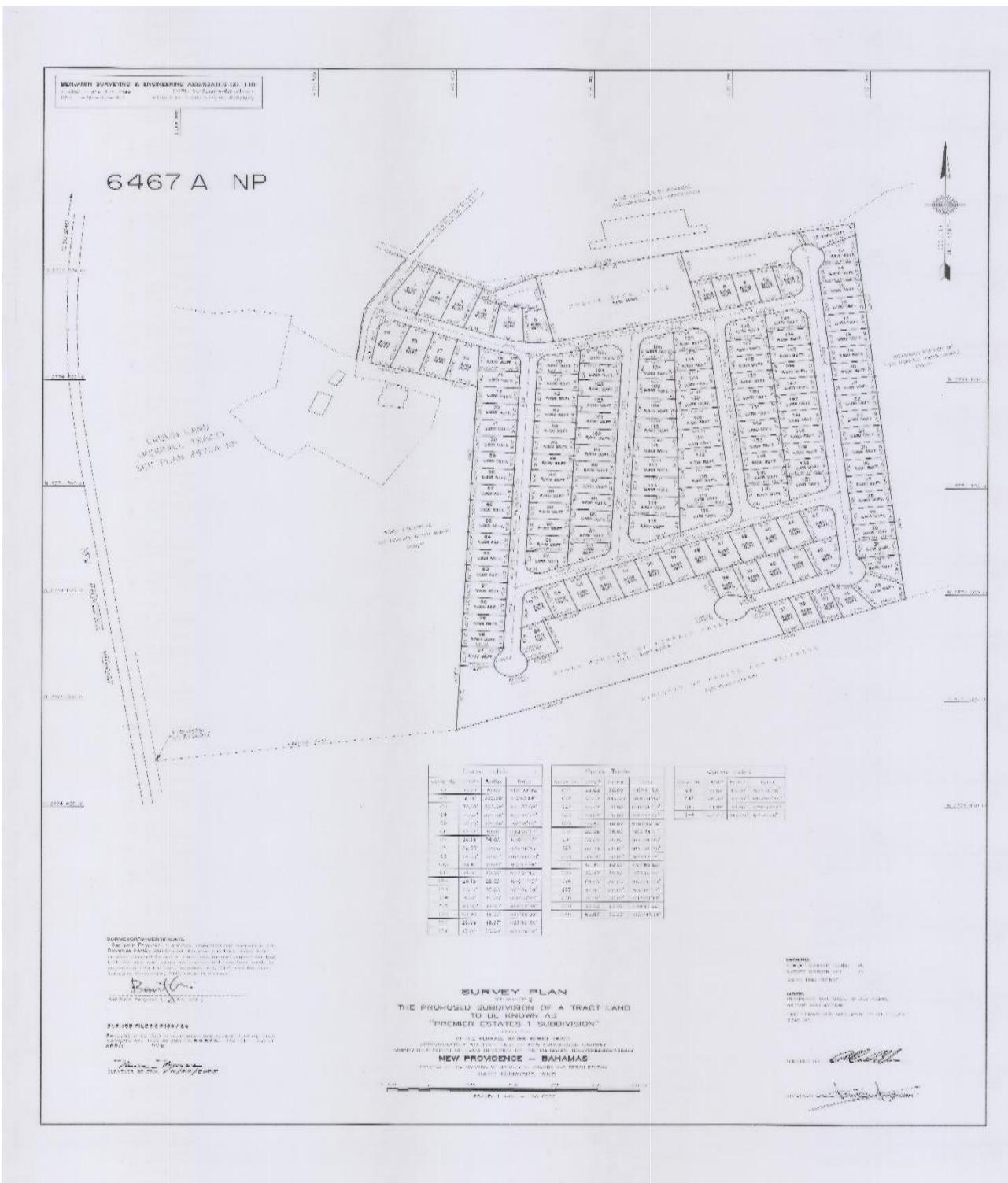


Figure 2.1: Depicting Survey plan showing Lots and boundaries for Premier estates I.

Models of Houses for 'Premier Estates I'

Model A

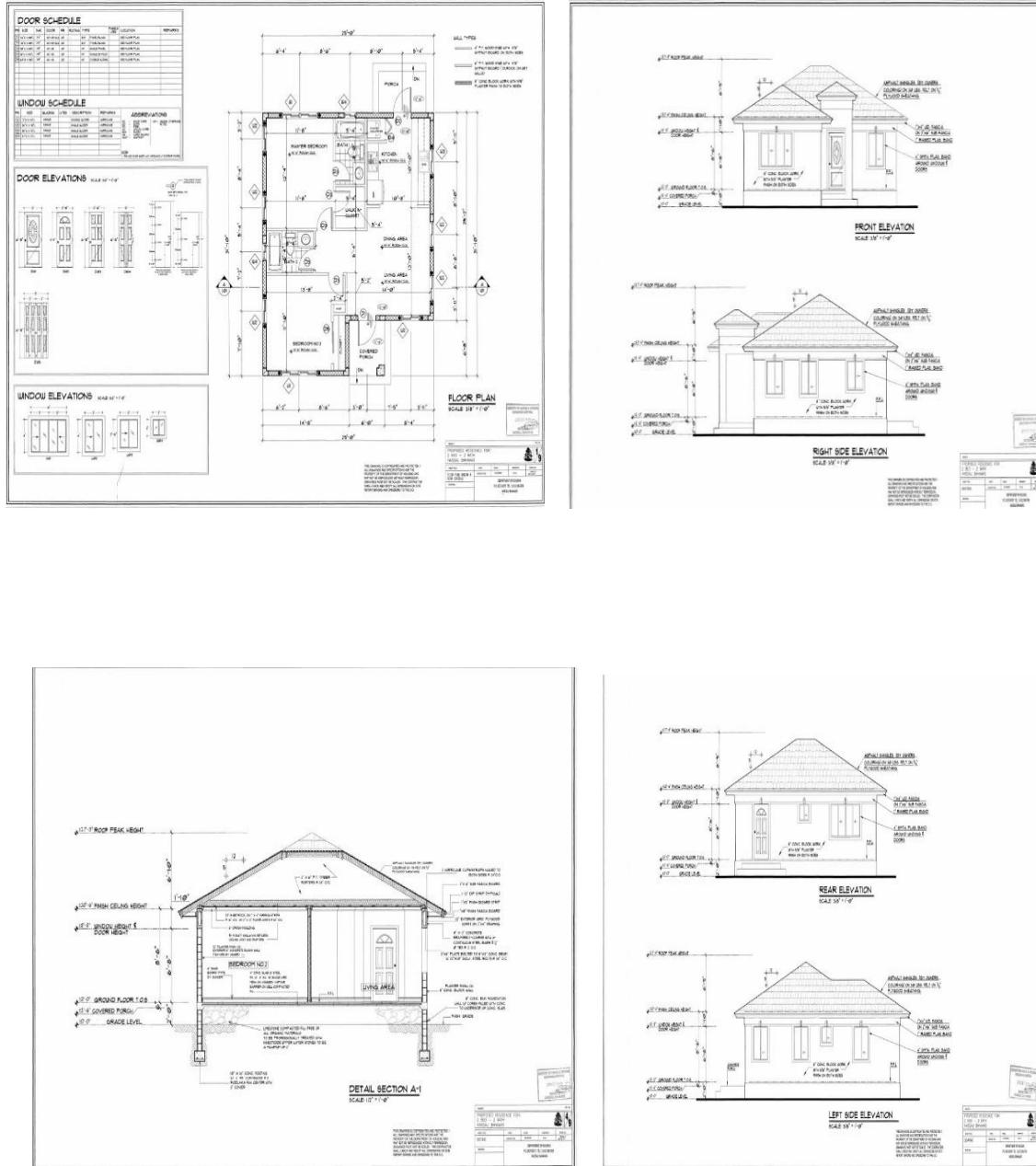


Figure 2.2: Showing Model A of the proposed development

Model C

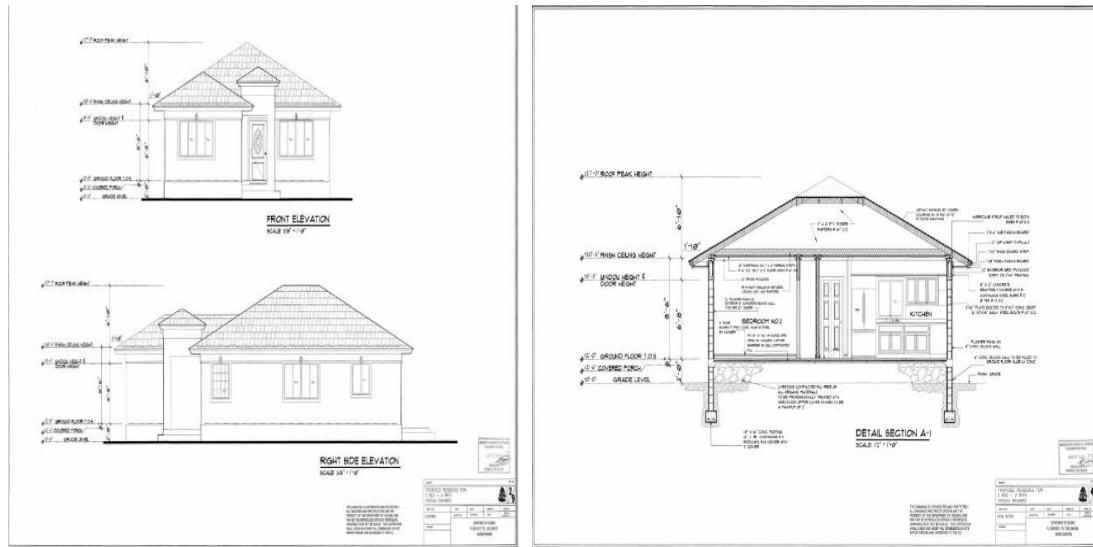
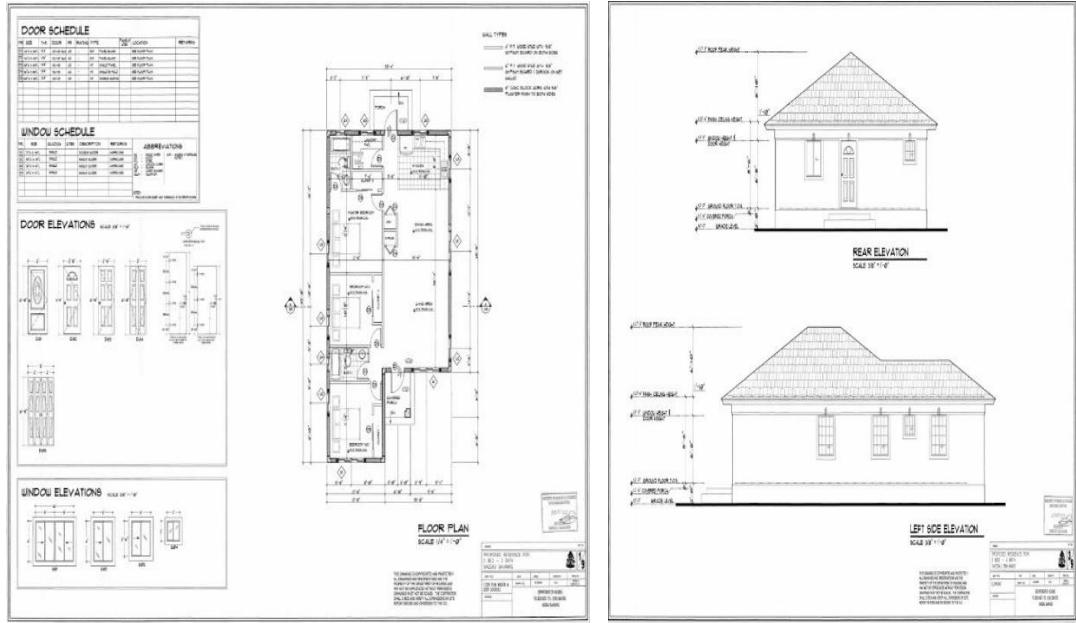


Figure 2.3: Showing Model C of the proposed development

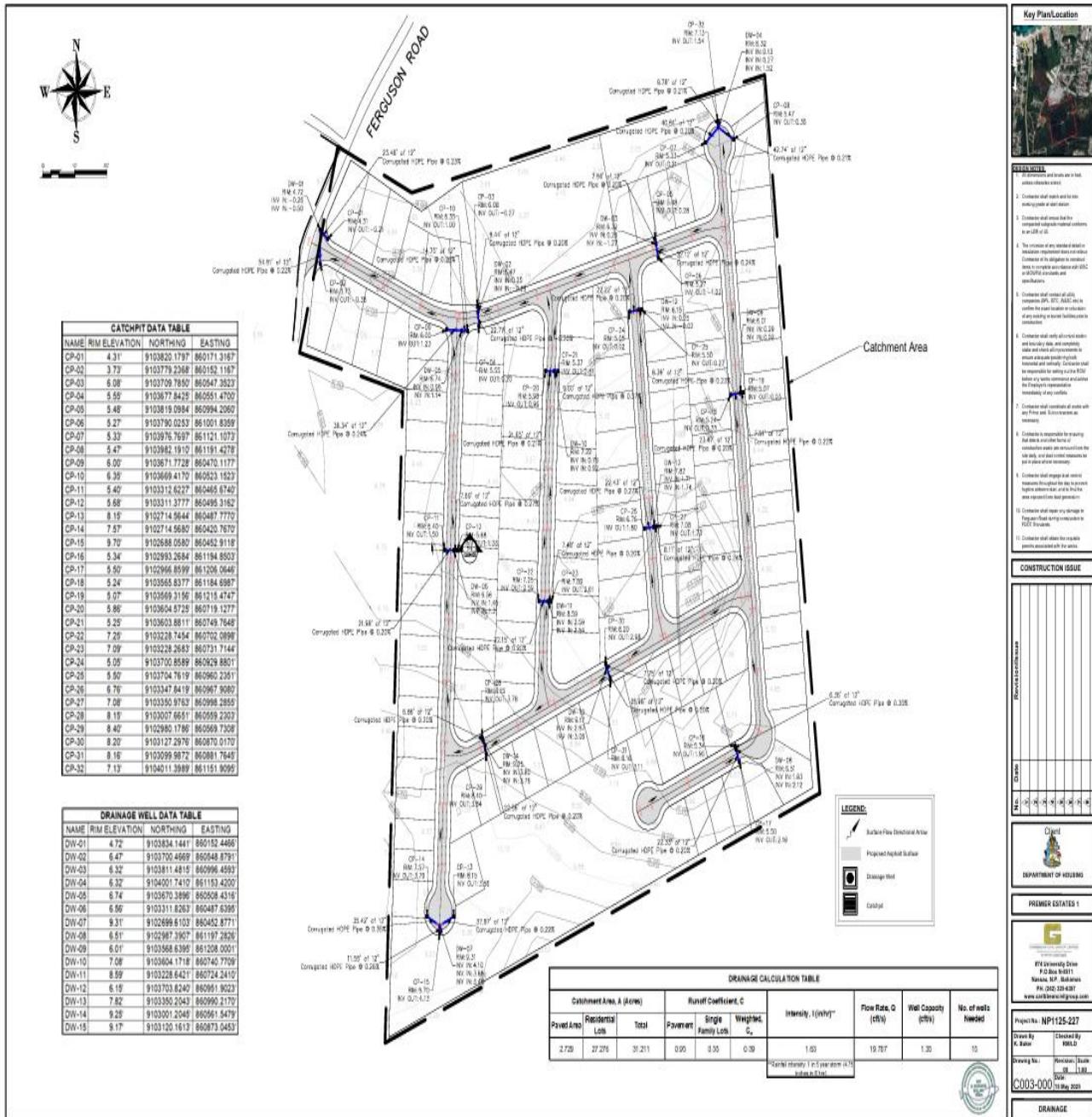


Figure 2.4: Depicts catch pits (basins) and drainage wells positions within subdivision (civil designs), (Source CCG, 2025)

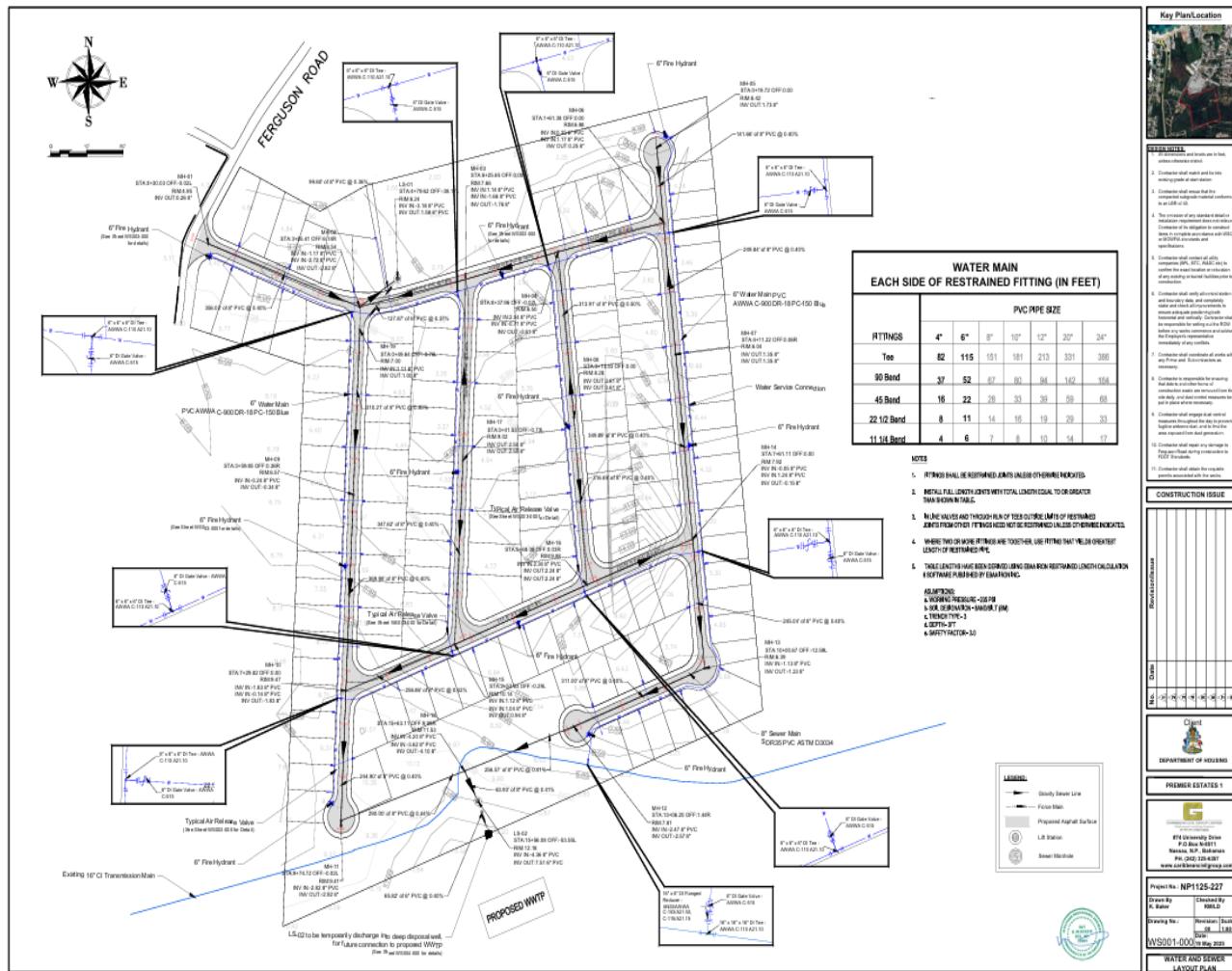


Figure 2.5: Depicts road reservations, water mains, laterals, with sewer lines, and location of waste water treatment plant (WWTP) within subdivision (Source: CCG 2025)

2.1.2 Economic Benefits and Impact

The Residential developments will represent a further investment in The Bahamas of more than **BSD \$30,000,000** by the Ministry of Housing and Urban Renewal and will further contribute to the economic vibrancy of New Providence. New Construction jobs for semi and skilled laborers in the construction industry is a prime benefit of the project. This brings more revenue to families and hence economic stimulation. In addition to new first time affordable home ownership for Bahamian families.

2.2 Description of Alternatives

2.2.1 The “No-action” Alternative

With these type developments, there is always the “No Action” Alternative. The “No Action” alternative would keep property in the undeveloped state, unless sold to another buyer. With no new constructions under consideration, this would eliminate the intended purpose for purchasing the property. Any economic activity, employment opportunities on New Providence Island gained through construction jobs, permanent jobs, investment injections, would be missed and lost.

2.2.2 Other Alternatives Considered

The property is government owned, with a minimal development footprint.

The site selection was based on:

- The land was available for government affordable housing development.
- The size of the project with its moderate environmental impact on the environment, made it ideal to accommodate the project components.

3.0 Agency Consultation and Public Involvement

3.1 Agency consultation activities and results

- Meeting and site visit with DEPP in June 2025 to observe and note existing site conditions and preparation of draft Terms of Reference (TOR) for the EIA.
- TOR for EIA approved by the DEPP in June 2025.
- Discussions held between the Ministry of Housing and Urban Renewal and the Water and Sewerage Corporation (WSC) on concerns relative to the decommissioned Perpall Tract well fields, and conservation of ground water resources, and opportunities for water extraction from the area in the near future, and location of the Waste Water Treatment Plant (WWTP) (*See Appendix – H*).

3.2 Public involvement activities and results

The public and other relevant stakeholders will be given an opportunity to raise their concerns and pose questions regarding the EIA to the Environmental Consultant, and the Department of Housing, Ministry of Housing and Urban Renewal representatives at a public/ In-house/Virtual Public Meeting on a date and time to be determined by the DEPP

4.0 Baseline Description of Affected Environment

4.1 Geographical Location

The proposed Premier Estates I Subdivision development is situated Off of Ferguson Road – Perpall Tract, running North to South. On the Northern boundary boarded by land occupied by BTC, along the Southern boundary boarded by lands vested to the Ministry of Health and Wellness, and on the east and west boarded by lands being portion of the Perpall Water Works Tract (*Figure 2.1 and 2.2 below*).

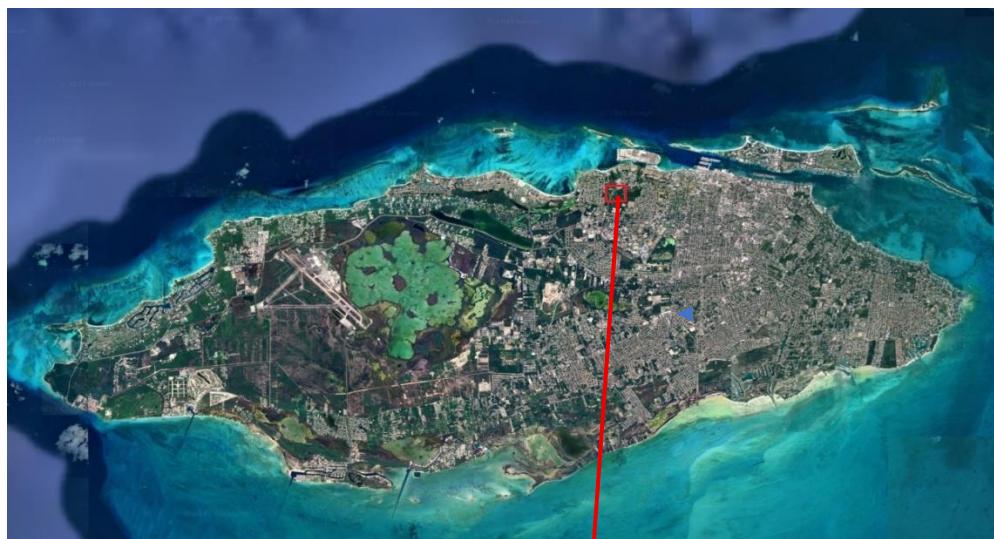


Figure 4.0: Map of New Providence Island with the project location as the inset at top Right Corner (Outlined in Red) (Source: Google Maps 2025).



Figure 4.1: Depicts a closer view of the project location in relation to its boundary location.

4.2 Land Use

Presently the area lots identified as “Premier Estates I” designated for the development was previously zoned as “green space”, and subsequently rezoned “residential” by the Department of Physical Planning

4.3 Physical Environment

4.3.1 Climate

The Bahamas’ climate is classified as subtropical, influenced by the sea, particularly 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 °F during the winter to the low and high 80s °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.

Like the other Bahama Islands, New Providence Island 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.

4.3.1.1 Hurricanes

The Bahamas is affected by hurricanes from June 1st to November 30th. The most recent hurricane to directly affect New Providence was Hurricane Matthew that made landfall in October 2016 and was classified as a Category 4 hurricane. The island experienced sustained periods of hurricane force winds, with the southern and eastern coastal areas experiencing storm surges and coastal flooding up to eight (8) feet in places.

On 1st September 2019 Hurricane Dorian passed to the northwest of New Providence, in which the island received heavy rains and strong winds for several days, with flooding in low lying areas. The hurricane directly hit Marsh Harbour, Abaco with Category 5 Hurricane winds of up to 300 km per hour, and damaged or destroyed most buildings in the township. It then moved westerly impacting the East end of Grand Bahama Island, before turning north away from the Bahamas. The destruction was most severe and telling, with the loss of human life, property, infrastructure, and natural vegetation.

Between 1859 and 2019, according to datasets from the Coastal Services Center (National Oceanic and Atmospheric Administration), seventy-two (72) tropical disturbances (tropical storms and hurricanes) have come within 50 nautical miles of Nassau, New Providence. This data suggests that New Providence is highly likely to receive a direct hit from a hurricane event in any given year.

4.3.2 Topography

The total acreage of land comprises approximately 30 acres of government lands consist of dense dry broadleaf evergreen forest with high plant diversity and vegetation cover. Evidence of old wells trenches and bore holes, are indicative of its past usage for extraction of freshwater by the Water and Sewerage

Corporation (WSC), and eventually abandoned. The natural vegetation morphed into a regenerated dry broadleaf evergreen coppice formation over an extended period of time according to **Bowleg (2025)**,

The ‘Premier Estates-I Housing Subdivision’ is proposed for the north-east quadrant of the Perpall’s Tract Lands, at a lower elevation (< 10-Ft above msl). The gradient of both surface runoff and the natural groundwater flow is from the South to North. The Premier Estates - I Housing Subdivision’ shall be located on lower elevated lands (< 10-Ft above msl). The entire Perpall’s Tract Area is primarily designated as ‘Flatlands’.

Groundwater is encountered within 3 to 5Ft (0.924 to 1.524-m) below ground level (bgl) toward the North (lower elevation) tracts of land. The typical direction of groundwater flow is from South to North within this area (along with surface runoff). Open surface water trenches/canals exist on the lower land parcels of the Wellfield Area, moving toward the Northern boundary.



Figure 4.2 : Showing the diversity of tree species in the upper canopy level of the property



Figure 4.3a & b: Photos of abandoned well trenches found in various areas of the property subject to subdivision development



Figure 4.4a & b Photos of abandoned deep wells found in various areas within the parcel.

4.3.3 Hydrogeology and soils

The hydrological, geological and water resources of the Bahamas are directly linked, due to the lack of any rivers. Hence, the only natural means of recharge for the underlying freshwater resources is via rainfall. According to Sealy (1994), the remaining amount of rainfall is estimated to form lens. It is estimated that some 75% of precipitation that reaches the land is lost to the atmosphere through evaporation and as runoff from the surface back to the sea. 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.

The physical baseline aspects for the hydrology | hydrogeology of the project site includes water resources, surface water, drainage, and flood prone areas. Groundwater is encountered within 3 to 5Ft (0.924 to 1.524-m) below ground level (bgl) toward the North (lower elevation) tracts of land. The typical direction of groundwater flow is from South to North within this area (along with surface runoff). Open surface water trenches/canals exist on the lower land parcels of the Wellfield Area, moving toward the Northern boundary.

Perpall's Tract Wellfield

Originally established as a wellfield in the late 1930s, with the intent to provide water to the City of Nassau; Government acquired the entire acreage for this purpose through eminent domain between 1937 and 1942. These low elevated lands to the north of the ridge were ideally suited for freshwater production. The developed water resources area had a safe yield of 124,000 gallons/day (@ <600-mg/L Chloride), but 65% of the developed area is below 7Ft elevation (above mean sea level – amsl). (*Bowleg 2025*)

Historically, flooding was and shall continue to be a concern toward the North, in the Perpall's Tract Wellfield Area (at the lower elevation). Typical karst geologic features (blue hole, caves, depressions, & solution features) may exist at the site; however, surface water concerns & drainage must be addressed for the lower elevations of Perpall's Tract. The Premier Estates-I Housing Subdivision' is to be located on lower elevated lands. (*Bowleg 2025*).

The Perpall Tract is considered A 'Potential Flood Hazard' for the low elevation parcel: The Lynden Pindling International Airport (LPIA) | Historical Rainfall Dataset for New Providence (NP) is located within 6.21-mile (10-km), in support of flood prediction data. Flooding due to excessive rainfall, and/or during the passage of Tropical Storms is a concern for the lower land parcel(s) of the 'Perpall's Tract Wellfield Area'. It is RECOMMENDED FOR THIS SPECIFIC SITE AREA that wherever possible, the placement of the critical infrastructure be located at the minimum higher elevation (+10 Ft (*Bowleg 2025*)).

Incorporation of the buildings into the 'unique' greenspace must be encouraged. For effective mitigation of potential stormwater flows toward the North (from the elevated developed areas); retention ponds may be incorporated into an ideal shared greenspace / bike trail area, for use by the neighboring communities and as an urban park / tourist attraction (throughout the lower elevation). Apart from the known hydrological benefit of the land, the rich natural biodiversity of the area must also be taken into careful consideration. (*Bowleg,2025*)

Additional site hydrogeological | water resources assessment(s) must be conducted to evaluate the available information & data achieves, assess the present limits of the freshwater lens, notate the existing conditions (against the historical) for the hydro-geological features, and also determine influences between the landform and the marine environment (groundwater levels vs marine/tidal level trends). (*Bowleg 2025*)

4.3.4 Air Quality

Presently, there are no sources of air pollution or poor air quality on the project site, as it is currently undeveloped, with no existing residential buildings. According to the World Health Organization's 2018 Fact Sheet No 313, the air quality in the Bahamas is considered moderately unsafe. The most recent data indicates the country's annual mean concentration of PM2.5 is 17 $\mu\text{g}/\text{m}^3$, exceeds the recommended maximum of 10 $\mu\text{g}/\text{m}^3$.

4.3.5 Noise

The typical noise levels of highway traffic normally range from 70 to 80 dB (Decibels) at 15 meters (50 feet) from the highway. For comparison, a lawnmower, blender, and hairdryer are over 85 dB (Decibels). These levels affect many people, interrupting concentration, and limiting the ability to carry on a conversation. Presently there is no issue of noise pollution. Once construction activities commence, noise levels are expected to be raised (normal work hours 9am – 5pm), albeit temporarily as construction commences. Best Management Practices will be implemented to mitigate excessive noise levels during normal working hours. Noise levels will return to pre-construction levels once development activities cease.

4.4 Natural Environment

Studies with respect to botanical, avian and biodiversity were undertaken over an initial two-day period (14 & 15 June 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.

4.4.1 Terrestrial Surveys

4.4.1.1 Methodology

The 30-acre parcel of land was ground truced (walking) along the entire boundaries.. Using Areces et al. (1990), all vegetation identified 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 eradication or control. The presence and abundance of protected trees were 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 protected 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 30 acres). Firstly, the tally count for each protected plant species was totaled per plot, then averaged over the four plots for an overall plot average per acre, next the plot average was extrapolated to the entire property acreage. **Figures 4.8, 4.14, 4.18, and 4.23** 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.

4.4.1.2 Terrestrial Ecosystem

Only one dominant category of vegetation type identified was that of Dry Broadleaf Evergreen Formation.



Figure 4.5a & b: Showing Agave plant (left) and Flowering Wild Tamarind (right) growing within interior



Figure 4.6a and b : Showing existing road tracts within and at the boundaries of the land parcel.

4.4.2 Vegetation Map

A vegetation map at **Figure 4.7**, below highlights the Human Altered vegetation type (Dry broadleaved Evergreen Formation) found at the project site.

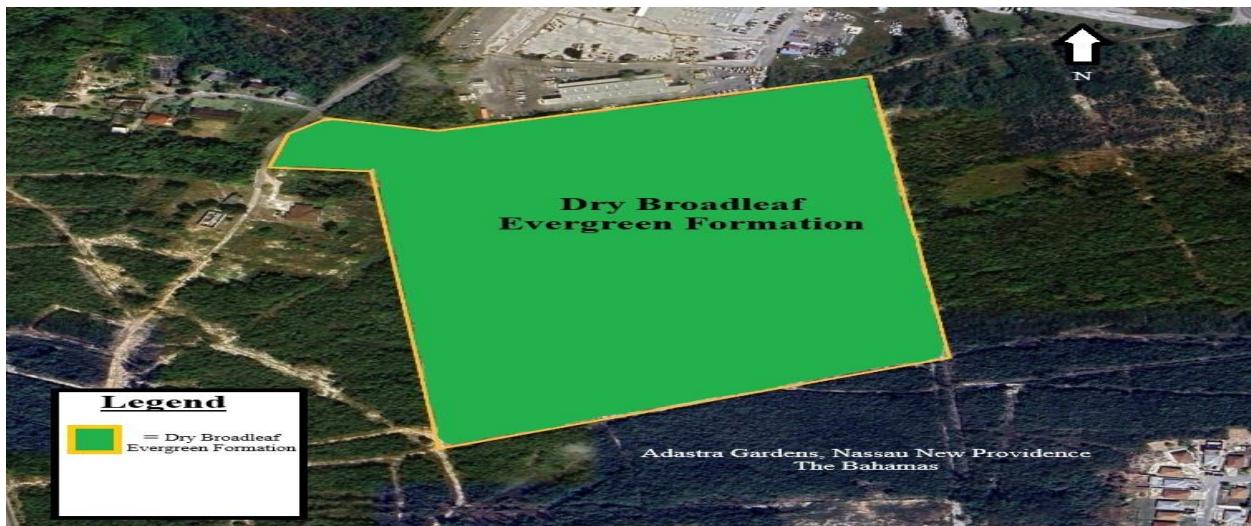


Figure 4.7: Map depicting the one vegetative type (Dry Broadleaf Evergreen Formation) edged in yellow, found on the project site.

4.4.3 Vascular Plant Diversity

Based on an analysis of data collection, a total of one hundred (100) species were identified from the site (**Table 4.1**). There is a high probability that this number provides an excellent representation of the species on site. One can reasonably conclude, that the list is a fair representation of the extent of the diversity on the property.

Table – 4.1: Vascular plant species recorded on property

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

Botanical Name	Common Name	N	NN	P	I
<i>Bidens alba</i>	Shepherd's needle		✓		
<i>Bursera simaruba</i>	Gum Elemi			✓	

<i>Caladium bicolor</i>	White spindle flower		✓		
<i>Cassytha filiformis</i>	Love vine	✓			
<i>Rhynchospora floridensis</i>	White-top sedge		✓		
<i>Sabal palmetto</i>	Sabal palm			✓	
<i>Salvia greggii</i>	Native sedge	✓			
<i>Schinus terebinthifolia</i>	Brazilian pepper				✓
<i>Sideroxylon salicifolium</i>	Willowbustic	✓			
<i>Casuarina equisetifolia</i>	Casuarina				✓
<i>Ipomoea indica</i>	Morning Glory				✓
<i>Leucanthemum vulgare</i>	Wild Oxe-Eye Daisy	✓			
<i>Mucuna pruriens</i>	Monkey Tamarind		✓		
<i>Ricinus communis</i>	Castor Bean Plant				✓
<i>Senna bicapsularis</i>	Sennas (Christmas Bush)		✓		
<i>Toxicodendron radicans</i>	Poison Ivy	✓			
<i>Petitia domingensis</i>	Wild Guava	✓			
<i>Trema lamarckiana</i>	Pain-in-the-back	✓			
<i>Lantana involucrata</i>	White Sage	✓			
<i>Carex polystachya</i>	Caribbean Sedge		✓		
<i>Urochloa mutica</i>	California Bay Grass		✓		
<i>Adiantum capillus</i>	Maiden Hair Fern		✓		
<i>Eugenia axillaris</i>	White Stopper		✓		
<i>Tabebuia bahamensis</i>	Five Finger	✓			
<i>Coccoloba uvifera</i>	Hawaiian Sea Grape		✓		
<i>Simarouba glauca</i>	Paradise Tree		✓		
<i>Pteridium aquilinum</i>	Bracken Fern	✓			
<i>Pithecellobium keyense</i>	Rahms Horn	✓			
<i>Pilocereus millspaughii</i>	Wild Fig		✓		
<i>Chrysobalanus icaco</i>	Cocoa Plum	✓			

<i>Passiflora edulis</i>	Passionflower Vine	√			
<i>Agave millspaughii</i>	Agave			√	
<i>Smilax havanensis</i>	Chainey Briar		√		
<i>Vachellia choriophylla</i>	Cinnecord	√			
<i>Strumpfia maritima</i>	Mosquito Bush		√		
<i>Senna occidentalis</i>	Wild Coffee	√			
<i>Stachytarpheta jamaicensis</i>	Rats Tail		√		
<i>Guapira discolor</i>	Short Leaf Blolly	√		√	
<i>Echites umbellatus</i>	Devils Potato		√		
<i>Leucaena leucocephala</i>	Jumbay		√		
<i>Coccoloba diversifolia</i>	Pidgeon Plum	√			
<i>Bromeliaceae spp.</i>	Bromiliad		√		
<i>Smilax havanensis</i>	Chaney Briar		√		
<i>Chiococca alba</i>	Snowberry		√		
<i>Metopium taxiferum</i>	Poison Wood		√		
<i>Opuntia cochenillifera</i>	Prickly Pear		√		
<i>Tara vesicaria</i>	Brasiletto			√	
<i>Mucuna pruriens</i>	Monkey Tamarind		√		
<i>Ficus maxima</i>	Fig Tree		√		
<i>Radermachera sinica</i>	China Doll		√		
<i>Guapira obtusata</i>	Long Leaf Blolly	√			
<i>Phyllanthus epiphyllanthus</i>	Rock Bush		√		
<i>Lasiacis divaricata</i>	Bamboo Grass		√		
<i>Thouinia discolor</i>	Silver Leaf		√		
<i>Alvaradoa amorphoides</i>	Alvaradoa		√		
<i>Salvia arborescens</i>	Caribbean Sage		√		
<i>Waltheria indica</i>	Sleepy Morning		√		
<i>Heliotropium angiospermum</i>	Cat Tongue	√			
<i>Ficus aurea</i>	Golden Wild Fig		√		
<i>Picramnia pentandra</i>	Snake Root		√		
<i>Pisonia aculeata</i>	Haul Back	√			
<i>Melicoccus bijugatus</i>	Guinep Tree		√		

<i>Carica papaya</i>	Papaya Tree		✓		
<i>Leucothrinax morrisii</i>	Thatch Palm			✓	
<i>Pseudophoenix sargentii</i>	Buccaneer palm			✓	
<i>Scaevola taccada</i>	Hawaiian sea lettuce				✓
<i>Typha domingensis</i>	Cat Tail				✓
<i>Musa paradisiaca</i>	Banana		✓		
<i>Heliotropium curassavicum</i>	Pond Weed	✓			
<i>Heptapleurum actinophyllum</i>	Umbrella Tree		✓		
<i>Manilkara zapota</i>	Dilly		✓		
<i>Mangifera indica</i>	Mango		✓		
<i>Rauvolfia nitida</i>	Milk Bush	✓			
<i>Clusia rosea</i>	Signature Tree		✓		
<i>Cladium mariscus</i>	Saw Grass	✓			
<i>Colubrina arborescens</i>	Soap Bush	✓			
<i>Delonix regia</i>	Poinciana Tree		✓		
<i>Chrysophyllum oliviforme</i>	Satin Leaf	✓			
<i>Albizia lebbeck</i>	Woman's Toungle				✓
<i>Adonidia merrillii</i>	Christmas Tree Palm		✓		
<i>Eustoma exaltatum</i>	Catchfly Prairie Plant		✓		
<i>Couroupita guianensis</i>	Cannonball Tree		✓		
<i>Clitoria ternatea</i>	Butterfly Pea		✓		
<i>Phlebodium aureum</i>	Serpent Fern	✓			
<i>Dracaena trifasciata</i>	Snake Plant		✓		
<i>Wodyetia bifurcata</i>	Foxtail Palm		✓		
<i>Bourreria succulenta</i>	Strongback	✓			
<i>Jacquinia keyensis</i>	Joe Wood			✓	
<i>Zanthoxylum fagara</i>	Wild Lime	✓			
<i>Combretum indicum</i>	Rangoon Creeper		✓		
<i>Coccothrinax argentata</i>	Silver Palm			✓	
<i>Annona glabra</i>	Pond Apple	✓			
<i>Canavalia rosea</i>	Bay Bean	✓			

<i>Phaseolus vulgaris</i>	Bean Plant		✓		
<i>Manihot esculenta</i>	Cassava		✓		
<i>Axonopus ssp.</i>	Carpet Grass		✓		
<i>Swietenia mahagoni</i>	Mahogany			✓	
<i>Pluchea baccharis</i>	Rosy Camphorweed		✓		
<i>Tillandsia ssp</i>	Air Plant		✓		
<i>Eleusine indica</i>	Goose Grass		✓		
<i>Lysiloma latisiliquum</i>	Wild Tamarind			✓	

4.4.4 Protected Trees Species Identified

A total of eleven (11) Protected tree Species was identified from field surveys (*See Table 4.2*).

Table – 4.2: Protected Species Recorded on Property

Botanical Name	Common Name	Status
<i>Agave millspaughii</i>	Agave	EET
<i>Bursera simaruba</i>	Gum Elemi	CHE
<i>Cocothrinax argentata</i>	Silver top palm	CHE
<i>Guapira discolor</i>	Small Leaf Blolly	CHE
<i>Pseudophoenix sargentii</i>	Buccaneer palm	CHE
<i>Leucothrinax morrisii</i>	Thatch Palm	CHE
<i>Sabal palmetto</i>	Sabal Palm	CHE
<i>Tara vesicaria</i>	Brasiletto	CHE
<i>Jacquinia keyensis</i>	Joe Wood	CHE
<i>Swietenia mahagoni</i>	Mahogany	CHE
<i>Lysiloma latisiliquum</i>	Wild Tamarind	CHE

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

4.4.5 Invasive Species

A total of five (5) invasive species were observed and listed (**Table 4.3**). The National Invasive Species Strategy (2013) outlines recommendations 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
<i>Casuarina equisetifolia</i>	Australian Pine	Numerous individuals occurring as mature trees throughout the site	Control
<i>Scaevola taccada</i>	Hawaiian sea lettuce	Numerous individuals occurring along human altered environment and edges of site	Eradication
<i>Schinus terebinthifolius</i>	Brazilian pepper	Numerous individuals occurring throughout the	Eradication

		entire site and especially along the corridor of site	
<i>Typha domingensis</i>	Cat Tail	Few individuals found along wetland portions of the site grouped together	Eradication
<i>Ipomoea indica</i>	Morning Glory	Numerous amounts found throughout the entire site	Control
<i>Ricinus communis</i>	Castor Bean	Numerous individuals occurring through portions of the compound.	Control

SUMMARY OF SAMPLE PLOT DATA

KEY:

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

Plot 1 – (25°04'19"N 77°22'08"W) Consisted of a coppice forest with flat terrain on an uneven slope, covered with tree litter. Dominant Wild Tamarind covered the overstory with mature sabal palms in the mid-story and scattered shade tolerant shrubs on the ground.

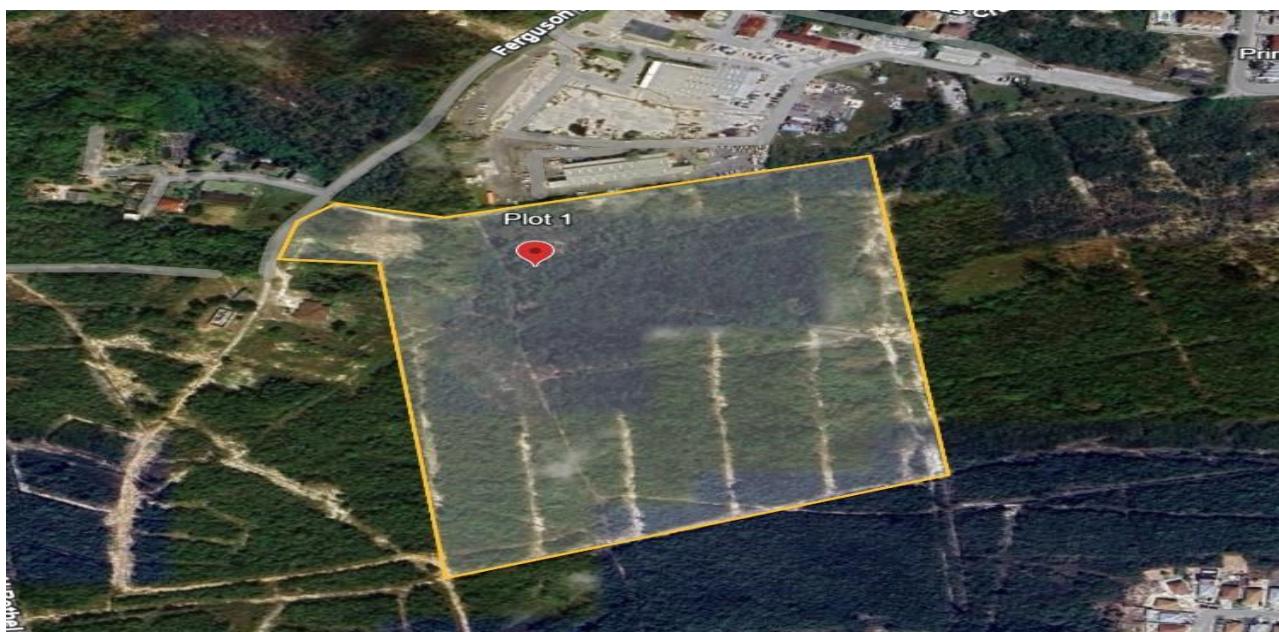


Figure 4.8: Depicts the general Location of Plot 1 within property boundaries

Species Name	Species Presence	Species Cover
Wild Tamarind	D	70%
Sabal Palm	F	20%
Gum Elemi	R	10

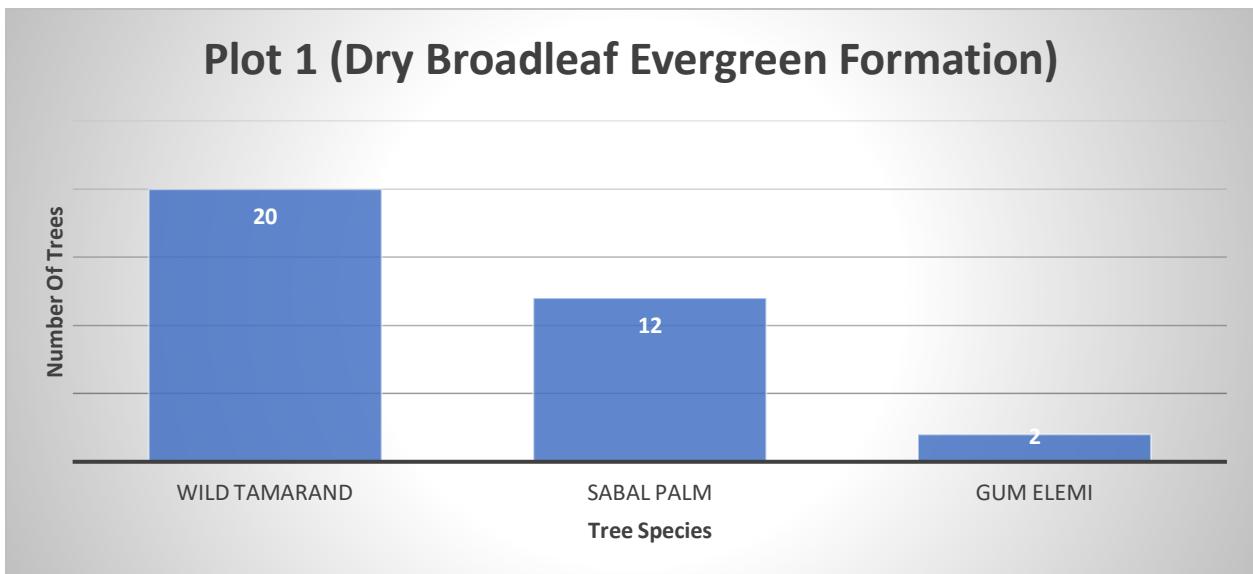


Figure 4.9: Showing Graph of Protected Tree Species

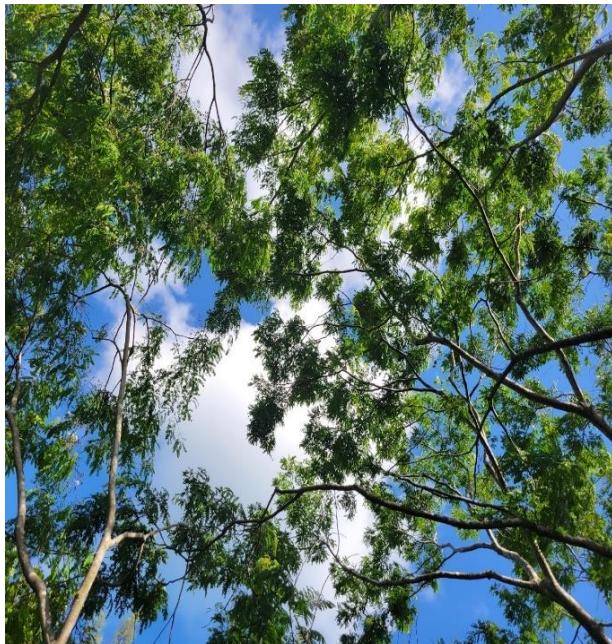


Figure 4.10: Depicts tree Canopy (wild tamarind)

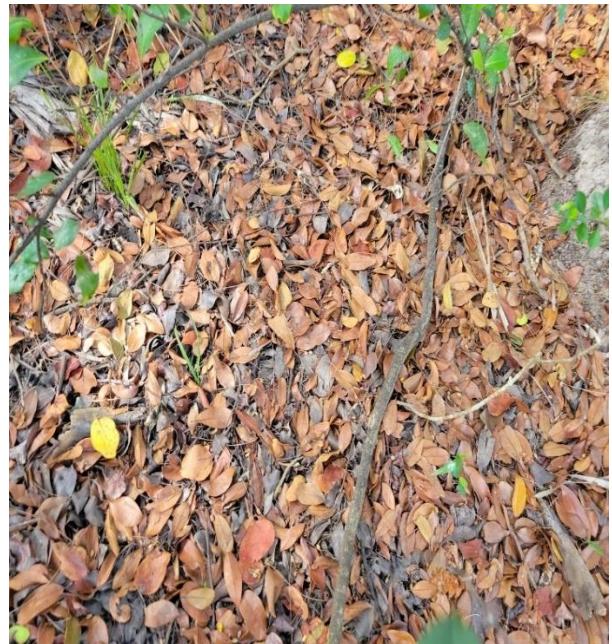


Figure 4.11: Showing broadleaf Litter On Floor



Figure 4.12: Showing density of plants in parcel



Figure 4.13: Showing mature sabal palm tree

Plot 2 – (25°04'11"N 77°22'07"W) Consisted of a coppice forest with mature sabal palm and wild tamarind covering the overstory. The forest floor is covered with leaf litter and juvenile plants consisting of mainly paradise plants and poison wood scattered throughout.

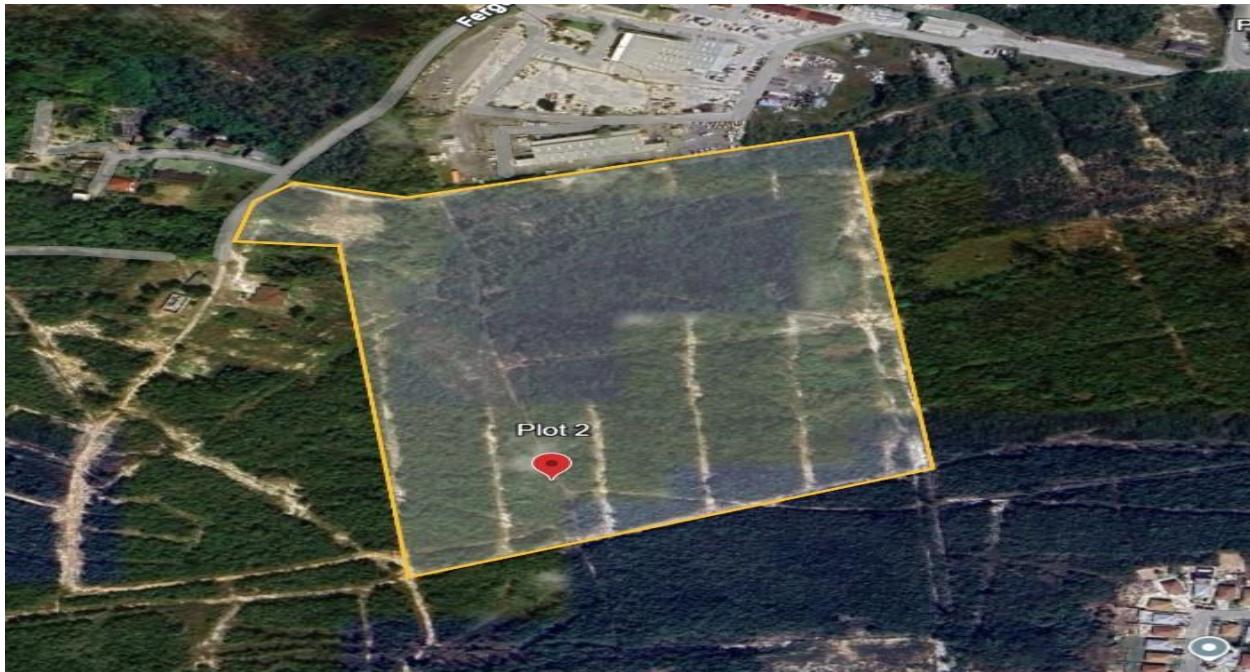


Figure 4.14: Showing Location of Plot 2

Species Name	Species Presence	Species Cover
Wild Tamarand	D	60%
Sabal Palm	A	40%

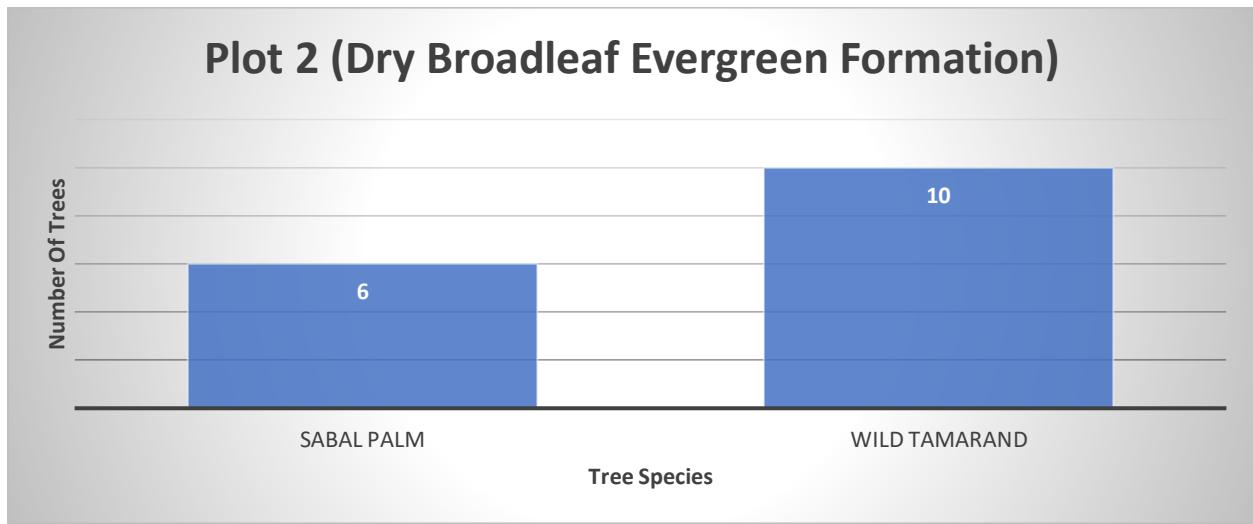


Figure 4.15: Showing graph of Protected Tree Species



Figure 4.16a & B: Showing tree canopy composing of sabal palm (left) and Wild Tamrind trees(right).



Figure 4.17: Showing interior of parcel with sabal palm trees and mature ferns along with other coppice species.

Plot 3 – (25°04'18"N 77°22'03"W) Consisted of a mature coppice forest with mature Wild Tamarind Trees dominant in the overstory and juvenile thatch Palms and silver palm trees throughout the midstory. The forest Floor consists of leaf litter and herbaceous plants.



Figure 4.18: Showing Location of Plot 3

Species Name	Species Presence	Species Cover
Wild Tamarind	D	75%
Silver Palm	O	10%
Thatch Palm	O	10%
Gumelemi	R	5%

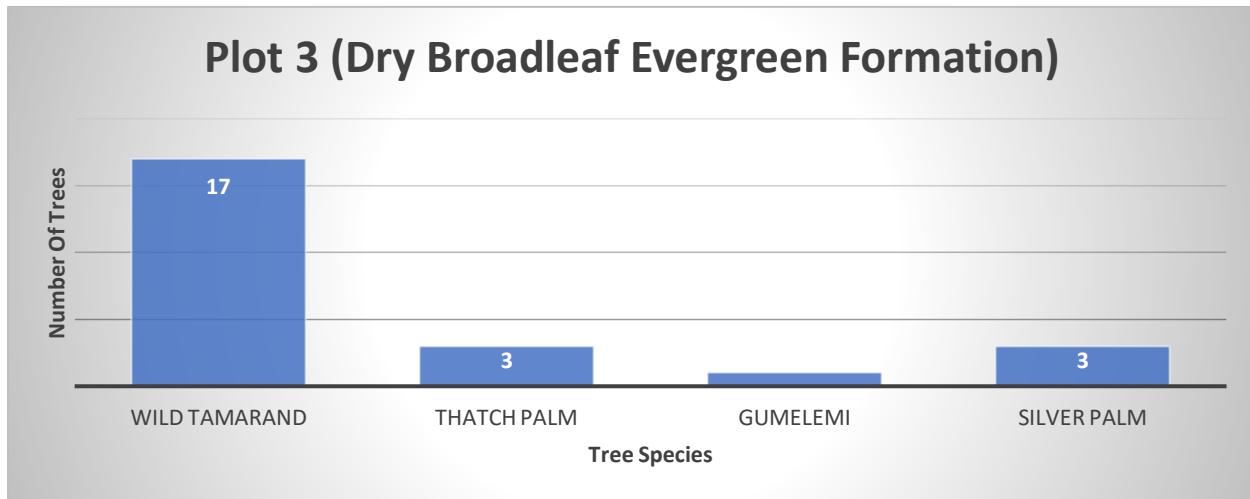


Figure 4.19: Showing Graph of Protected Tree Species

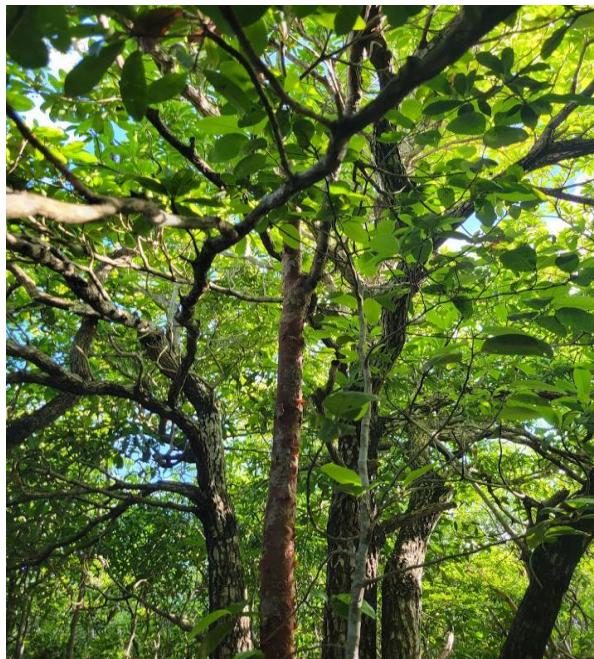


Figure 4.20: Tree canopy (mature gumelemi trees)



Figure 4.21: Showing Juvenile thatch palms



Figure 4.22 a and b: Showing juvenile hardwood trees inside parcel facing east (left) and north (right)

Plot 4 – (25°04'12"N 77°22'02"W) Consisted of a open mature coppice stand. Juvenile sabal palms and thatch palms are scattered throughout the forest floor along with other seedling hardwood species.



Figure 4.23: Showing Location of plot 4

Species Name	Species Presence	Species Cover
Sabal Palm	O	15%
Silver Palm	F	35%
Thatch Palm	F	35%

Gumelemi	R	15%
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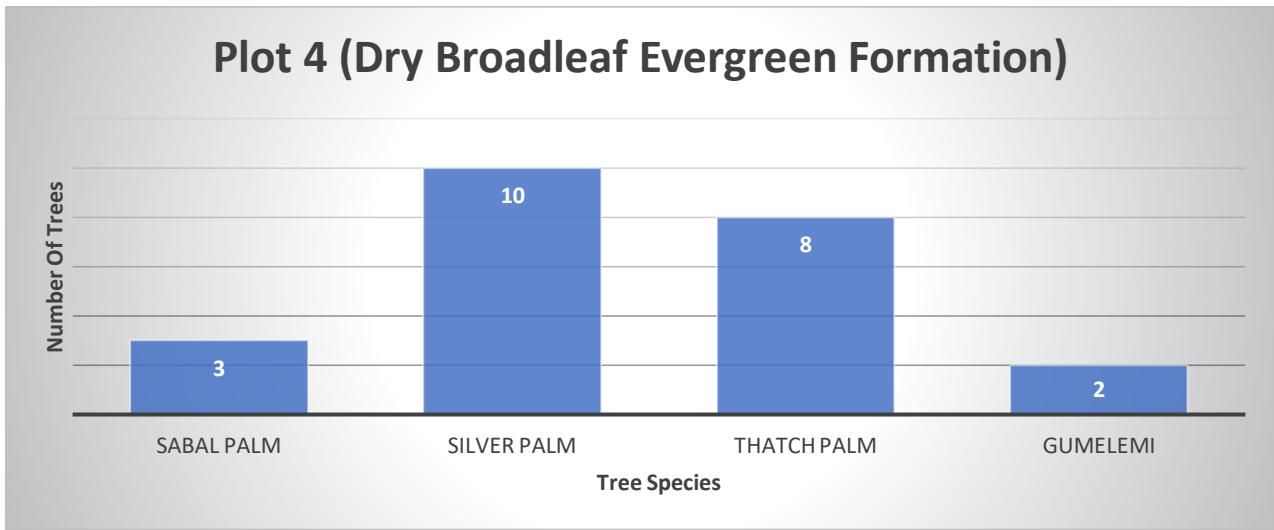


Figure 4.24: Showing graph of protected species



Figure 4.25: Juvenile/ mature hardwood tree stand



Figure 4.26: Upper Canopy of Gumelemi Trees



Figure 4.27: thatch palm seedlings



Figure 4.28: Showing Juvenile coppice species

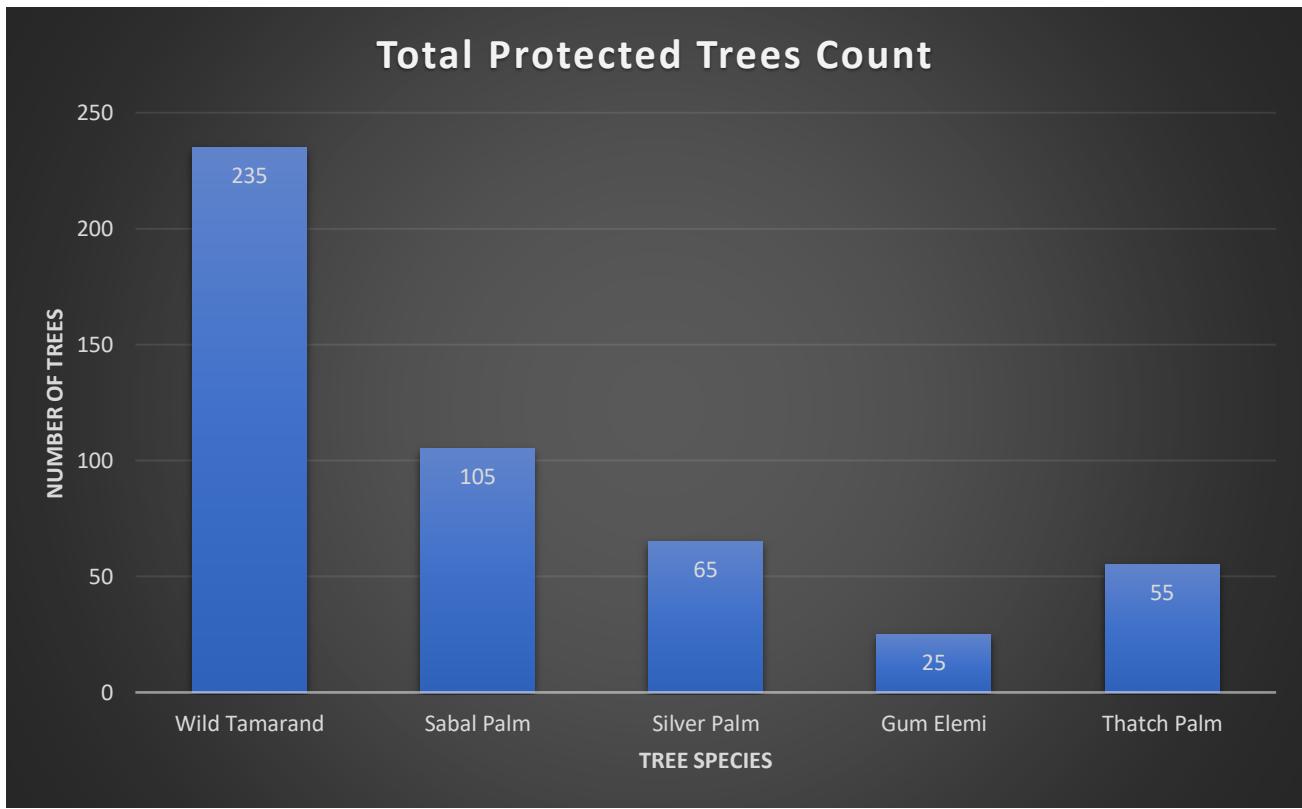


Figure 4.29: Graph Showing Total Protected Tree Tally.

Based on the data collected the total number of protected trees is **14,550 (30 acres)**.

	Total	Average Number of Trees
Gum Elemi	25	750
Silver Palm	65	1950
Thatch Palm	55	1650
Sabal Palm	105	3150
Wild tamarand	235	7050
Total	485	14550

4.5 Avian Assessment Surveys

Avian surveys were conducted on 14th and 15th June 2025 (Summer session) to identify the presence, abundance and habitat utilization of the avian species found within the boundaries of the project site.

4.5.1 Methodology

The assessment consisted of active avian observations, commencing at 8am to 2pm 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 summer survey sessions period.

4.5.2 Avian Survey Results

A total of Nineteen (19) species recorded during the summer session. (*Table – 4.4*)

Table – 4.4: Avian observations – (Summer 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

Scientific Name	Common Name	Range	Status	Observation (Summer Session – June 14 th -15 th 2025)	Habitat Utilization
Smooth Billed Ani	<i>Crotophaga ani</i>	PRB	LC	M	HA/IU
White-crowned pigeon	<i>Patagioenas leucocephala</i>	PRB	NT	M	FO/HA
Common ground dove	<i>Colombina passerine</i>	PRB	LC	F	HA/IU
Cuban grassquit	<i>Tiaris canora</i>	PRB	LC	M	HA
Bahama woodstar	<i>Nesophlox evelynae</i>	PRB/E	LC	F	IU
Bahama Mockingbird	<i>Mimus gundlachii</i>	PRB	LC	M	HA
Mourning Dove	<i>Zenaida macroura</i>	PRB	LC	F	HA
Black & White Warbler	<i>Mniotilla varia</i>	WRN	LC	F	FO
Eurasian Collared Dove	<i>Streptopelia decaocto</i>	PRB	LC	M	HA
American Kestrel	<i>Falco sparverius</i>	PRB	LC	F	FO
Palm warbler	<i>Dendroica palmarum</i>	WRN	LC	F	HA
Killdeer	<i>Charadrius vociferus</i>	PRB	NT	M	HA
Black-faced Grassquit	<i>Melanospiza bicolor</i>	PRB	LC	M	IU
Grey Kingbird	<i>Tyrannus dominicensis</i>	PRB	LC	F	FO
Thick-Billed Vireo	<i>Vireo crassirostris</i>	PRB	LC	M	FO/IU
Yellow Crowned Night Heron	<i>Nyctanassa violacea</i>	PRB	LC	F	W/IU
Limpkin	<i>Aramus guarauna</i>	PRB	LC	M	IU
Grey Cat Bird	<i>Dumetella carolinensis</i>	PRB	LC	M	FO/IU
Mangrove Cuckoo	<i>Coccyzus minor</i>	SRB	LC	F	W/IU
TOTAL SPECIES				19	



Figure 4.30: Killdeer



Figure 4.31: Yellow Crowned Night Heron (Juvenile)



Figure 4.32: American Kestrel



Figure 4.33: Thick Billed Vireo

4.5.3 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 species that live and breed all year round throughout the Bahamas. On the project site the predominant avian species identified included the white crown pigeon (*Patagioenas leucocephala*), Common ground dove (*Colombina passerine*), Laughing gulls (*Leucophaeus atricilla*), northern mockingbird (*Mimus gundlachii*). Fourteen out of the eighteen species (77%) found on property 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.
- **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 includes both land and sea birds.

4.5.4 Endemic Species

Birds found in the Bahamas are referred to as Endemic. The Bahama woodstar (*Nesophlox evelnae*) and the Bahama Mockingbird (*Mimus gundlachii*) were the endemic species observed.

4.5.5 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 in the near future, although presently not qualified for the threatened status. The White-crowned pigeon (*Patagioenas leucocephala*), and Killdeer (*Charadrius vociferus*) currently designated as near-threatened status, were observed during the surveys.

4.5.6 General Discussion

The dominance of the PRB species along with some SRB 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 roosting 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. During the survey it was noted that a high percentage of the birds observed were in the Interior Upland areas, versus a smaller percentage were flyovers. Also important is the timing of the surveys. Bird Surveys should be carried out in the summer months and winter months to have a representative sample of species associated with the seasons.

4.6 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 4.4** provides a summary of the observations. **Figures 4.34, 4.35, 4.36 & 4.37** below shows images of the observed species.

Table 4.5: Summary of observed wildlife from project site

Common Name	Scientific Name	Abundance
Yellow Butterfly	<i>Colias sp.</i>	M
Monarch Butterfly	<i>Danaus plexippus</i>	M
Black Dragon Fly	<i>Trames sp.</i>	M
Brown Anole	<i>Anolis sagrei</i>	M
Curly tailed lizard	<i>Leiocephalus carinatus</i>	M
Millipede	<i>Diplopoda ssp.</i>	M
Mosquito	<i>Culicidae ssp</i>	M
Honeybee	<i>Apis mellifera</i>	M
Paper Wasp	<i>Polistes ssp.</i>	M
Common Snail	<i>Cornu aspersum</i>	M
Termite	<i>Isoptera ssp</i>	M
Ladybug	<i>Coccinellidae</i>	M
Spiny back Orbweaver	<i>Gasteracantha cancriformis</i>	M



Figure 4.34: Yellow Butterfly

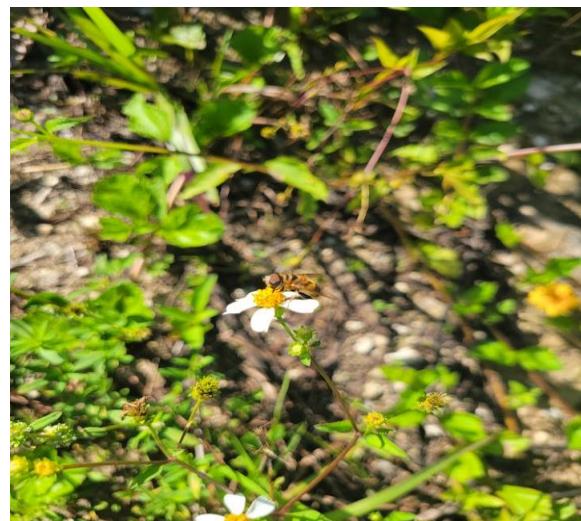


Figure 4.35: Honeybee

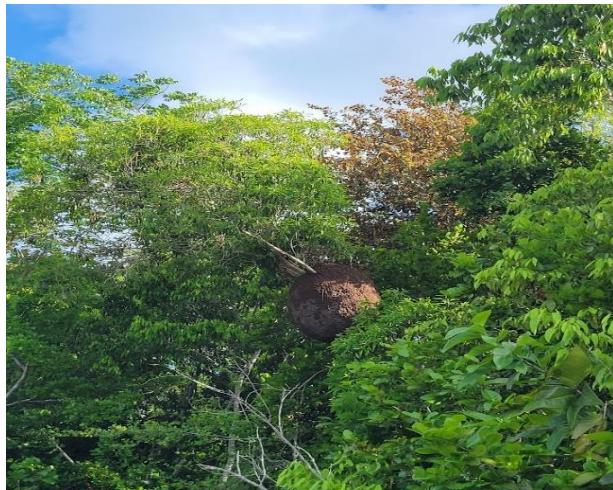


Figure 4.36: Termite Mound



Figure 4.37: Brown Wasp nest

4.9 National Parks and Protected Areas

New Providence Island has a total of five (5) National Parks, which includes the Clifton Heritage Park managed by the Clifton Heritage Authority; the Retreat, the Primeval Forest National Park, Bonefish Pond National Park, and Harold & Wilson Ponds National Park, under the management of the Bahamas National Trust (BNT).

The Clifton Heritage Park located on the western tip of New Providence, protects 250 acres of intact broadleaved coppice forest, where there are remnants of the historical and cultural heritage of three important groups that had an influence on the country: the Lucayans, the Loyalists and Africans.

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Primeval Forest National Park protects 7.5 acres of undisturbed old-growth broadleaved coppice forest and is representative of the early hardwood forests of the Bahamas. Located in southwestern New Providence.

Bonefish Pond National Park is a mangrove ecosystem on the shores of Southern New Providence, Bonefish Pond protects 1,235 acres of important coastal wetlands.

Harrold & Wilson Ponds National Park protects 250 acres of vital wetland habitats for birdlife on New Providence. Surrounded by development, these freshwater wetlands are internationally recognized as Important Bird Areas. Harrold & Wilson Ponds National Park is currently closed to the public due to damaged boardwalks.

The Retreat is an area of eleven (11) acres botanic gardens, showcasing rare and exotic palms, cycads and intact native broadleaved coppice ecosystem and flowering plants, located on Village Road. The site once housed the headquarters of the Bahamas National Trust.

4.10 Socio-economic Aspects

4.10.1 Population

According to the Population Census 2022, (**Table 4.5**) the population of The Bahamas was 399,314. Residents included all persons regardless of their legal status, with a growth of 13.62 % over the past decade. New Providence experienced the largest increase in population and is the most populous island in The Bahamas, containing more than 70% of the total population. It is the location of the national capital city of Nassau, whose boundaries coincide with the island and had a population of 296,522 (20.38% change) from 2010 of 50,193.

Table – 4.5: Population Census Bahamas (2022 Census data), Bahamas National Statistics Institute.

Island	Population		Change	
	Years	2010	2022	Actual
All Bahamas	351,461	399,314	47,853	13.62
New Providence	246,329	296,522	50,193	20.38

4.10.2 Economy Tourism

According to the Central Bank of the Bahamas Annual Report 2024, visitor arrivals rose by 16.2% to 11.2 million in 2024. The dominant sea arrival expanded by 19.7% to 9.5 million. By contract air arrivals, declined slightly by 0.2% to 1.7 million, following a 17.0% gain in 2023.

Construction

The Construction Sector was undergirded by several new and ongoing foreign direct investments projects. With near-term forward-looking indicators suggested continued strengthening in domestic financing of activities. Total mortgage commitment for new constructions and repairs increased in numbers from 139 to 390, while associated value rose by \$39.3 million (41.8%) to \$133.2 million. By Loan categories, residential approval rose by 133 (55.6%) to 372 transactions, corresponding to value of \$21.6 million. Commercial commitments grew by 6 (50.0%) to 18, doubling in value to \$45.1 million.

Employment

In terms of employment, according to The Bahamas National Statistics Institute for Q2-2024, domestic unemployment rate measured at 8.7%. However, the number of employed persons declined slightly to 213,210 in the June quarter from 213,585 in the first quarter. The jobless rate in New Providence stood at 8.6% in the June quarter, whilst Grand Bahama averaged 9.8%.

4.10.3 Transportation

The Premier Estates I Subdivision will be accessed from the main entrance off Ferguson Road – Perpall Tract, running North to South. Public buses traverse West Bay Street to provide public busing services to the public who may need transportation directly to Downtown Nassau and other points of interest. Alternate parking locations away from project will be arranged for Construction workers, to reduce potential vehicle congestion in the project area.

4.11 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

Bahamian culture is an amalgam of its African and European heritages. It has also been influenced by the peoples of the Caribbean and the Americas. Nassau, the Capital, situated in New Providence was originally

known as Charlestown. It was laid out and renamed Nassau in 1695 by Nicholas Trott, the most successful Proprietor Governor, in honor of the Prince of Orange-Nassau who became William III of England. Because of its natural deep harbor, New Providence was singled out as the most suitable seat for Government.

4.12 Touristic and Recreational Areas

A large majority of tourist who visit the Bahamas either as stop over visitors or cruise passengers end up vacationing in New Providence, with Nassau being the Capital. New Providence as significant touristic and recreational landmarks and activities for the enjoyment of visitors and locals alike. Notable of these are the arts, including painting, sculpture, and photography, as well as crafts, have blossomed several prominent institutions devoted to their cultivation.

Art and crafts can be seen at a variety of galleries, including the National Art Gallery, located in a mansion overlooking Nassau Harbour. The Department of Archives preserves public and private records and makes them accessible to the public. The Antiquities, Monuments and Museums Corporation regulates and controls antiquities, monuments, museums, and archaeology. The Bahamas Historical Society, in Nassau, operates a museum and publishes a scholarly journal. Visitors can enjoy the Native straw market downtown Nassau for native straw works (handmade baskets of native straw, etc.), native wood carvings, in addition to local shops in the Nassau Cruise Port for tee shirts, fine jewelry, native rums and souvenirs

4.13 Waste

The sustainable management of all waste requires an understanding of all sources of waste (i.e., solid and liquid).

4.13.1 Solid Waste streams

All solid waste generated and collected will be disposed of in the New Providence Ecology Park Waste disposal site at Tonique Williams Darling Highway.

4.13.2 Liquid Waste streams

Sewerage waste and effluent generated from the residences will be disposed of via a central sewer system proposed for development (*See Appendix - D*), with a lift station and waste water treatment plant (WWTP) to be located on the southern portion of the property. The utility for the plant will be shared between the Ministry of Housing (Premier Estates I), and the Ministry of Health and Wellness (new Hospital site)

4.14 Utilities

4.14.1 Potable water

Municipal potable water supply is readily available to the project site from the West Bay Street easement (running East-West), and supplied by the WSC

4.14.2 Electricity

The project development will receive electricity supply from the national grid (Bahamas Power and Light - BPL).

4.14.3 Fuel storage and distribution

Fuel storage will be in the form of day tank storage on site in a predetermined protected and secured location.

4.14.4 Construction & Material Sources

All building material for the construction of the homes will be derived locally, and stored in 40 ft containers.

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, alteration 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, 2019 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 parts regarding administration, regulation of excavation and landfill operations, provisions governing dangerous excavations, landfill operations, quarries or mines, zoning of the Bahamas for the purposes of quarrying and mining operations, 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 (Amendment) Regulations 2023	An amendment to the First Schedule to increase fees for the harvesting of protected trees
Forestry (Declaration of Protected Trees) Order, 2021	An Order which increases 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 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 with 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: <ul style="list-style-type: none"> Protocol for co-operation in combating oil spills. Protocols for specially protected areas and wildlife (SPA&W); Protocol concerning pollution from land-based sources and activities (LBS).
Convention on Biological Diversity. Signed: June 12, 1992	The convention has three main goals: <ul style="list-style-type: none"> 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	The Bahamas is a signatory to this convention. It establishes a framework with the aim to stabilize atmospheric greenhouse gases.
Kyoto Protocol Signed: April 9, 1999	The Kyoto Protocol was developed under the UNFCCC to provide emissions targets and timelines for developed countries.
Paris Agreement Ratified: August 22, 2016	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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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,

	<p>birds and plants, and forests.</p> <ul style="list-style-type: none"> • It administers the Wild Birds and Wild Animals Protection Acts.
Department of Environmental Planning and Protection (DEPP)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Oversees and enforces fisheries regulations and the establishment of Marine Reserves and Marine Protected Areas (MPAs)

Department of Local Government (DLG)	<ul style="list-style-type: none"> • Implements the provisions of the local government Act, thus ensuring sound and sustainable family island development
Ministry of Tourism and Aviation (MTA)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • Overseas and maintains physical infrastructure in the country. • Responsible for building controls and Regulations
Disaster Recovery Authority (DRA)	<ul style="list-style-type: none"> • “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)	<ul style="list-style-type: none"> • 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)	<ul style="list-style-type: none"> • optimizes the development of the country’s water resources and 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	<ul style="list-style-type: none"> • Regulates Health and Safety under the Health and Safety at Works Act, 2002. • conducts inspections at workplaces to ensure adequate worker safety and regulations compliance
Bahamas National Trust (BNT)	<ul style="list-style-type: none"> • Established as a non-government entity

	<p>(non-profit) by the BNT Act 1959.</p> <ul style="list-style-type: none"> • To manage national parks and protected areas, historic preservation, public awareness, and environmental outreach
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6.0 Anticipated Environmental Impacts of the Proposed Project

6.1 Impact Assessment Methodology

It is important to recognize that Residential and Resort development on small islands requires 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 temporarily 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 effects 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. 3**).

Table 6.1 Qualitative Assessment Criteria for Impact Assessment

Qualitative Criteria	Choices	Description
Nature	<ul style="list-style-type: none"> • Direct • Indirect 	Does origin/source activity Directly or Indirectly act on the environmental target (species or natural community)
Type	<ul style="list-style-type: none"> • Positive • Negative 	Positive implies species or natural community will have a higher likelihood of persistence with increased viability. Negative implies the opposite
Likelihood	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Specific habitats • Island environs • Regional • National or internationally 	Restricted to specific habitats. Impact that impacts the entire project site. Regional Impacts (New Providence Island) International Impacts refer to CITIES species
Duration	<ul style="list-style-type: none"> • Temporary • Long-term 	Temporary – impacts last less than three years. Long-term – more than three years
Reversibility	<ul style="list-style-type: none"> • 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
 - Clearance of vegetation/relocation/staging of selected protected trees for replanting
 - Retention of green space areas for public parks
 - Road reservation base work,
 - Installation of water and sewer mains and laterals
 - Final road construction and pavement
 - Infrastructure for electricity generation
- Construction of homes.

2.0 Project Operation Phase:

- Property Management
 - Completion of homes
 - Landscaping of road verges and green spaces
 - Invasive species management

6.2.1. Impact Assessment for Site Preparation, Infrastructure Development and Homes Construction

Table 6.2: Summary of impact matrix developed for site preparation and infrastructure development (Premier Estates I Subdivision Nassau, Providence Island)

Qualitative Criteria	Choices	Description
Nature	Direct	Direct impact on 30 acres property, which includes targeted protected species and associated biodiversity. 80% of site will be subject to land clearance for infrastructure and homes development.
TYPE	Negative	With the loss of significant protected species (broadleaved), the overall negative impact of site preparation is negative <ul style="list-style-type: none"> ➤ Selected Protected tree species will be relocated within landscaped area (if practical for relocation). Application for permit to harvest protected trees will be made to the Forestry Unit, Ministry of the Environment and Natural Resources.
	Negative	80% of existing vegetation will be lost during construction works.
Likelihood	Certainty	Impacts and benefits will be the result once actions outlined are completed
Scale	Habitat – specific to project area.	Coastal strand and dune communities are not impacted.
	Island Environs	Removal of Invasive Species (Australian Pine – casuarina, and Hawaiian sea lettuce, Brazilian pepper, Cattails etc.), will help reduce seed sources on the island.
Duration	Long Term	It is anticipated native plant communities along the coastline will be stabilized.
Reversibility	Irreversible	Natural ecological processes will not be maintained. Mitigation measures will be necessary.
Overall Significance	Moderate/High	Impact is visible in context. The Site conditions will be altered to a great extent and is presently a dense dry broadleaf evergreen coppice forest. 20% of natural vegetation will be retained as green spaces. New landscaping with native flowering plant species will encourage the return of wildlife and encourage biodiversity.

Table 6.3 summarizes the environmental impacts that are likely to occur for Premier Estates I Subdivision 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 80% of all existing vegetation including protected tree species, 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 the footprint of road, water and sewer infrastructures and home construction.
Marine	1	As there is no development on the marine environment, there will be no impact.
Avifuna	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 (Positive)	3	Construction of homes, etc. will enhance the visual and aesthetics of the project, given the high density of the residential housing and eventual removal of all construction waste. Debris not removed adequately and timely, impairs the visual and aesthetics of the site for extended periods.
Hydrology	5	Given the site is a historic natural drainage low lying area for the surrounding Chippingham community, and served as a wellfield for the extraction of potable water resources “The potential Storm surge effect to the ‘Premier Estates-I Subdivision’ is HIGH LONG TERM. (Bowleg 2025) Fuel, chemical spills, improper use of hazardous waste on the project site can pollute groundwater resources.
Hydrogeological	5	Placement of all critical infrastructures above +30-Ft (+9.14-m) Mean-Sea-Level (MSL) is generically suggested toward the integration of climate resilience measures, for built structures in the Caribbean Region. The ‘Premier Estates-I Subdivision’ is at the lower elevation of

		<p>Perpall's Tract (< than 10-Ft msl); the area may be subjected to notable changes in the groundwater (due to normal tidal influence), and vulnerable to saline inundation from the Northern Coast during the passage of a tropical storm. (<i>Bowleg, 2026</i>)</p> <p>Coastal inundation of seawater by storm surges is a concern for the lower land parcel(s) of the Perpall's Tract Wellfield Area. Runoff to the lower development from elevated land parcel may increase the flood hazard potential of the adjacent lower land parcels.</p> <p>Incorporation of homes into the 'unique' greenspace must be encouraged. For effective mitigation of potential stormwater flows toward the North (from the elevated developed areas); retention ponds may be incorporated into an ideal shared greenspace / bike trail area, for use by the neighboring communities and as an urban park / tourist attraction (throughout the lower elevation). Apart from the known hydrological benefit of the land, the rich natural biodiversity of the area must also be taken into careful consideration.</p>
Erosion/Sedimentation	3	<p>There is the potential for some soil erosion and sedimentation. However, the risk of higher levels of erosion will be minimized, as such, the current drainage and runoff characteristics will be impacted to a limited extent. With the design of a waste water treatment plan (central sewer system) including a stormwater management plan, any likely impact will be controlled, and mitigated.</p>
Air Quality	3	<p>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.</p>
Noise	3	<p>Noise levels tend to rise during construction activities, disturbing birds and animal species. Birds are likely to be displaced and leave the area, particularly where their nesting sites are disturbed.</p> <p>Human health is impacted by elevated noise levels. According to the CDC (2019), prolonged loud noise level exposure above 70dB may cause hearing damages.</p>
Solid & Hazardous Waste	1	<p>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.</p> <p>Hazardous waste not properly managed can also result in penetration into the soil, groundwater resources and marine environment (pollution).</p>
Occupational Health and Safety	5	<p>There are 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 with standard safety protocols and procedures. Consequently, there could be physical damage and</p>

		<p>potential loss of human lives.</p> <p>The risk of contracting covid-19 is high where workers are in close proximity to each other.</p>
Fire & Hurricane	3	<p>The risk of fires from construction activities is reduced by good housekeeping, training in fire and safety practices.</p> <p>As the Bahamas falls within the North Atlantic Hurricane Belt, with the season commencing June 1 to November 31. The risk of the New Providence being affected by a hurricane in any given year is relatively high. Hence the need for a Hurricane Preparedness and Recovery Plan.</p>

6.2.3 Socio-economic Impacts

Table 6.4 below summarizes the socio-economic impacts that are likely to occur from the affordable housing subdivision 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	<p>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 green spaces (abundant well fields). The development into an affordable home community for low to medium income residents, will require maximum land use and removal of significant areas of natural vegetation.</p>
Economic (beneficial)	5	<p>The Premier Estates I Subdivision project anticipates contributing to the revitalization of Nassau, New Providence and serve as a conduit for economic growth and development.</p> <p>Projected investment is pegged at thirty million dollars (BSD\$30,000,000.00).</p> <ul style="list-style-type: none"> ➤ Employment of up to 100 Bahamian construction workers for 2 to 3 years. ➤ NIB contributions for Employees <p>The overall economic impact in the Chippingham Area and by extension New Providence Island will be significantly positive and will contribute to a positive turn around in the first-time home ownership market for Bahamians.</p>
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 the project development cycle.

Table - 7.1: Summary of Environmental Mitigation Measures

Factor	Mitigation Measures
Terrestrial	<ul style="list-style-type: none"> Retention of 20% of the natural vegetation, as green spaces and public parks, fitted with park infrastructure and related apparatus. Removal of invasive casuarina species Australian Pine (<i>Casuarina equisetifolia</i>), Hawaiian Sea Lettuce (<i>Scaevola taccada</i>) and Brazilian pepper (<i>Schinus terebinthifolius</i>) Incorporation of home construction within natural landscapes. Encourage homeowners to plant native species and flowering plants in their properties In road verges areas where landscaping is being undertaken to plant native and endemic species.
Biodiversity	<ul style="list-style-type: none"> There will be clearing of vegetation for infrastructure, drainage and building footprints using heavy equipment and bulldozers. This action will negatively impact vegetation and associated biodiversity. New landscaping will introduce all native and flowering plants to attract the return of biodiversity to the area.
Avifauna	<ul style="list-style-type: none"> Once all construction activities are completed, with reduced noise levels, it is expected that birds will return. In areas where landscaping is being undertaken to plant native flowering species and endemic species to attract the return of avian species.
Visual and Aesthetics	<ul style="list-style-type: none"> Proper management and timely disposal of solid waste. Use only native and endemic plant and tree species within landscaped areas of development. No invasive plant species to be established on property.
Hydrological	<ul style="list-style-type: none"> For storm surge it is generically recommended that all key utility infrastructures be set at +30-Ft (+9.14-m) above mean-sea-level (MSL). This shall not be possible, and additional hydrological data reviews shall be required for the general area: (1.) Groundwater level trends, (2.) Pump test and flow interpretations, and (3.) Projected Storm Surge Model. Once pre-clearing of any land and pre-construction, that hydrological area assessment be conducted through the responsible regulatory body (i.e. Water & Sewerage Corporation), for the required purpose of closing out the long-term water resources data set(s). A photo documentation of the historic trench systems should also be conducted. (<i>Bowleg 2025</i>).

	<ul style="list-style-type: none"> ➤ Retention ponds should be incorporated into an ideal shared greenspace / bike trail area, for use by the neighboring communities & as an urban park / tourist attraction.
Hydrogeological	<ul style="list-style-type: none"> ➤ With the continued development of the elevated portion of lands at the Perpall's Tract Wellfield Area, a water balance analysis for the projected surface water flows from the elevated South to the North should be undertaken. Any water balance should be based on the long-term rainfall records from the Lynden Pindling International Airport (LPIA), along with coastal tidal surge projections at the lower elevated portions of the land. <i>(Bowleg 2025)</i>
Erosion/Sedimentation	<ul style="list-style-type: none"> • Erect sediment curtains and silt fencing to contain and control sediment dispersion. • This methodology reduces the likelihood of soil and sediment erosion.
Air Quality	<ul style="list-style-type: none"> • 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.
Noise	<ul style="list-style-type: none"> ➤ 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	<ul style="list-style-type: none"> • Solid waste generation will be limited to construction waste, and vegetation removals. • Solid and hazardous waste will be placed in containers and properly disposed of at the New Providence Ecology Park Landfill site on Tonique Williams Darling Highway, in accordance with Department of Environmental Health Services (DEHS) regulations and standards.
Fire and Hurricane	<ul style="list-style-type: none"> • Prepare a Fire Control and Prevention Plan, with detailed steps to prevent, contain and control fires during construction of homes. • A Hurricane Preparedness and Contingency Plan will be developed in the event New Providence Island is impacted by a storm or hurricane (to include evacuation protocols, emergency and health provisions and recovery strategies).
Occupational Health and Safety	<ul style="list-style-type: none"> • All workers will be provided with 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.
Fire Control	<ul style="list-style-type: none"> • A Fire Control and Prevention Plan will be prepared with detailed steps to prevent, contain, and control fires during homes construction. • All homes will follow fire requirements of the Bahamas Building Code.
Invasive Species Control	<ul style="list-style-type: none"> • Control for the casuarina, Brazilian pepper tree and other invasives species will involve mechanical removal, cut up of limbs twigs and place in bins to

	remove site and transferred to the New Providence Ecology Park landfill site on Tonique Williams Darling Highway.
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8.0 Public Consultation Process

A Public Consultation exercise (Public Virtual/In-person Town Meeting with Report) 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 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 subdivision 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 EIA, specifically in relation to the following:

- 6.1 Terrestrial
- 6.2 Biodiversity
- 6.3 Avifauna
- 6.4 Visual and Aesthetics
- 6.5 Hydrological
- 6.6 Erosion/Sedimentation
- 6.7 Air Quality

- 6.8 Noise
- 6.9 Solid and Hazardous Waste
- 6.10 Fire and Hurricane
- 6.11 Occupational Health and Safety
- 6.12 Fire Control
- 6.13 Invasive Species Control

7.0 Environmental Monitoring

- 7.1. Environmental Monitoring Checklist
- 7.2. Environmental Reporting

8.0 Conclusions

Conclusions on implementing recommended mitigation measures.

9.0 References

Citation of reference materials used in EMP preparation.

10.0 Emergency Response Plans

- 10.1 Fire Control Plan
- 10.2 Invasive Species Control Plan

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, hydrogeological, and biological resources of the Premier Estates I Subdivision project site. The result is an environmental impact assessment (EIA) document which details the impacts that the proposed high-density development of 147 affordable residential housing units and associated infrastructure will likely have on this unique Dry Broadleaf Evergreen Forest Environment.

With a projected capital investment of **BSD \$30,000,000**, it is anticipated that the economic impact for the Chippingham area and by extension New Providence Island will be boosted significantly. This boost will include new construction jobs, new affordable home ownership for low-medium income persons, new entrepreneurial opportunities to provide goods and services. The long-term economic effect will be a positive impact for the local economy. From an environmental perspective, mitigation measures outlined in Table 7.1 above, if adhered to will greatly reduce the negative impacts identified in Tables 6.2 and 6.3 above.

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

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 home occupation.

- a) Ensure that BEST management practices are employed during the construction phases, including practices that prevent soil erosion, groundwater pollution and sediment runoff.
- b) Remove invasive species (Australian pine, Hawaiian sea lettuce and Brazilian pepper, Cattails etc.) in accordance with the National Invasive Species Strategy.
- c) Planting and establishment of only native flowering species within new landscape areas.
- d) Once pre-clearing of any land and pre-construction, that hydrological area assessment be conducted through the responsible regulatory body (i.e. Water & Sewerage Corporation), for the required purpose of closing out the long-term water resources data set(s)
- e) Retention of a significant portion of the existing green space as a public park
- f) Retention ponds should be incorporated into an ideal shared greenspace, bike trail area, for use by the neighboring communities and as an urban park.
- g) Undertake a water balance analysis for the projected surface water flows from the elevated South to the lower-level North.

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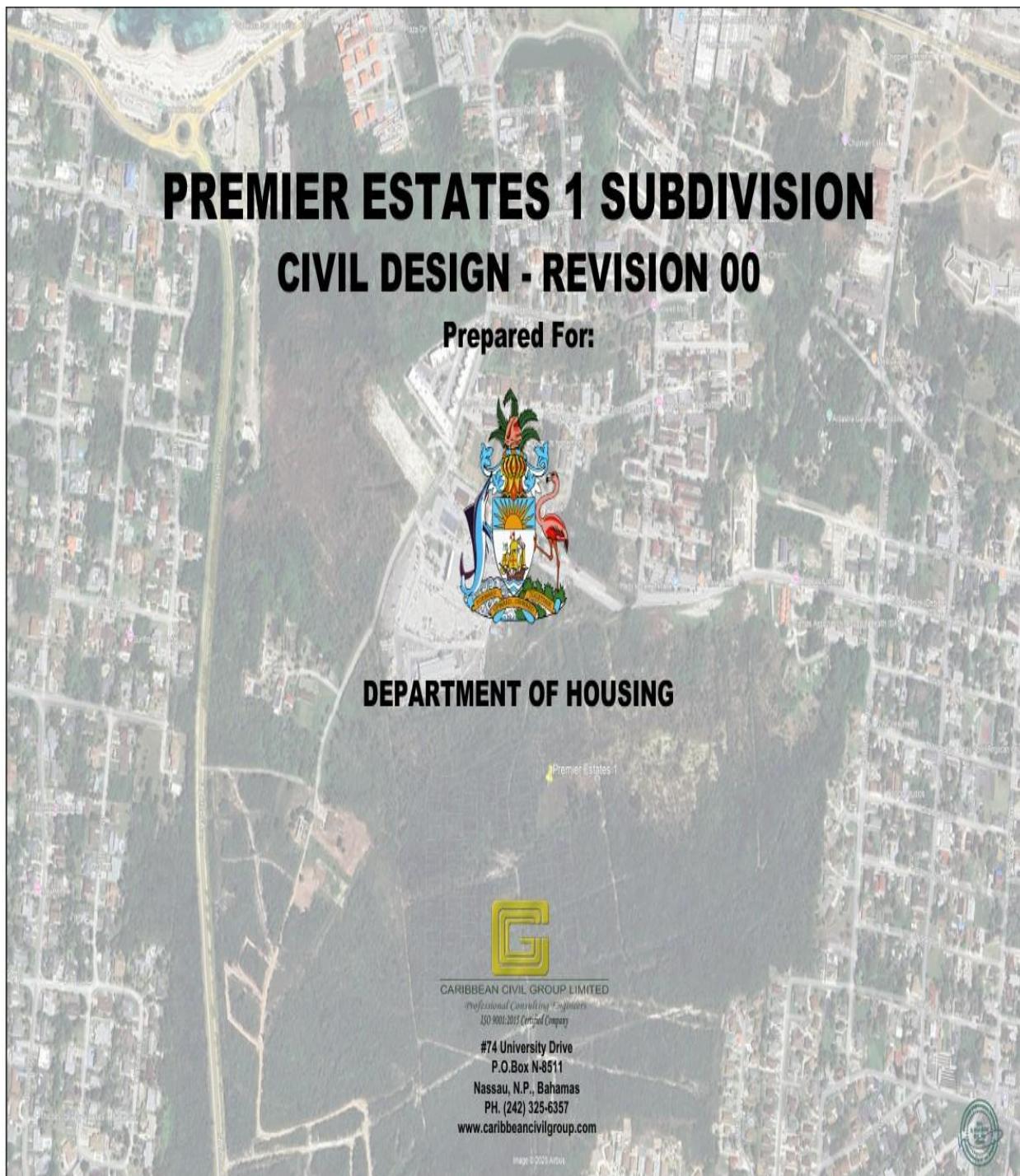
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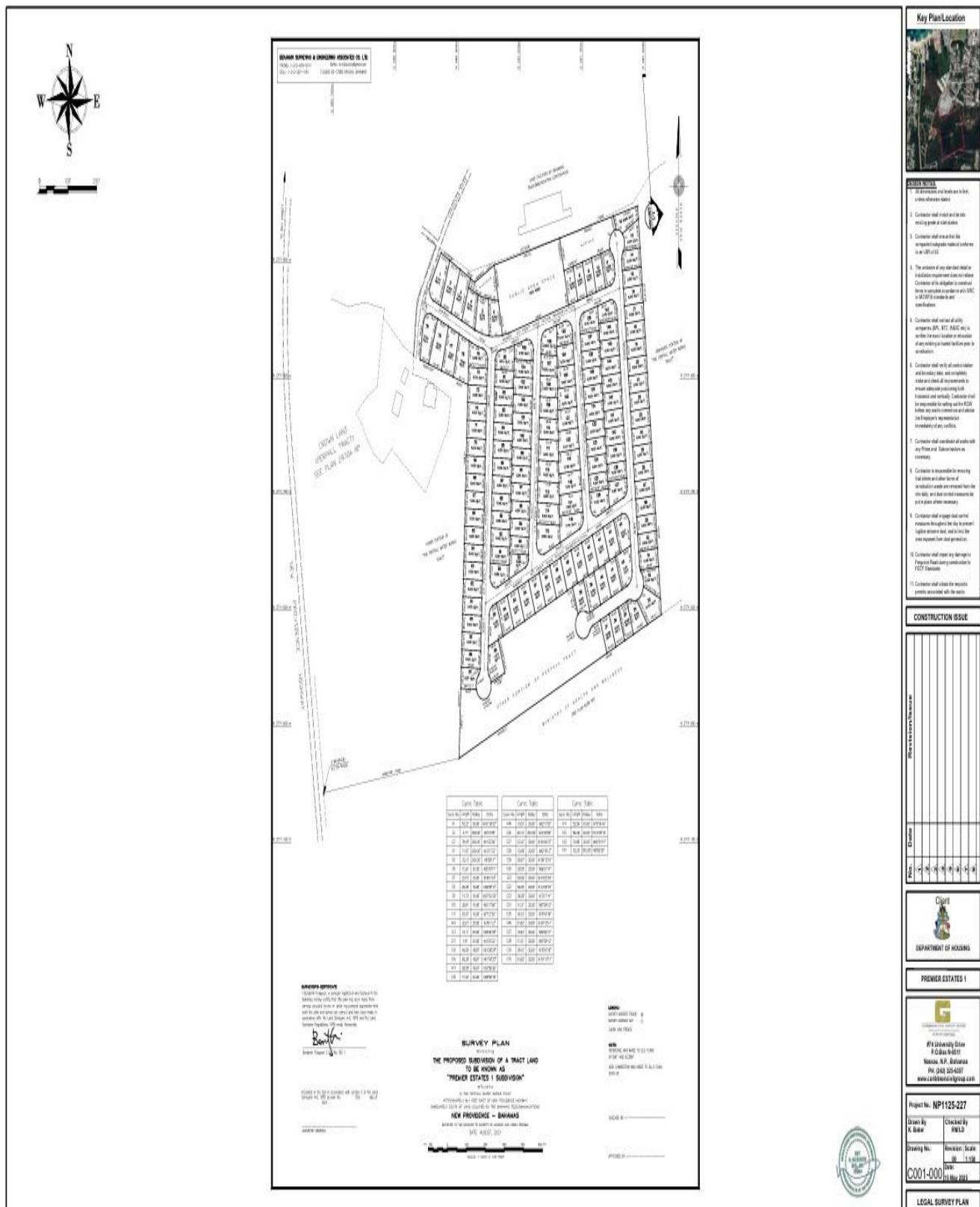
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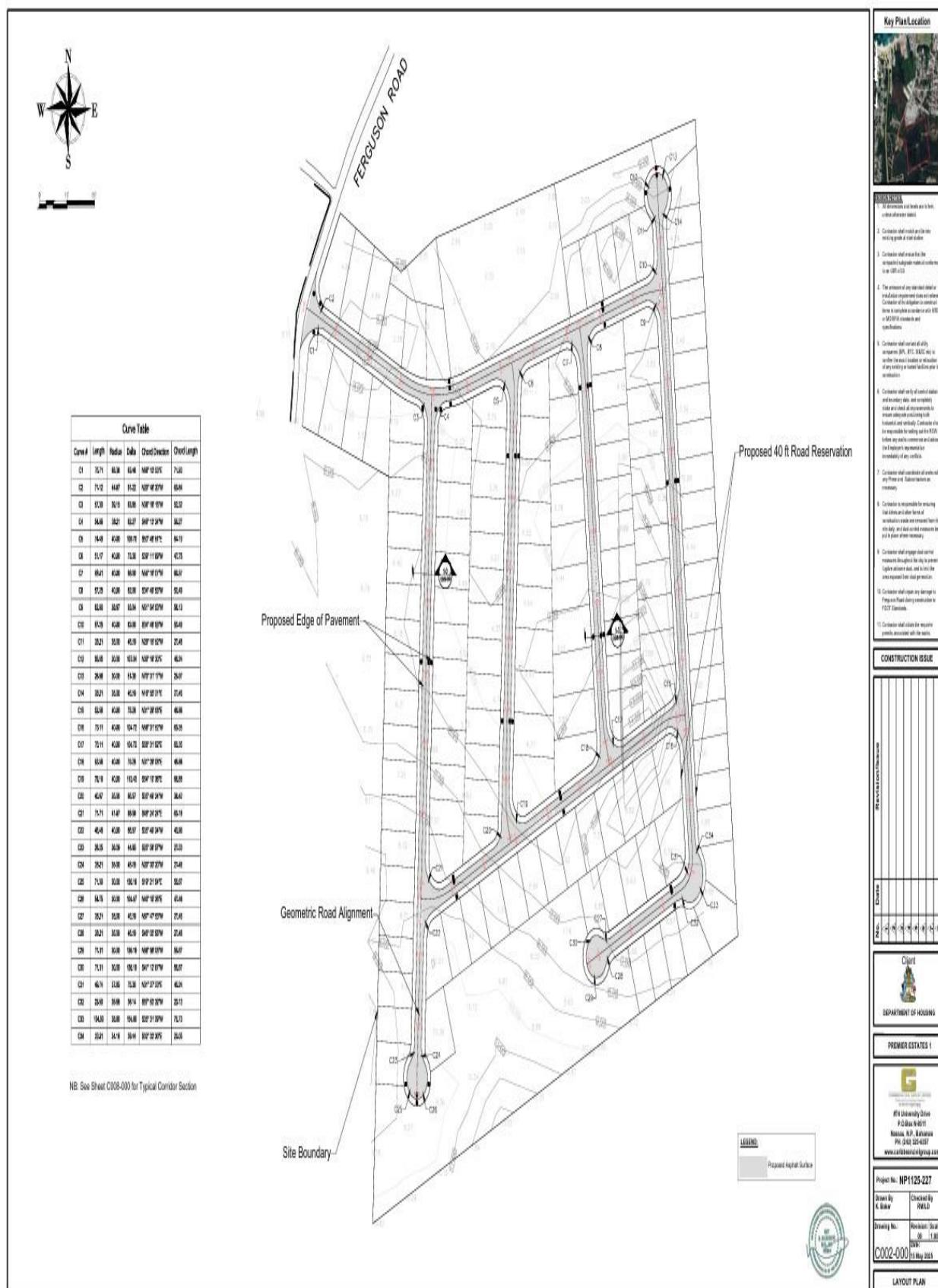
13.0 Appendices

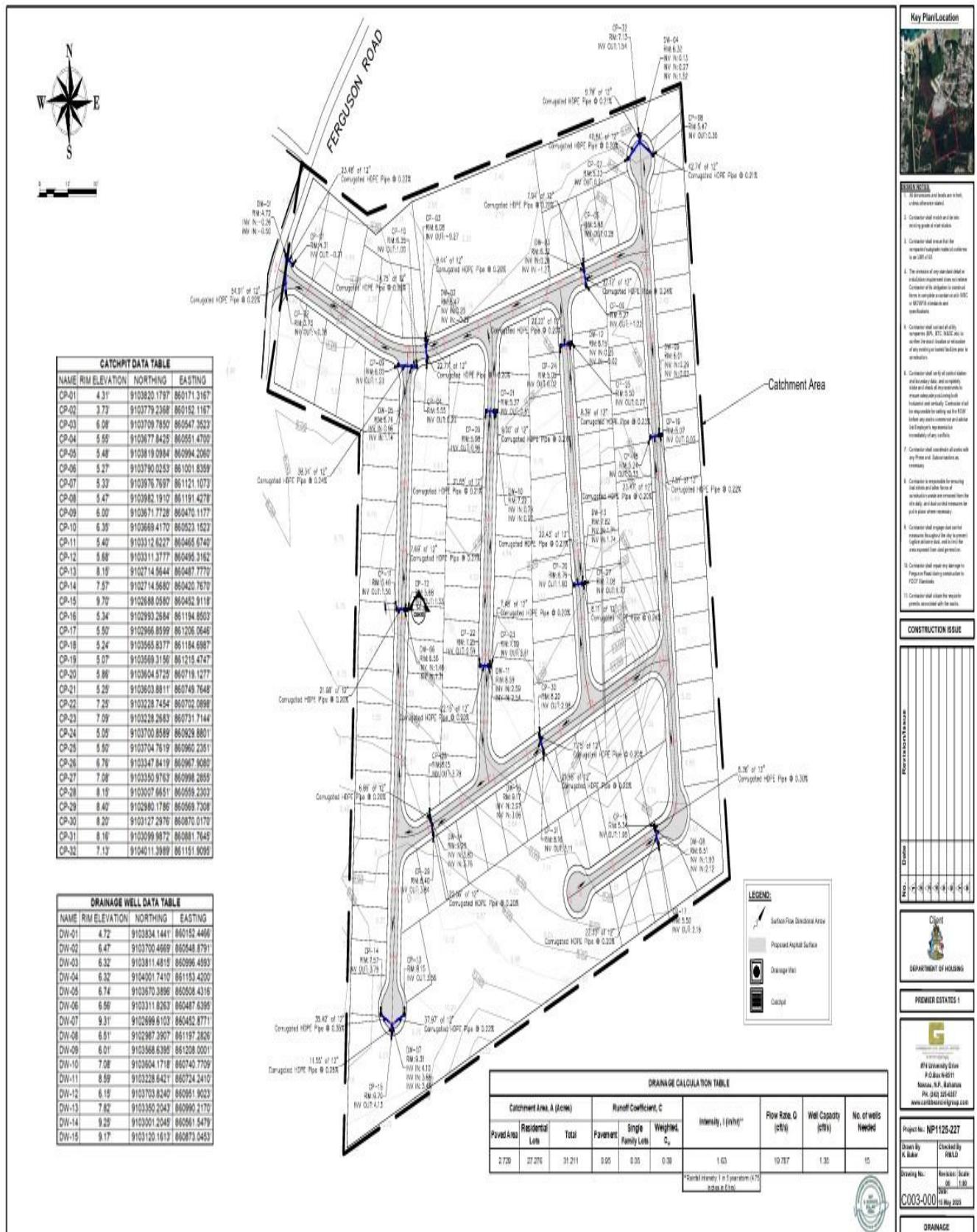
Appendix A: Premier Estates I Master Plans Project Drawings

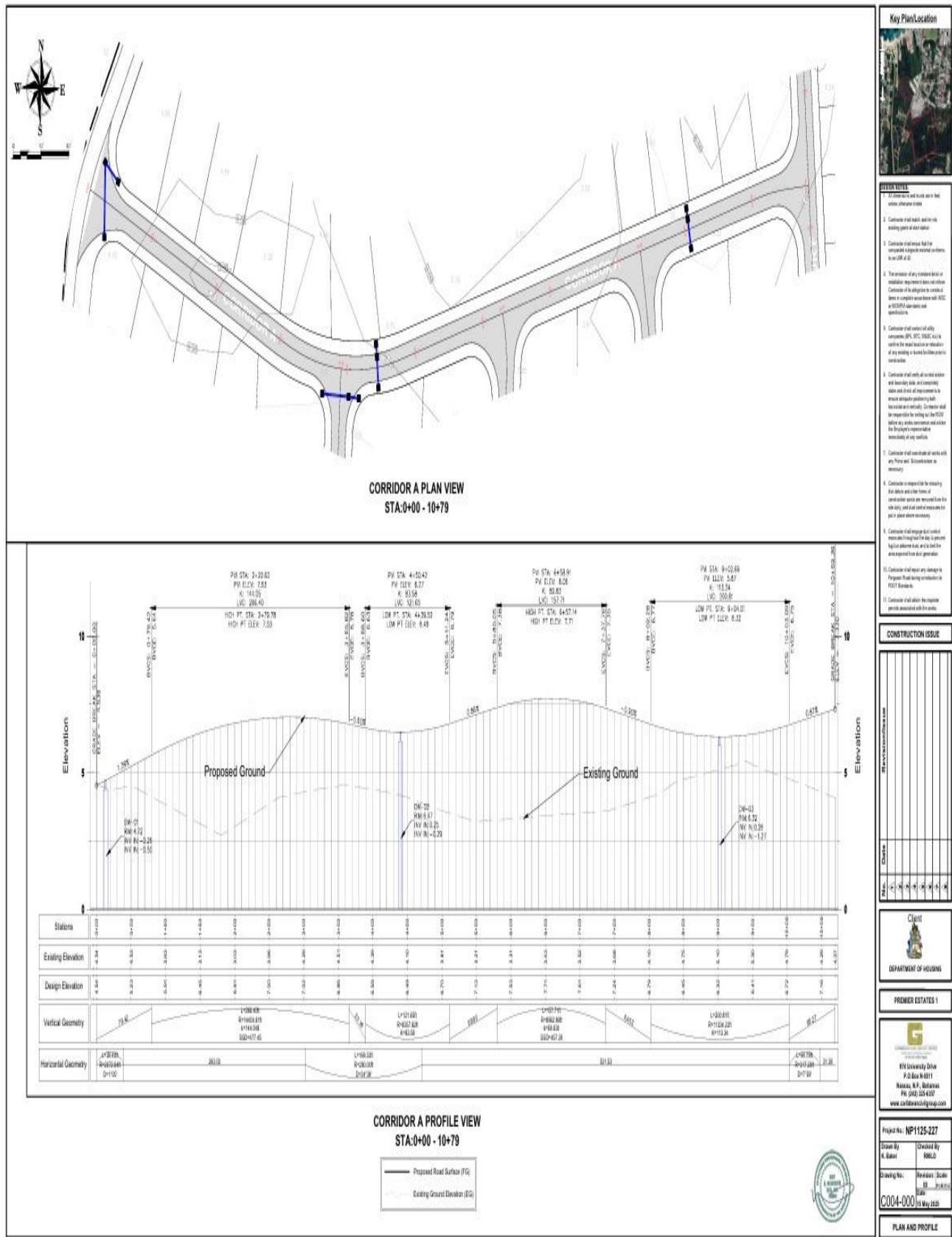


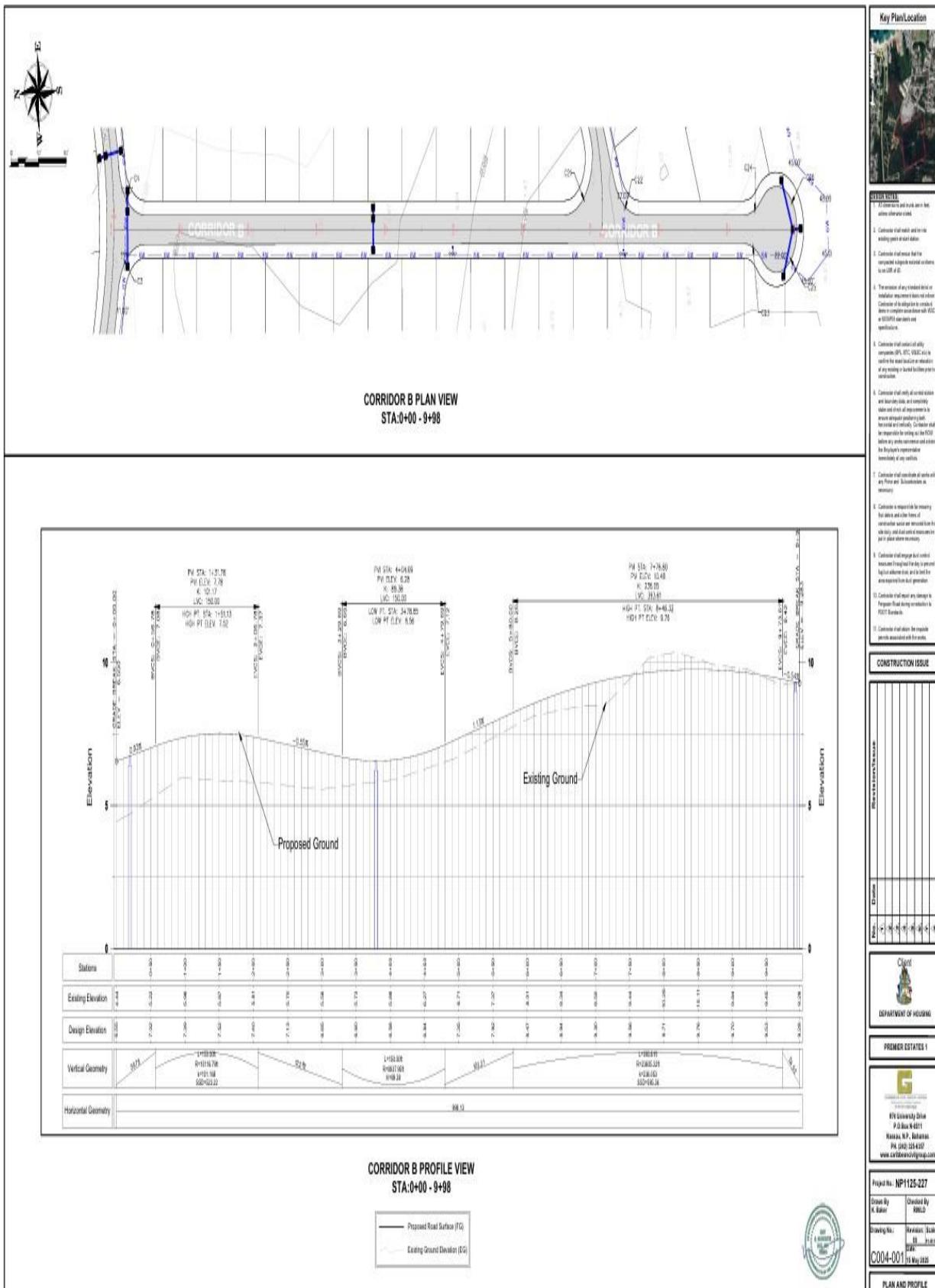
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C000-000	DRAWING INDEX	15 May 2025
C001-000	LEGAL SURVEY PLAN	15 May 2025
C002-000	LAYOUT PLAN	15 May 2025
C003-000	DRAINAGE	15 May 2025
C004-000	PLAN AND PROFILE	15 May 2025
C004-001	PLAN AND PROFILE cont'd	15 May 2025
C004-002	PLAN AND PROFILE cont'd	15 May 2025
C004-003	PLAN AND PROFILE cont'd	15 May 2025
C004-004	PLAN AND PROFILE cont'd	15 May 2025
C004-005	PLAN AND PROFILE cont'd	15 May 2025
C004-006	PLAN AND PROFILE cont'd	15 May 2025
C005-000	CROSS SECTIONS	15 May 2025
C005-001	CROSS SECTIONS cont'd	15 May 2025
C005-002	CROSS SECTIONS cont'd	15 May 2025
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C005-006	CROSS SECTIONS cont'd	15 May 2025
C005-007	CROSS SECTIONS cont'd	15 May 2025
C005-008	CROSS SECTIONS cont'd	15 May 2025
C006-000	VOLUME TABLES	15 May 2025
C007-000	SIGNS AND MARKINGS	15 May 2025
C008-000	TYPICAL SECTIONS	15 May 2025
C009-000	DESIGN DETAILS	15 May 2025
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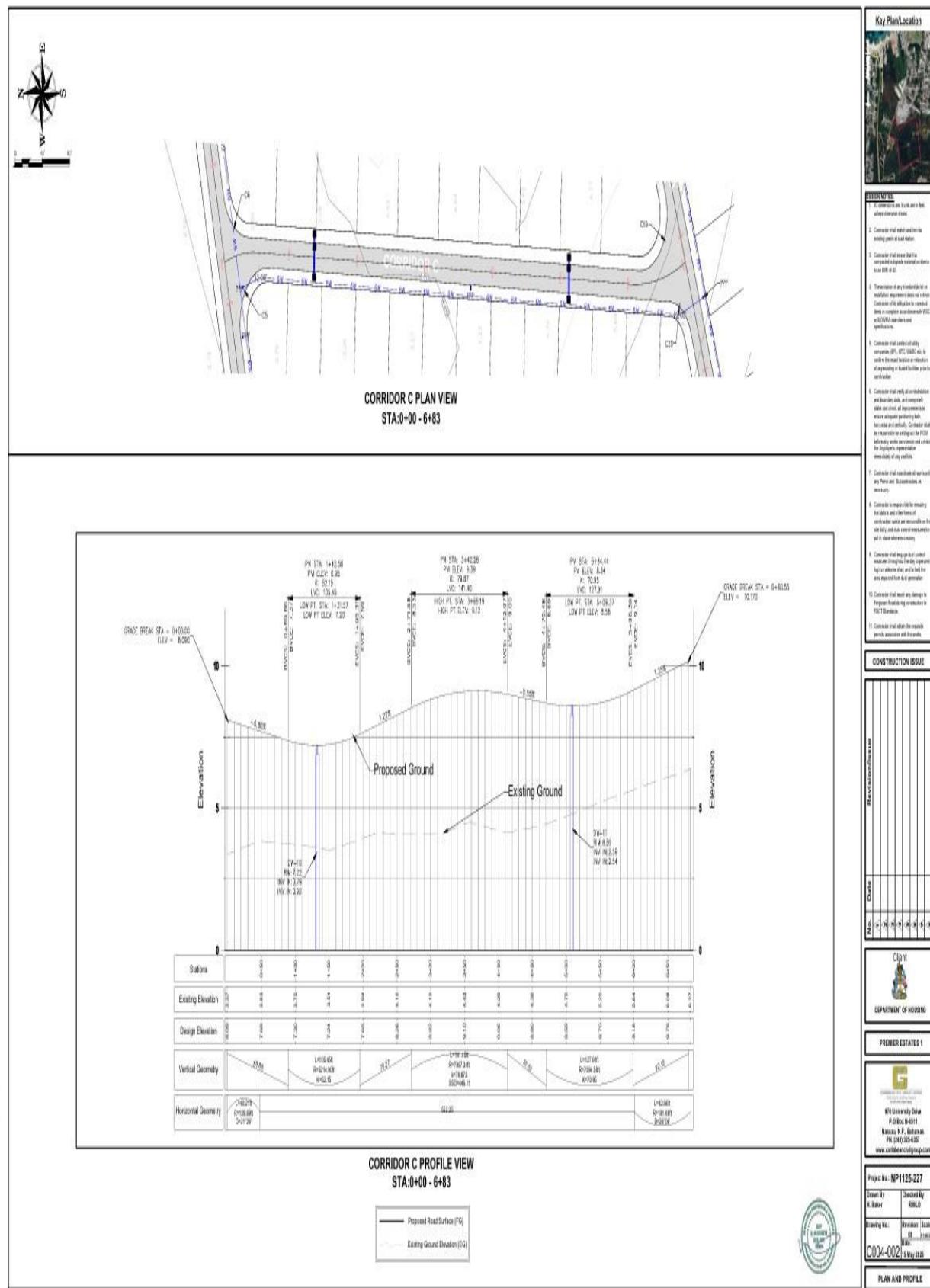


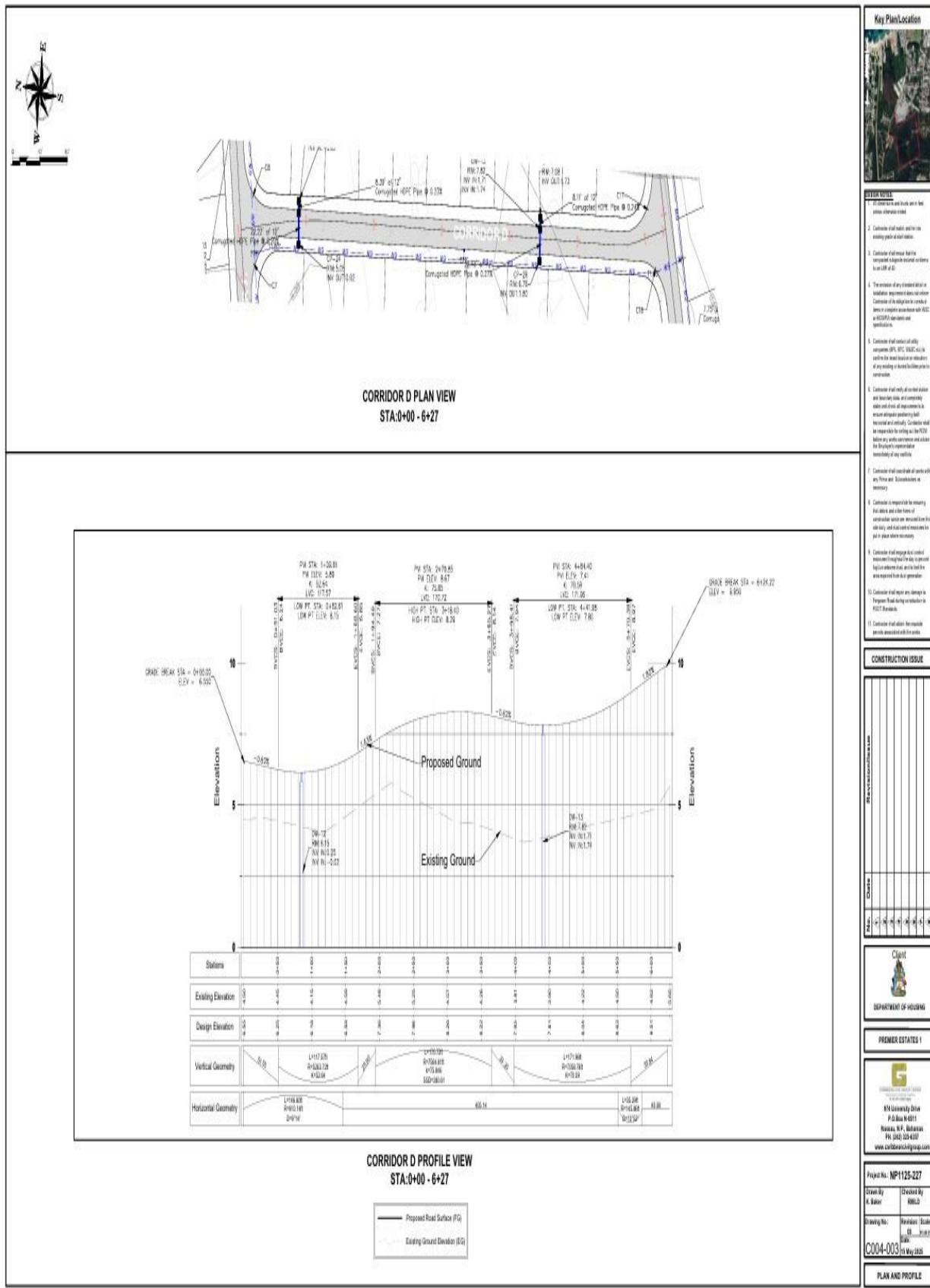


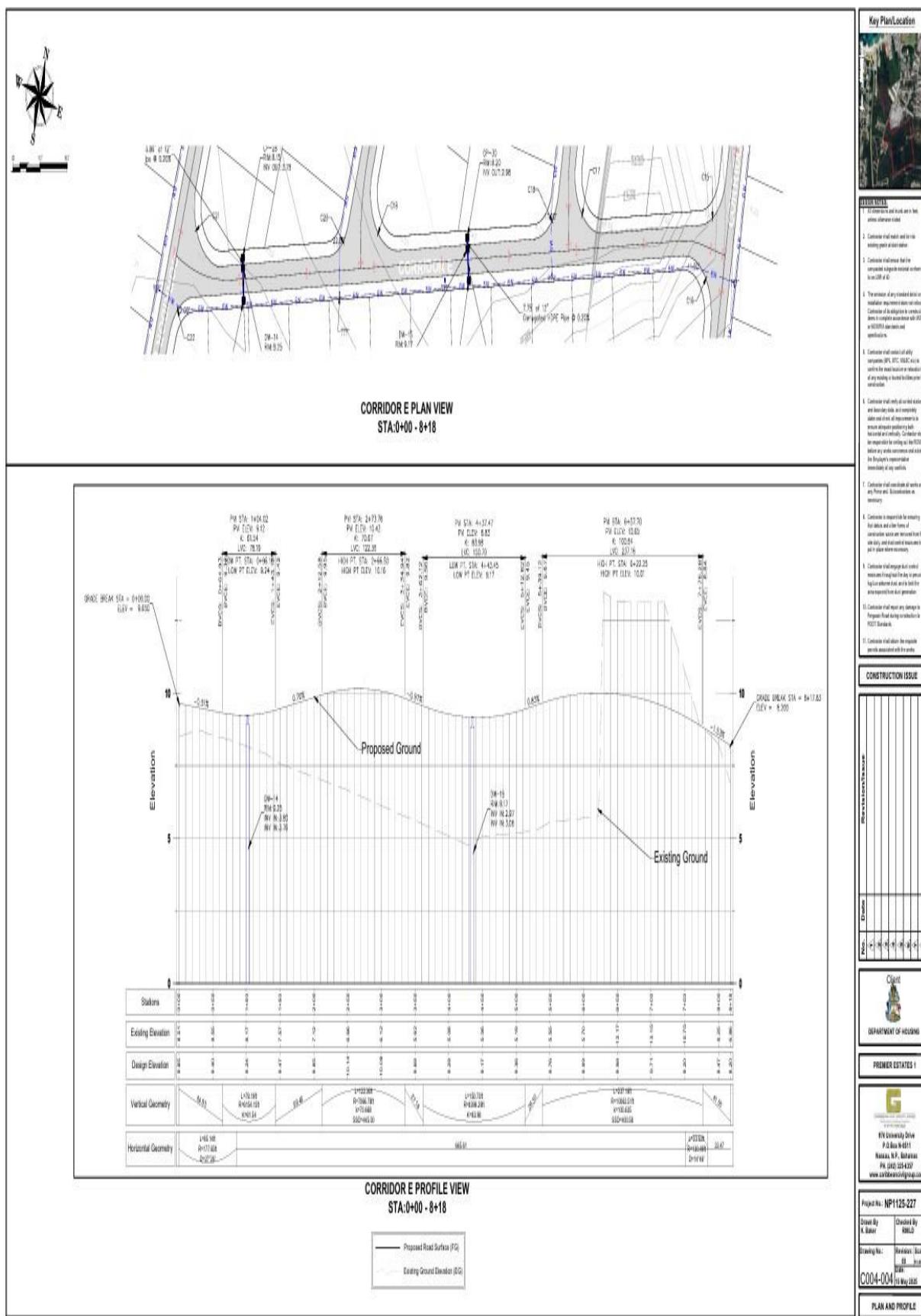


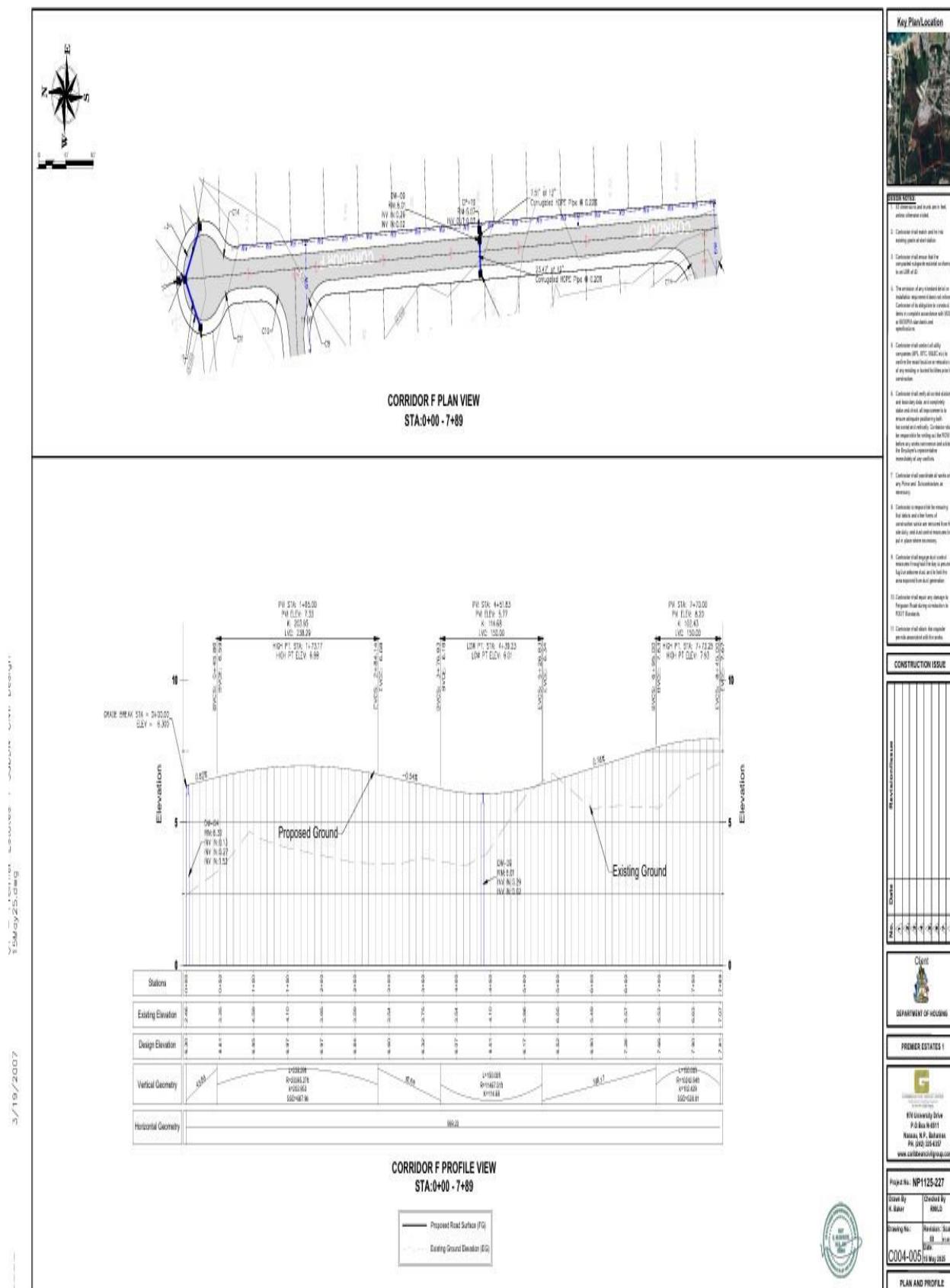


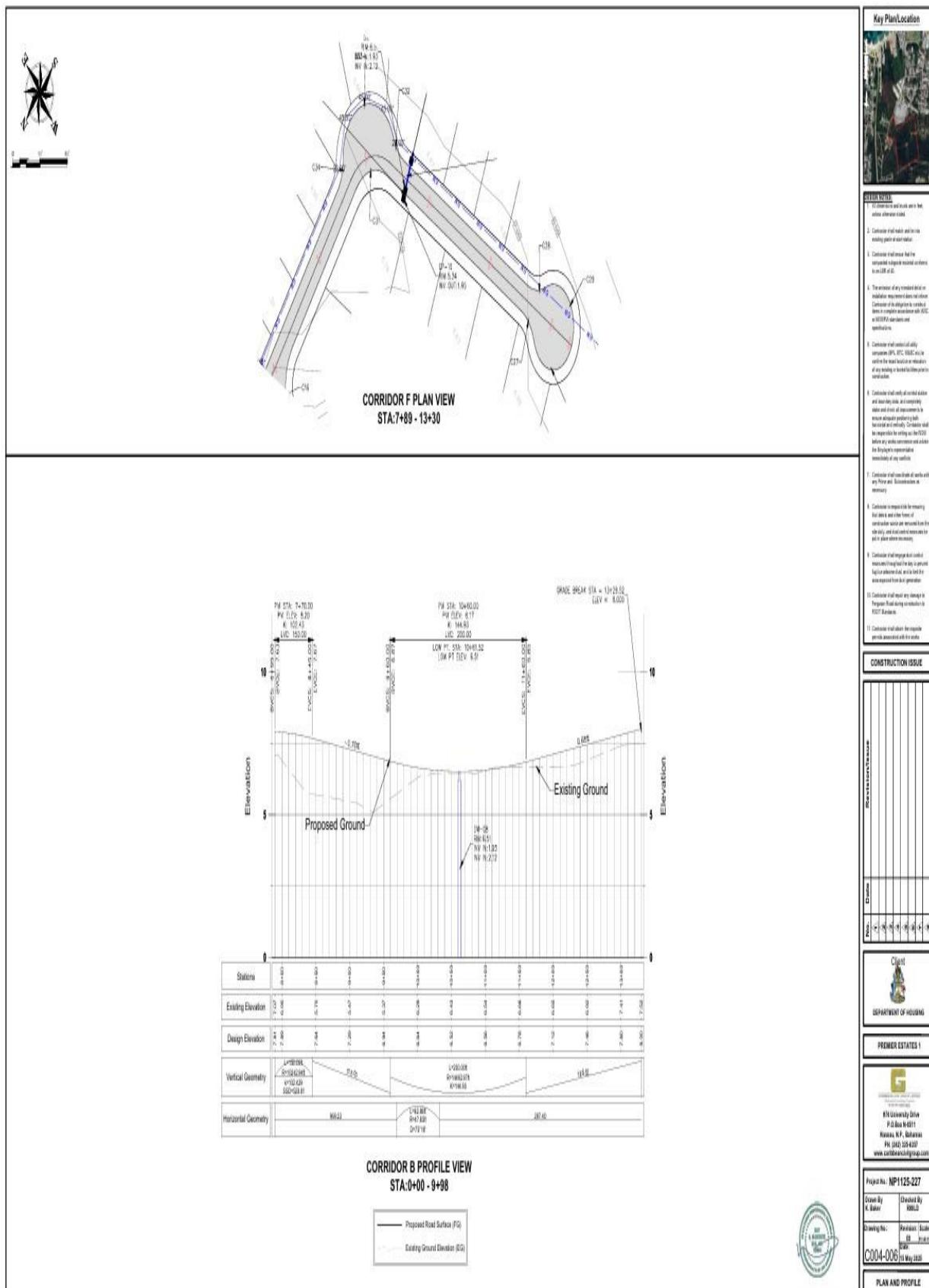


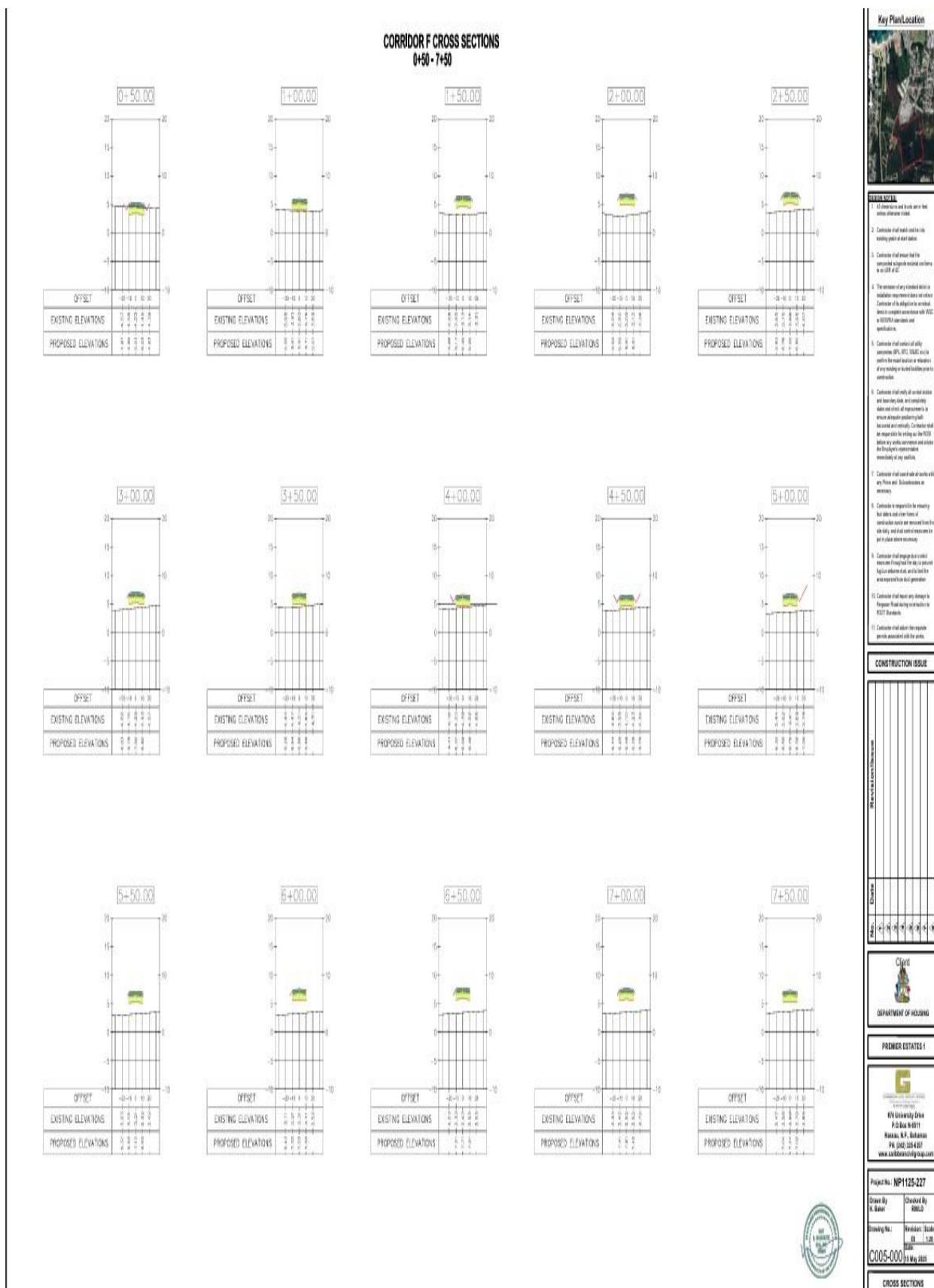


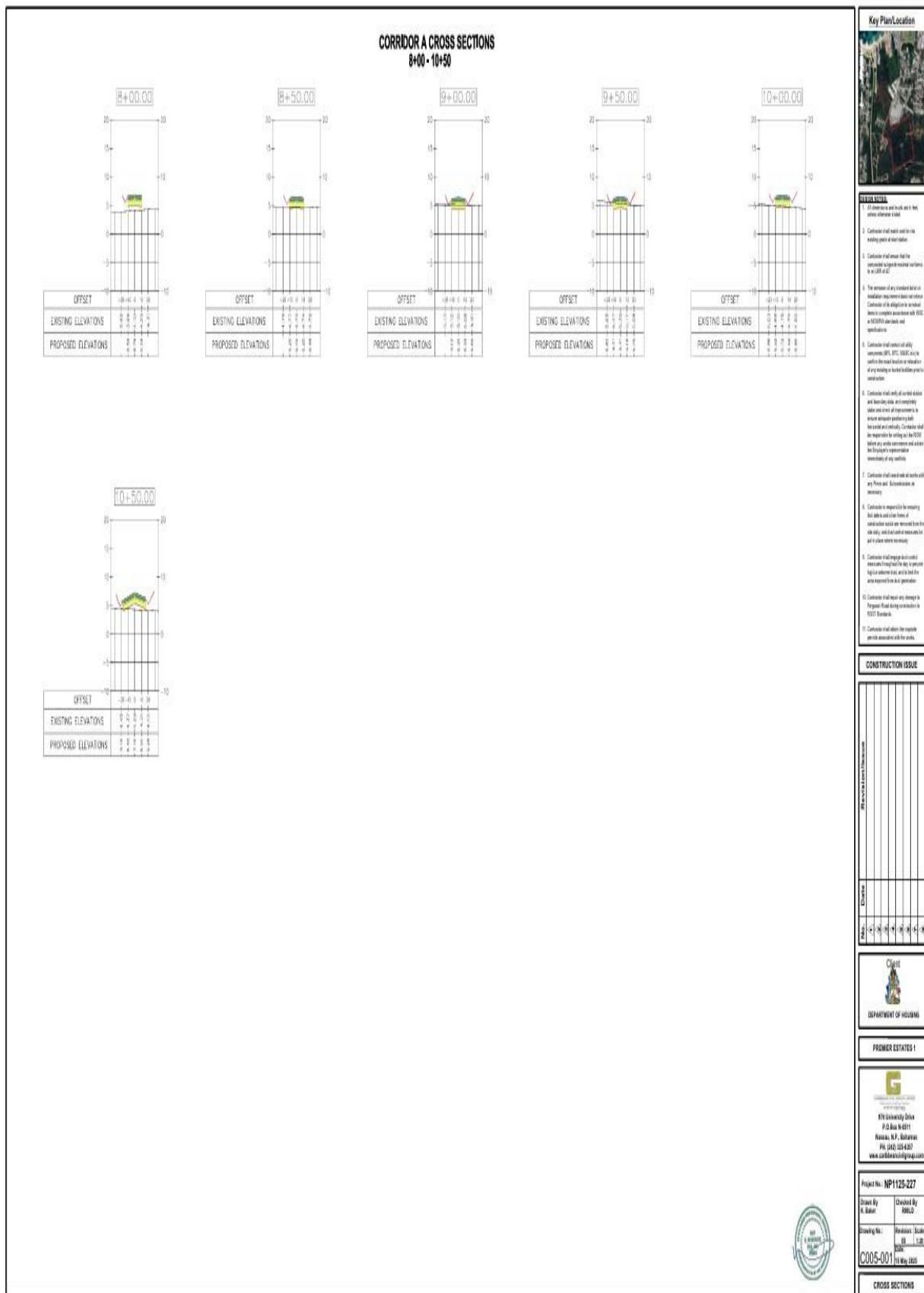


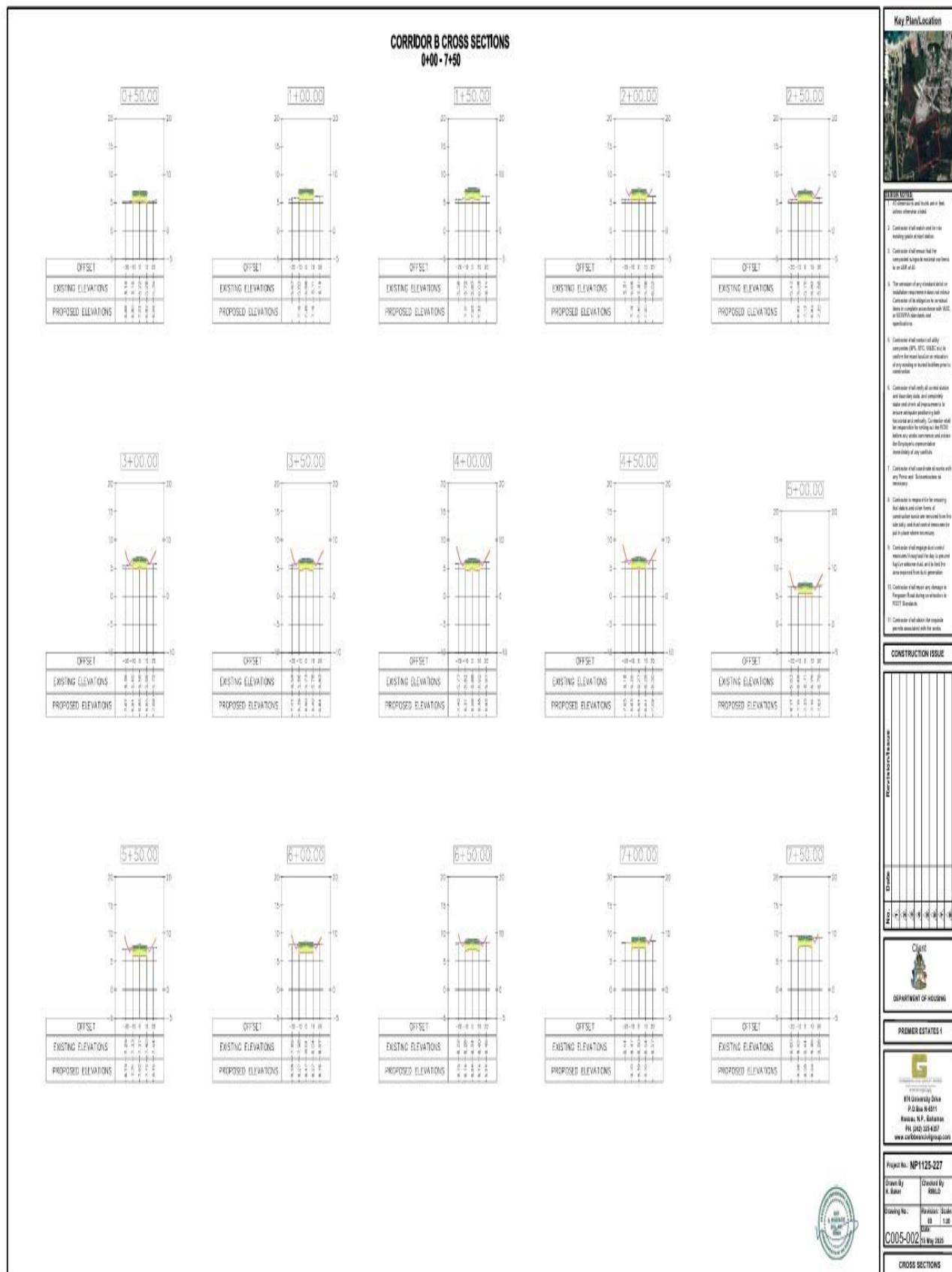


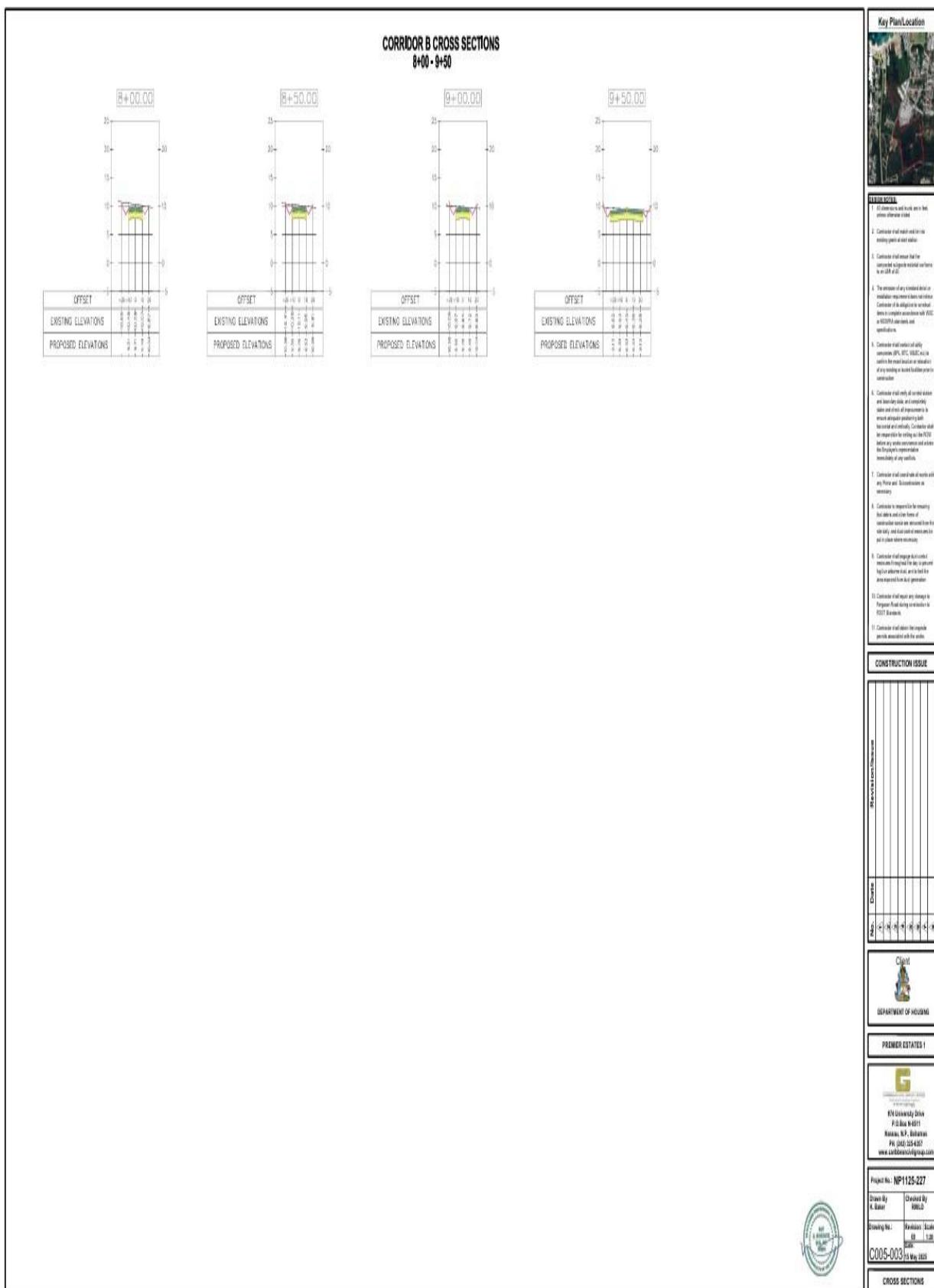




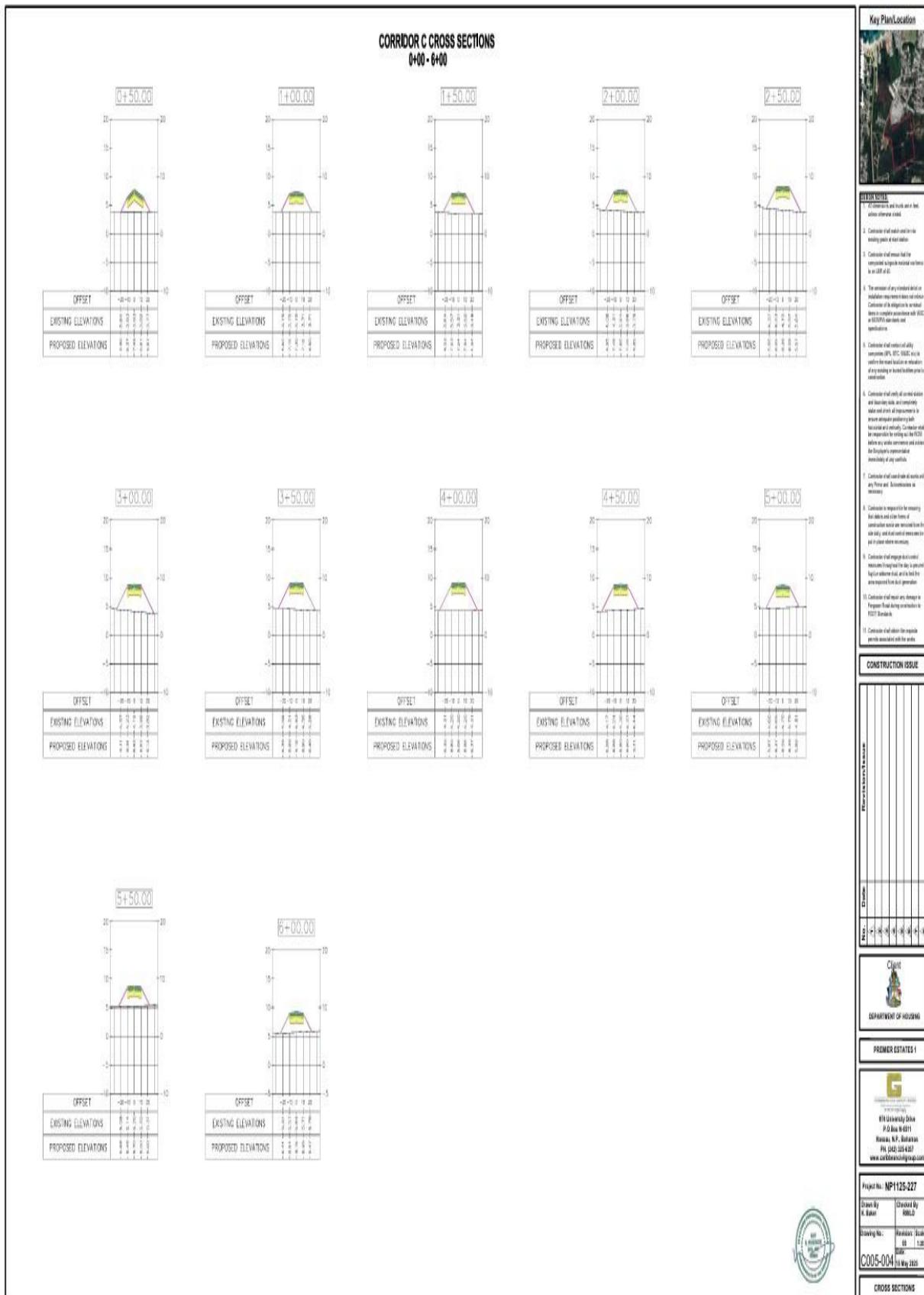


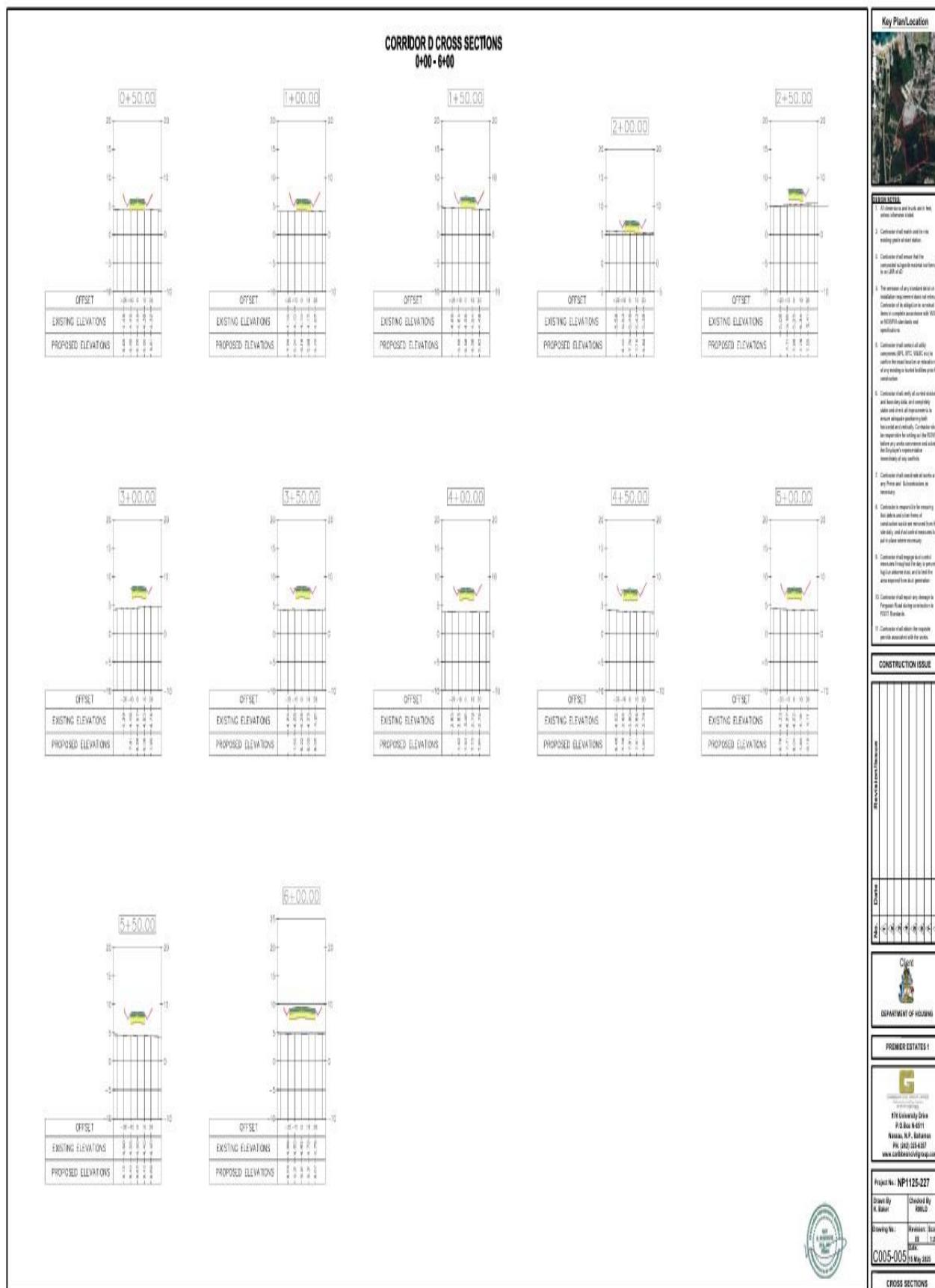


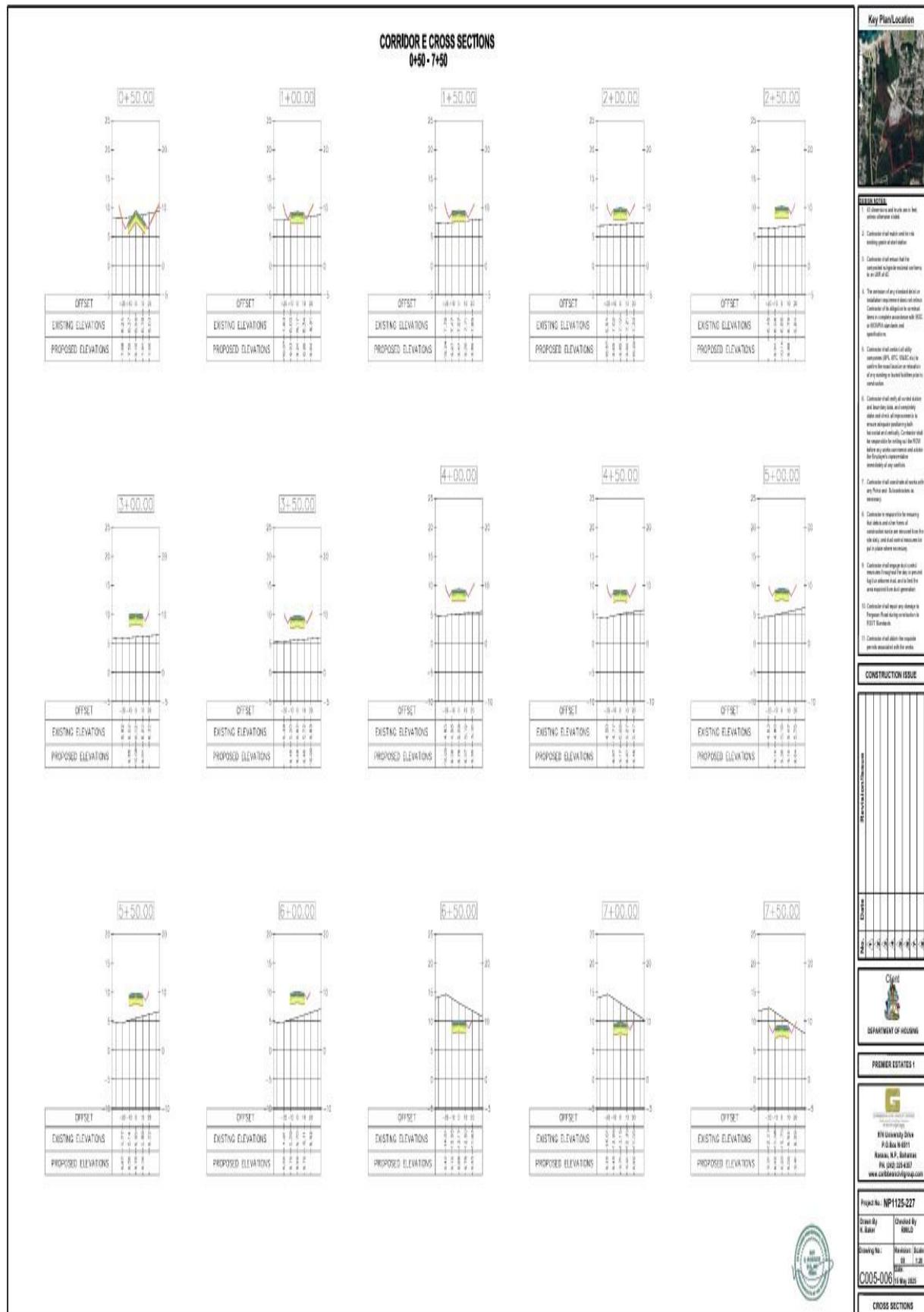




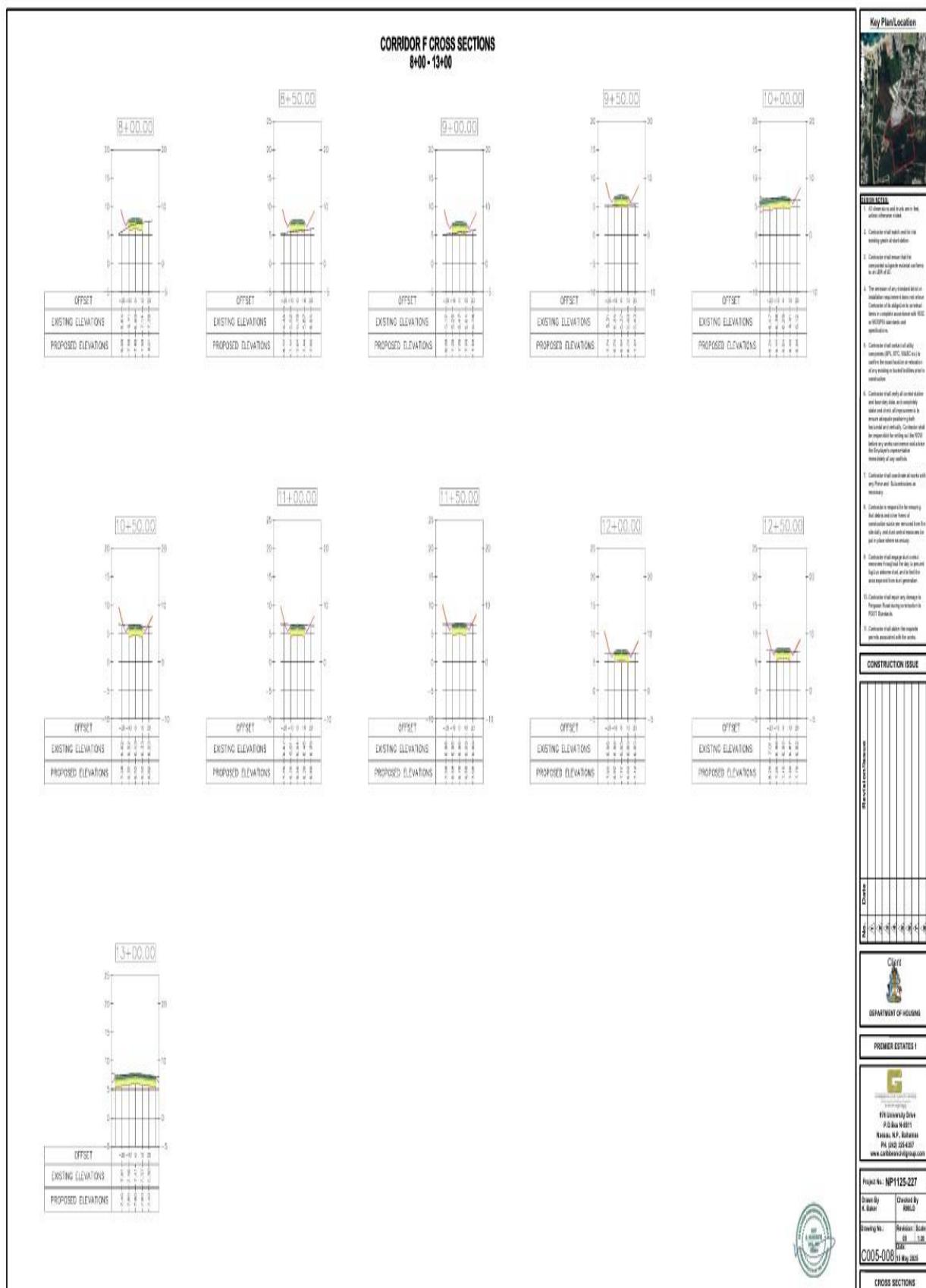
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TOTAL VOLUME TABLES

CORRIDOR A

Total Volume Table						
Station	FII Area	Cut Area	FII Volume	Cut Volume	Cumulative FII Vol	Cumulative Cut Vol
0+00.00	25.35	5.83	0.00	0.00	0.00	0.00
1+00.00	68.79	6.00	87.17	5.21	87.17	5.21
1+50.00	83.98	0.00	141.36	0.00	228.53	5.21
2+00.00	101.55	0.00	170.76	0.00	399.29	5.21
2+50.00	63.67	0.00	168.64	0.00	568.93	5.21
3+00.00	67.21	0.00	198.77	0.00	707.71	5.21
3+50.00	66.99	0.00	117.80	0.00	825.51	5.21
4+00.00	58.87	0.00	198.41	0.00	924.92	5.21
4+50.00	78.44	0.00	126.65	0.00	1051.57	5.21
5+00.00	123.86	0.00	187.89	0.00	1249.46	5.21
5+50.00	112.83	0.00	208.71	0.00	1458.16	5.21
6+00.00	95.27	0.00	183.42	0.00	1642.59	5.21
6+50.00	69.32	0.00	178.25	0.00	1821.84	5.21
7+00.00	93.98	0.00	183.81	0.00	2005.65	5.21
7+50.00	95.35	0.00	181.78	0.00	2187.23	5.21
8+00.00	92.63	0.00	174.97	0.00	2362.23	5.21
8+50.00	82.32	0.00	143.47	0.00	2505.68	5.21
9+00.00	39.34	0.00	84.13	0.00	2589.81	5.21
9+50.00	52.02	0.48	84.58	0.43	2694.40	5.64
10+00.00	159.70	0.00	186.03	0.43	2880.44	6.08
10+50.00	242.56	0.00	301.98	0.00	3240.02	6.08

CORRIDOR B

Total Volume Table						
Station	FII Area	Cut Area	FII Volume	Cut Volume	Cumulative FII Vol	Cumulative Cut Vol
0+00.00	71.87	0.00	0.00	0.00	0.00	0.00
1+00.00	30.02	0.00	94.34	0.00	94.34	0.00
1+50.00	40.27	0.00	65.08	0.00	159.42	0.00
2+00.00	45.92	0.00	79.59	0.00	238.32	0.00
2+50.00	45.97	0.00	85.19	0.00	324.50	0.00
3+00.00	47.35	0.01	86.41	0.00	410.91	0.00
3+50.00	36.59	0.07	77.28	0.81	488.17	0.82
4+00.00	31.43	1.06	82.02	2.64	550.00	3.46
4+50.00	27.23	3.07	54.32	4.68	605.00	8.14
5+00.00	26.03	2.58	51.17	5.22	656.17	13.36
5+50.00	20.09	3.42	44.55	5.53	700.72	18.89
6+00.00	13.00	4.40	31.19	7.24	731.91	26.13
6+50.00	15.93	2.89	27.34	8.75	758.25	32.88
7+00.00	17.08	0.79	31.12	3.41	780.36	36.28
7+50.00	2.16	4.31	18.38	4.72	808.74	41.01
8+00.00	0.05	35.08	2.08	36.45	810.81	77.46
8+50.00	0.37	28.08	0.39	57.18	811.19	104.82
9+00.00	7.81	18.77	7.57	42.08	818.78	176.70
9+50.00	12.12	22.80	18.45	58.49	837.21	215.19

CORRIDOR C

Total Volume Table						
Station	FII Area	Cut Area	FII Volume	Cut Volume	Cumulative FII Vol	Cumulative Cut Vol
0+00.00	97.80	3.35	0.00	0.00	0.00	0.00
1+00.00	110.89	1.06	193.23	3.16	193.23	3.16
1+50.00	114.83	0.00	209.00	0.00	402.23	4.13
2+00.00	115.14	0.00	212.34	0.00	615.07	4.13
2+50.00	138.64	0.00	238.81	0.00	853.88	4.13
3+00.00	171.88	0.00	206.24	0.00	1158.12	4.13
3+50.00	169.78	0.00	215.14	0.00	1455.26	4.13
4+00.00	181.23	0.00	225.01	0.00	1780.27	4.13
4+50.00	161.86	0.00	317.68	0.00	2097.95	4.13
5+00.00	128.46	0.00	275.14	0.00	2388.09	4.22
5+50.00	111.51	0.00	223.52	0.00	2591.81	4.82
6+00.00	112.51	0.00	207.42	0.52	2799.03	5.34

CORRIDOR F

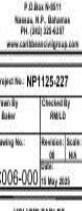
Total Volume Table						
Station	FII Area	Cut Area	FII Volume	Cut Volume	Cumulative FII Vol	Cumulative Cut Vol
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1+00.00	95.20	0.00	244.43	0.00	244.43	0.00
1+50.00	119.53	0.00	197.30	0.00	432.53	0.00
2+00.00	135.13	0.00	234.87	0.00	717.40	0.00
2+50.00	136.54	0.00	251.55	0.00	968.95	0.00
3+00.00	121.53	0.00	226.00	0.00	1443.17	0.00
3+50.00	184.80	0.00	255.81	0.00	1648.95	0.00
4+00.00	75.75	0.00	172.54	0.00	1821.39	0.00
4+50.00	12.86	1.79	93.00	5.38	1904.44	5.38
5+00.00	3.74	15.23	15.46	18.46	1919.90	24.82
6+00.00	48.11	0.71	48.93	14.78	1968.83	39.58
6+50.00	61.22	0.07	101.71	0.72	2070.55	40.30
7+00.00	75.74	0.07	132.37	0.13	2208.92	40.43
7+50.00	62.45	0.00	118.66	0.06	2327.81	40.48
8+00.00	97.03	0.00	101.37	0.00	2428.99	40.48
8+50.00	85.52	0.00	120.00	0.00	2568.98	40.48
9+00.00	82.07	0.00	155.18	0.00	2718.16	40.48
9+50.00	78.81	0.00	149.88	0.00	2866.05	40.48
10+00.00	13.90	21.67	85.77	20.25	2952.82	60.74
10+50.00	11.25	19.58	28.85	30.02	2981.97	60.77
11+00.00	16.29	12.42	31.06	21.28	3072.73	12.04
11+50.00	18.18	9.45	31.91	20.25	3044.05	12.30
12+00.00	29.97	4.31	44.58	13.74	3095.23	14.03
12+50.00	33.02	3.49	55.32	7.22	3147.55	15.25
13+00.00	32.64	15.03	58.94	17.15	3206.90	16.40
13+50.00	41.14	0.00	105.57	3147.71	178.83	

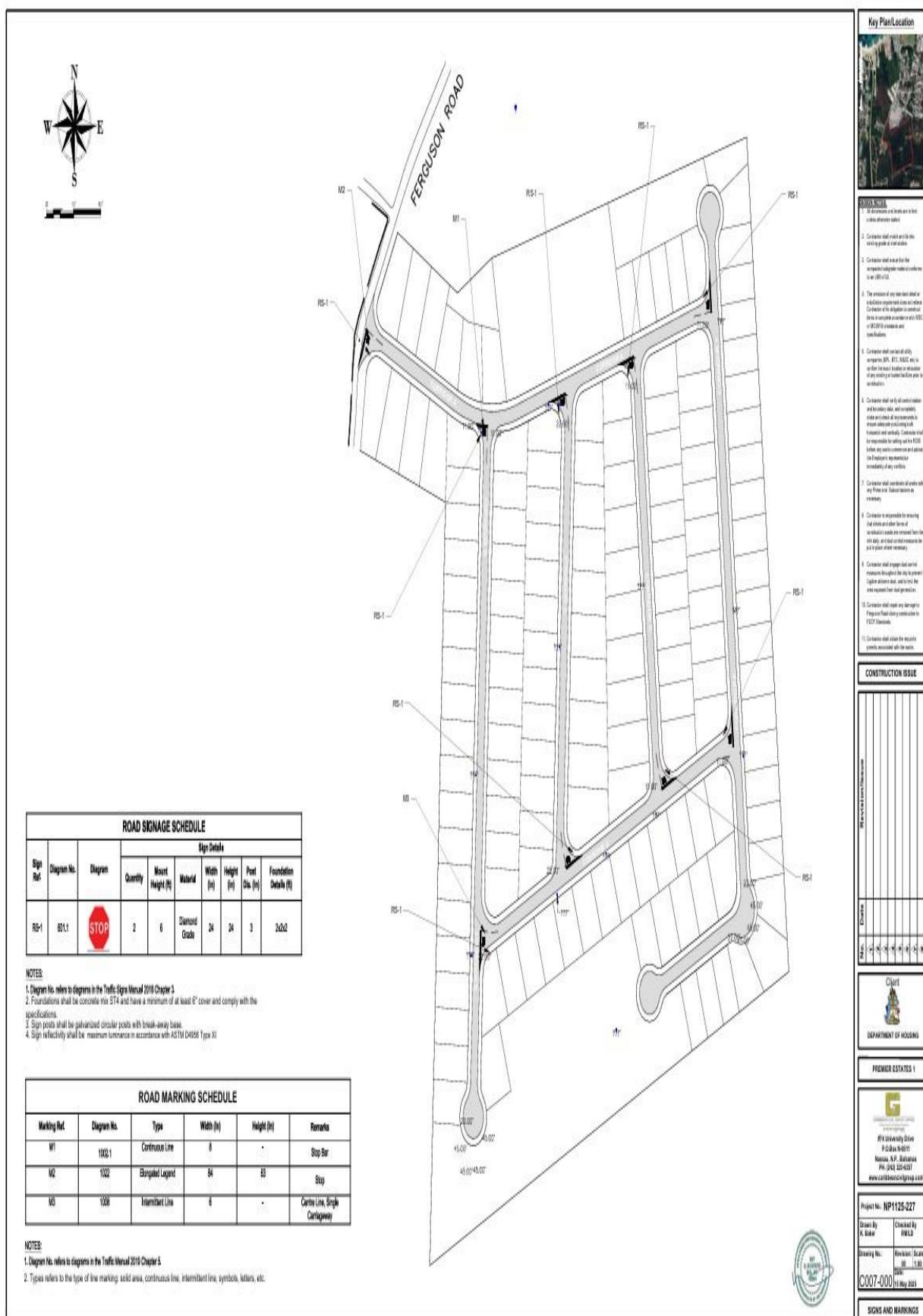
CORRIDOR D

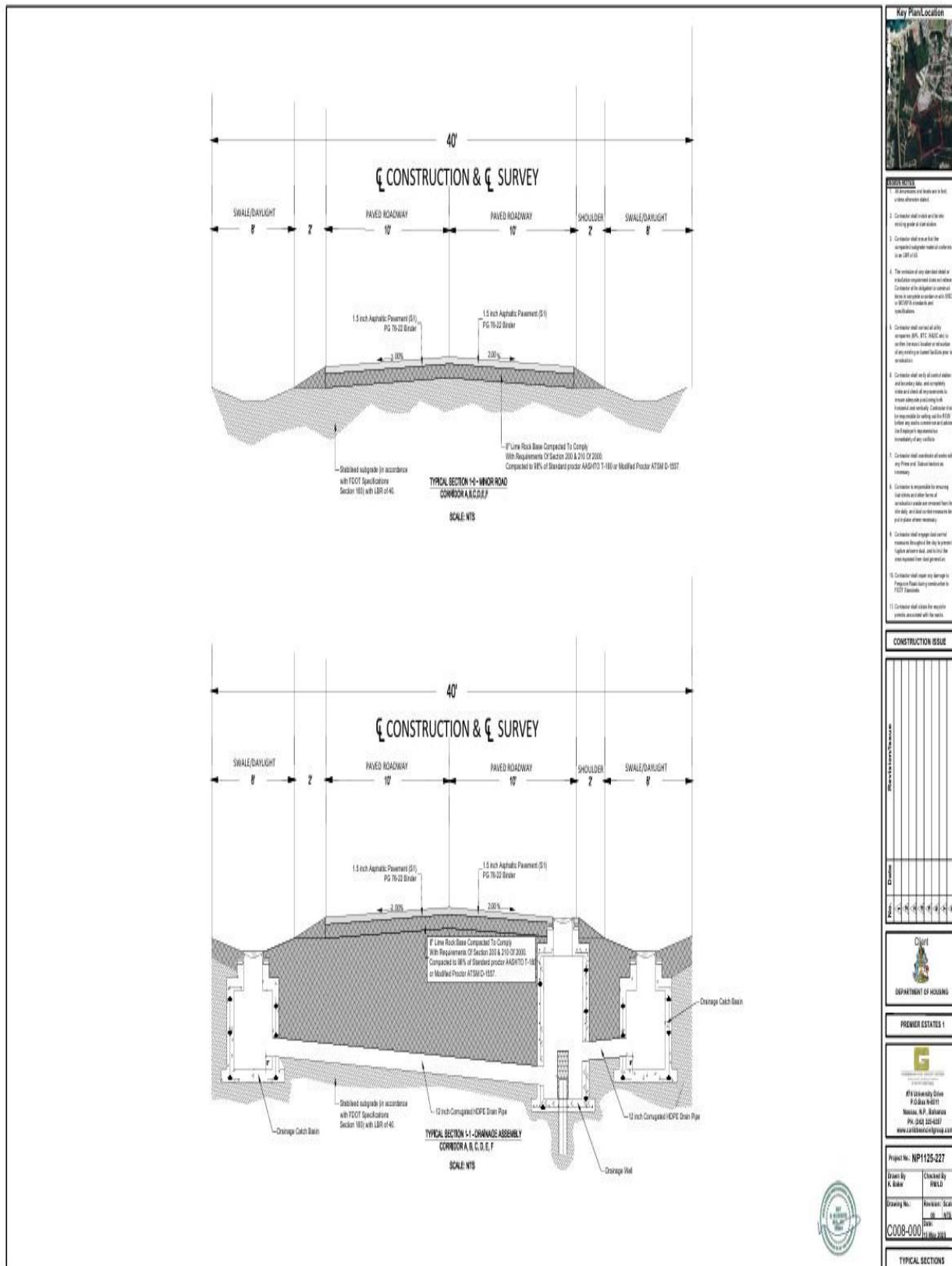
Total Volume Table						
Station	FII Area	Cut Area	FII Volume	Cut Volume	Cumulative FII Vol	Cumulative Cut Vol
0+00.00	174.53	0.00	0.00	0.00	0.00	0.00
1+00.00	81.64	0.00	237.57	0.00	237.57	0.00
1+50.00	75.82	0.00	145.36	0.00	383.36	0.00
2+00.00	81.23	0.00	126.00	0.00	510.29	0.00
2+50.00	79.91	0.00	129.75	0.00	640.04	0.00
3+00.00	103.71	0.00	184.09	0.00	834.10	0.00
3+50.00	116.21	0.00	222.15	0.00	1014.25	0.00
4+00.00	158.57	0.00	271.10	0.00	1302.35	0.00
4+50.00	202.29	0.00	338.43	0.00	1622.78	0.00
5+00.00	236.88	0.00	407.36	0.00	2060.14	0.00
5+50.00	317.80	0.00	515.06	0.00	2566.12	0.00
6+00.00	472.55	3.28	680.06	3.03	3246.08	3.03

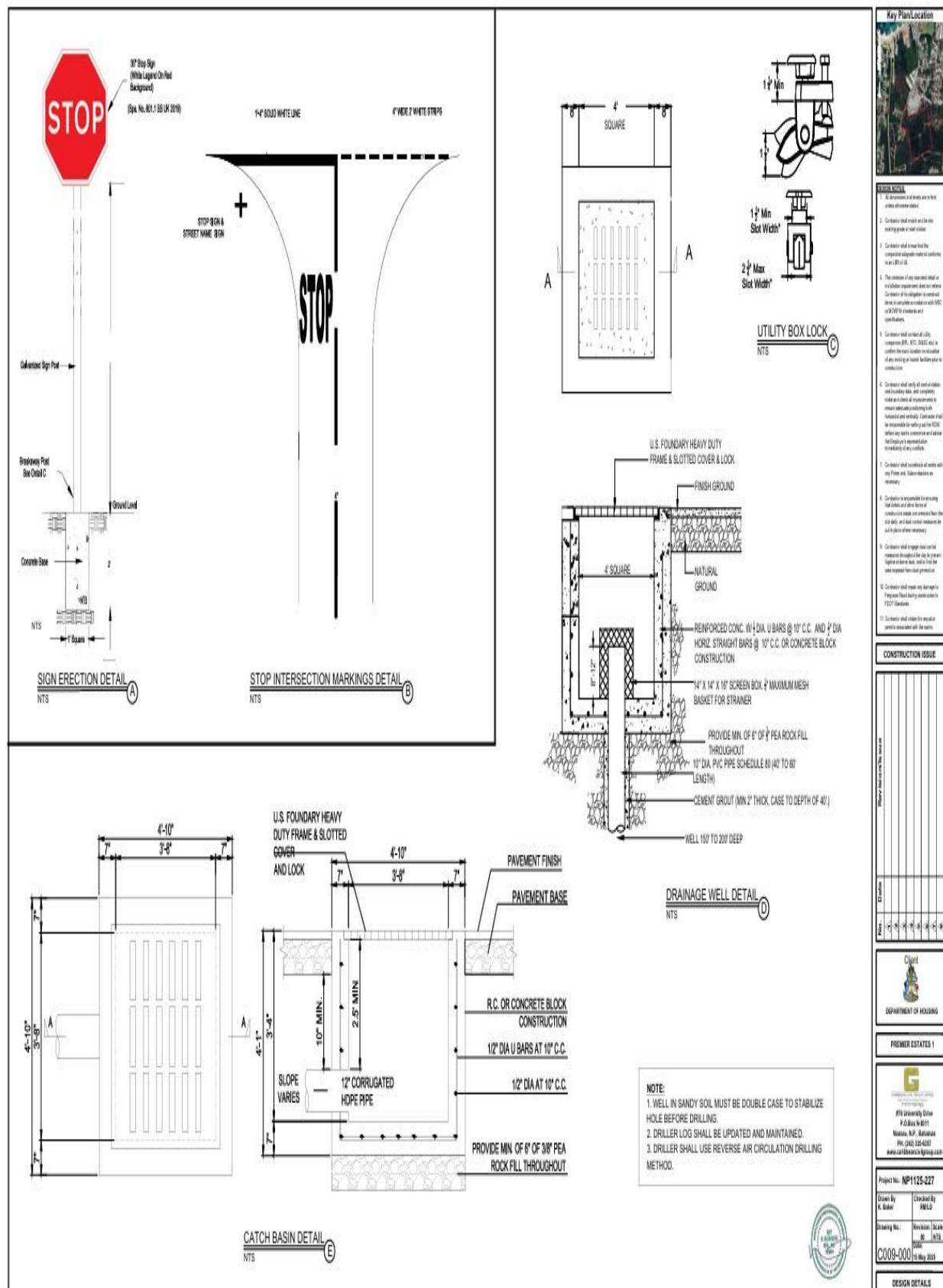
GRAND TOTAL VOLUME

CUT (sq. yd.)	FILL (cu. yd.)	NET (cu. yd.)
3674.63	11053.94	106579.32 (Fill)

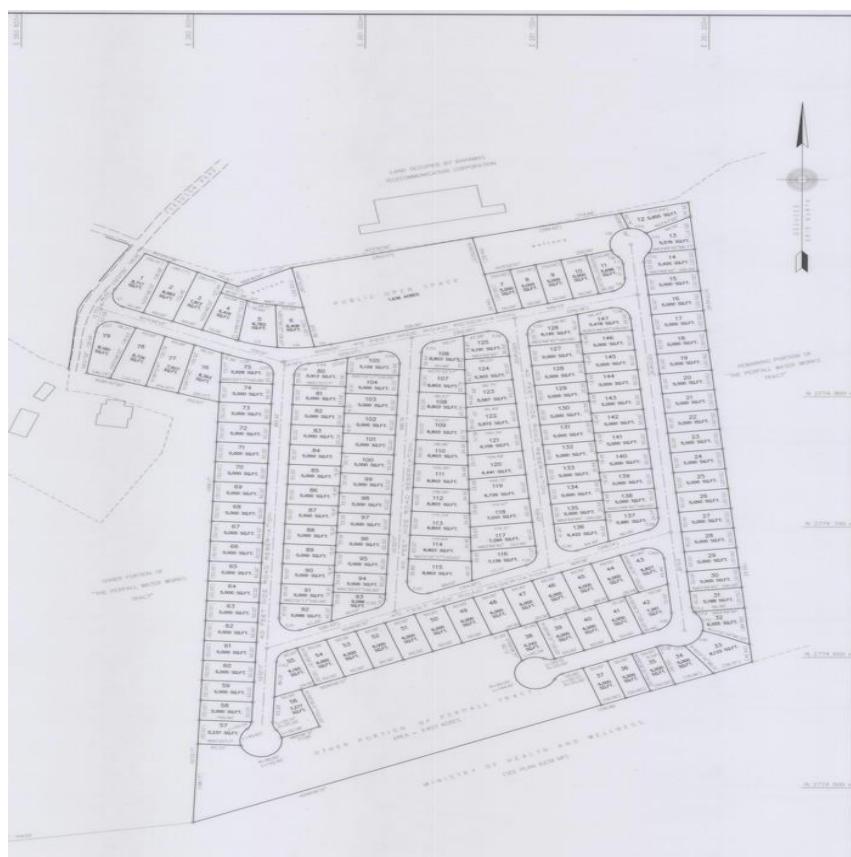








Appendix B: Hydrogeological Assessment Report



Source: Subdivision Site Plan (2025)

PREMIER ESTATES-I SUBDIVISION

‘LOW ELEVATION WATER RESOURCES AREA’

WESTERN NP, The Bahamas

SURFACE | GROUNDWATER FLOW PREDICTIONS

BENCH LEVEL HYDROLOGICAL ASSESSMENT

July 28, 2025

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Historical Brief on the Development Area – Perpall’s Tract Wellfield

The Perpall’s Tract Wellfield Area has been considered a valuable natural & ecologically sensitive region, containing a coppice forest with a significant diversity of native plants, along with traditional medicinal plants. The area of approximately 212 acres, was developed in March 1943 to supply water for the Allied Military ('Fighting') Forces of World War II.

Originally established as a wellfield in the late 1930s, with the intent to provide water to the City of Nassau; Government acquired the entire acreage for this purpose through eminent domain between 1937 and 1942. These low elevated lands to the north of the ridge were ideally suited for freshwater production. The developed water resources area had a safe yield of 124,000 gallons/day (@ <600-mg/L Chloride), but 65% of the developed area is below 7Ft elevation (above mean sea level – amsl).

The water resource area has been subjected to over abstraction (> 124,000-Gal/Day), and affected by saline intrusion; potable water operations ceased with the hope that the freshwater lens would eventually replenish itself, permitting the wells & trenches to be reopened. At present, the area remains decommissioned & surrounded by Urban Development (both residential and commercial). It was further determined that the adjacent expansion "has tended to subdue water development interest".

Present concerns exist regarding the proposed plan to construct a new hospital facility in the south- western quadrant, utilizing 50-acres of the Perpall’s Tract Wellfield Area. Environmental advocates have claimed that this plan would destroy the existing ecosystem, including the forest and the plants within it. The role of the forest in absorbing carbon gases, and the potential loss of indigenous bush medicines found in the area has been highlighted. "Despite all concerns, there is a perception that the Government shall proceed with the hospital project". Similar concerns were also raised during the construction of an additional Housing Subdivision in the south-east quadrant (in the vicinity of Constitution Drive, 2005 – 2007), and the 2009 construction of a Corridor (North Bethel Highway), through the western boundaries of the Perpall’s Area.

An additional residential subdivision was also later built on the Perpall’s Tract Lands, north of Sayle Street | west of Eden Street (in the 'Chippingham Area'), along the Eastern Perpall’s Land Boundary – in the vicinity of lands prior occupied by 'The Nassau Seafloor Aquarium' (March 1967 – 1989). High historical relevance of the area exists. The Aquarium was also the first of its type, in the Caribbean.

The present southern residential subdivision, accessed from the East via Sayle Street / Poitier Avenue (Adastral Estates 3, North of Constitution Drive) is located on the higher elevation of the Perpall’s Tract Lands, above the 10-Ft mean sea level (msl) - per the designation of the historic wellfield maps. The proposed hospital site is also to be located on an elevated land section to the south-west boundary, with lower flat lands to the North.

The 'Premier Estates-I Housing Subdivision' is proposed for the north-east quadrant of the Perpall’s Tract Lands, at a lower elevation (< 10-Ft above msl). The gradient of both surface runoff and the natural groundwater flow is from the South to North.

Documented historical aspects (circa 1930's / 40's) exist for the entire area. The proposed Subdivision should expect similar concerns of ecosystem / biodiversity / flood mitigation / water resources. Wide public consultation is encouraged, particularly with those special interest groups who were the drivers behind the protection process of the Perpall's Tract Wellfield Area.

Source(s): The Present Status and Future Potential of Government Wellfields, Perpall's Wellfield, United Nations Development Programme, Office of Technical Cooperation, New York 1977 | WSC Summary of Land Acquisitions for Water Supply Purposes, New Providence, Perpall's Waterworks (2003) | WSC WRMU Sr. Hydrologist Records (1999 – 2023) | https://captivecetaceans.fandom.com/wiki/Seafloor_Aquarium

TECHNICAL NOTES | GUIDANCE FOR APPLICATION OF COLLECTED SITE DATA -

"based on the decisive parameters - for recharge from rainfall & evapotranspiration losses in the unsaturated zone":

- 1.) Prior water | tidal level analysis conducted for several natural & designed open water bodies (Lakes/Ponds) within the Western District of New Providence (NP), and on North Abaco. Specific natural areas monitored, to date remain undisturbed | undeveloped.
- 2.) Certified 2023/2024 Rainfall from LPIA utilized for the analysis of several areas (for recharge, under typical evaporation / evapotranspiration conditions for the Western, NP area).
- 3.) Runoff analysis [per Rainfall data + predictions] to a lake area for increase from 25% [@ Predeveloped] to a maximum 45% [@ Post Developed]. Evaporation | Evapotranspiration rates remaining constant ('typical' - expected for any vegetative cover removed to be replaced and/or enhanced).
- 4.) From a separate site - data analysis (in Western NP), for Predeveloped Conditions; Lake Overtopping | Flood Conditions are 'generally' experienced during the months of: April, November, & December [when monthly rainfall @ LPIA exceeds a total of 4.0-Inches]. For Post Developed conditions; Lake Overtopping | Flood Conditions are experienced during the months of: April, August, November, & December [again, when monthly rainfall @ LPIA exceeds a total of 4.0-Inches]. Additional ultimate 'extreme conditions of rainfall' (6x multiplier of monthly average for 30-In/Month) + runoff conditions @ 60% for potential water area expansion.
- 5.) Additional analysis conducted for "ultimate extreme conditions" and toward the prediction of the required drainage wells to facilitate anticipated disposal of surface flows (where, each drainage well accepts up to 432,000-Gallons/Day (GPD). This was merely an academic process for verification/validation of analysis methods; as under the scenario all ponds/lakes become a single water body, and the entire land area is inundated - drainage wells not functional for excessive flow conditions where an entire area becomes inundated.

Note

[National Oceanic and Atmospheric Administration](#) | [National Ocean Service \(NOAA/NOS\)](#) is the United States of America Center for Operational Oceanographic Product and Services.

For Data Quality Assurance / Quality Control (QA/QC) all collected 'baseline' field data, and 'water level readings' obtained at an existing pond/canal were plotted against the 'preliminary' NOAA/NOS Tide & Current Gauge Data @ Virginia Key, Biscayne Bay, Florida Station at various tide datum. To relate Mean-Sea-Level (MSL) measured levels to Shattuck Datum (MSL Correction for Groundwater on NP, The Bahamas), a +3.67Ft adjustment must be made to the

measured data. Site water level data was corrected for Shattuck Datum (NP, Bahamas) and determined to be relative to the Mean Lower Low Water (MLLW) Datum for the NOAA/NOS Virginia Key, Florida Station #8723214.

Previous extensive analysis for a project site with a pond/wetland system, installed monitor wells, and an adjacent Blue Hole in North Abaco, The Bahamas utilized similar techniques of correlating measured levels at site with fixed NOAA/NOS Tide & Current data sources [[AEES/F&C North Abaco CHEC Port Development Hydrological Analysis \(2015 – 2016\), & AEES Hydro-geological Assessment @ Adelaide, NP \(Aug-2021\)](#)]

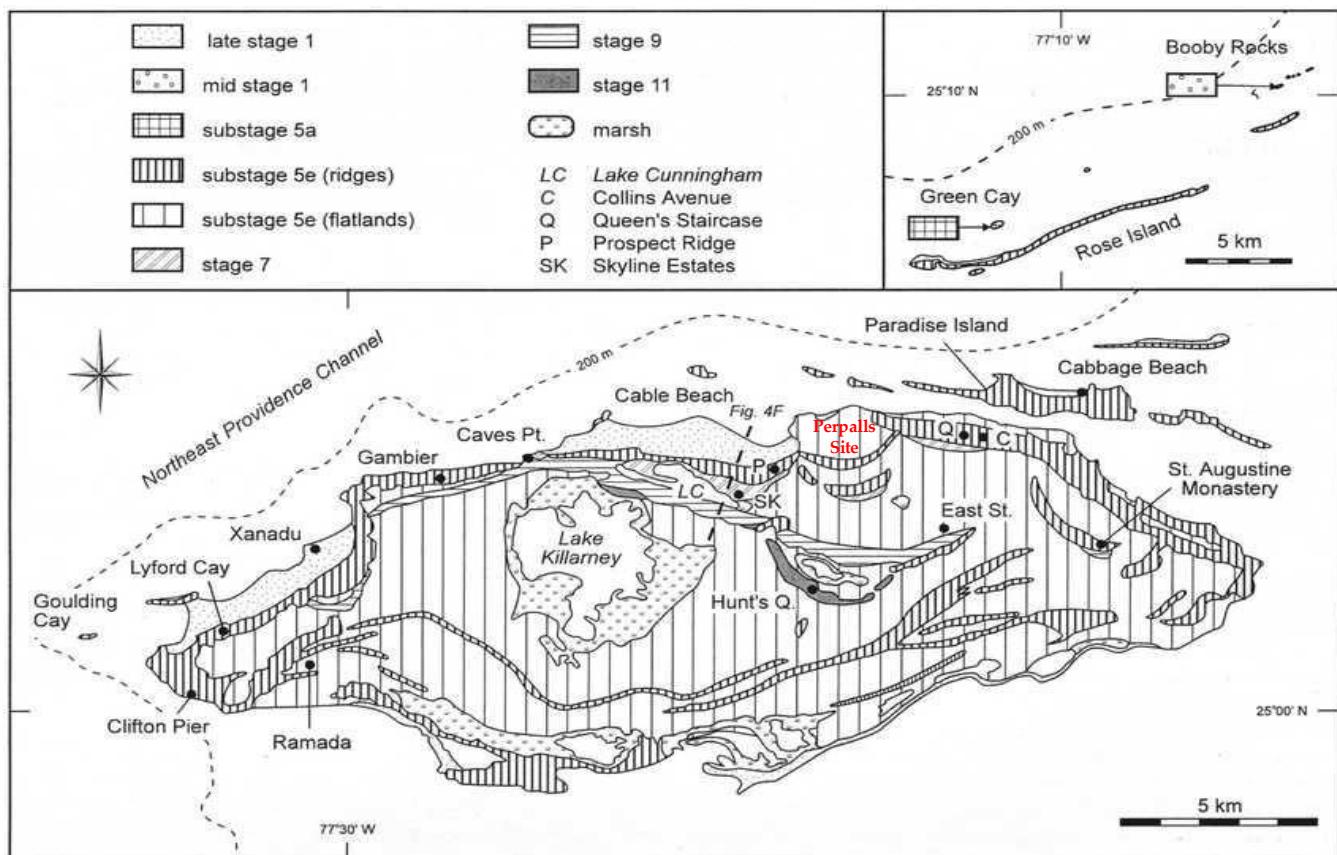
ALL PERPALL'S TRACT PROJECT SITE(S). NP - BAHAMAS

The ‘Premier Estates-I Housing Subdivision’ is a residential development to be located immediately south of the existing Lands occupied by the Bahamas Telecommunications Corporation (BTC). The site of the proposed commercial development (for the ‘Specialty Hospital’) is to be located on lands East of the Sanford Drive & North Bethel Highway intersection (on 50-Acres of the Perpall’s Tract Lands).

The proposed ‘Hospital Project Site’ is located on higher elevated lands, and just north of the primary East-West Ridge System on NP, but the ‘Premier Estates-I Housing Subdivision’ shall be located on lower elevated lands (< 10-Ft above msl). The entire Perpall’s Tract Area is primarily designated as ‘Flatlands’. The designation “substage 5e” defines the last interglacial period prior to the current one (‘the Holocene’). The Pleistocene epoch (“Ice Age”) preceded the Holocene epoch. To the immediate West, ‘late stage 1’ area geology (like Saunders Beach | Go-Slow Bend | Cable Beach Areas), typically refer to the final stages of a sea-level high-stand [the period when sea-levels were @ their highest point].

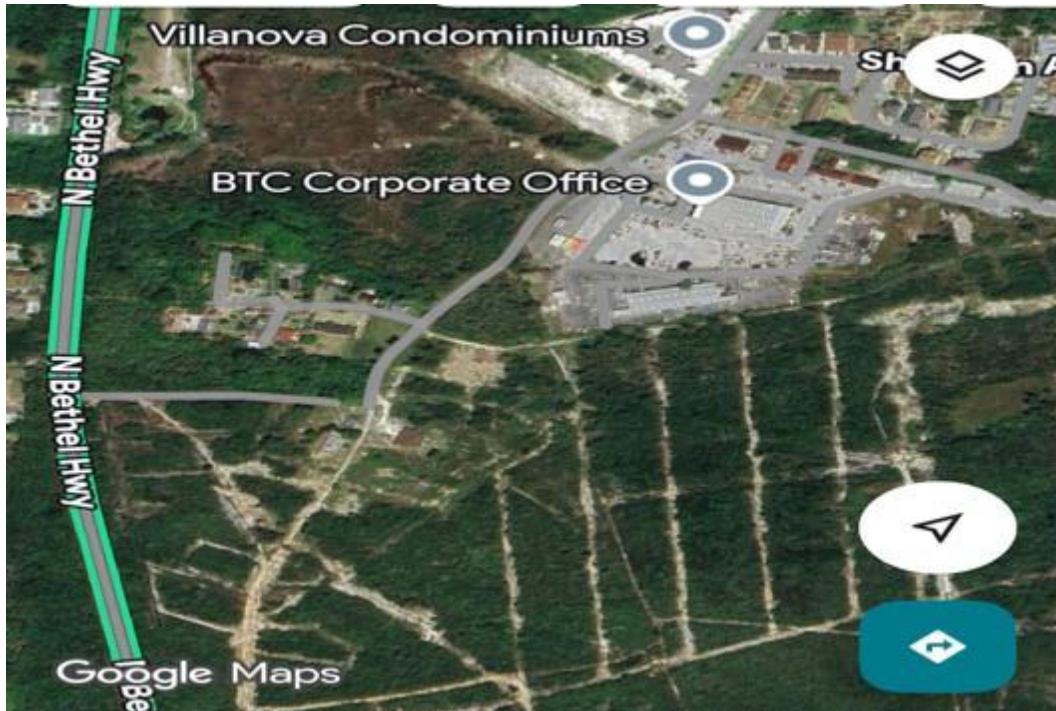
See **Figure I.** below for the Perpall’s Tract Wellfield Area on New Providence [Not-To-Scale – NTS]. **Figure II.** also follows, for an Overview of Existing Site Conditions @ the proposed ‘Premier Estates-I Housing Subdivision’ [NTS].

Figure I. – New Providence Surficial Geology Map, Perpall’s Area Location [Not-To-Scale]



Source: Base Map – 'Surficial Geology of New Providence Island & surrounding areas, Various contributions to Geology of New Providence'

Figure II. – Overview for Site Conditions for ‘Premier Estates’ – 2024/2025 [Not-To-Scale – NTS]



MARINE ENVIRONMENT & COASTAL ZONE

Placement of all critical infrastructures above +30-Ft (+9.14-m) Mean-Sea-Level (MSL) is generically suggested toward the integration of climate resilience measures, for built structures in the Caribbean Region.

The ‘Premier Estates-I Subdivision’ is at the lower elevation of Perpall’s Tract (< than 10-Ft msl); the area may be subjected to notable changes in the groundwater (due to normal tidal influence), and vulnerable to saline inundation from the Northern Coast during the passage of a tropical storm. The proposed Specialty Hospital Site is elevated, and fairly well situated away from the New Providence North Coast [within 1.1-miles | 1.77-km], and adjacent to one of the primary East-West Ridges for NP.

HYDRO-GEOLOGICAL ASSESSMENT OF SITE

A site hydrogeological | water resources review was conducted to evaluate information & data achieves, assess the limits of any possible freshwater lens, note the existing hydro-geological features, and also to determine influences between the landform and the marine environment.

The physical baseline aspects for the hydrology | hydrogeology includes water resources, surface water, drainage, and flood prone areas. Groundwater is encountered within 3 to 5Ft (0.924 to

1.524-m) below ground level (bgl) toward the North (lower elevation) tracts of land. The typical direction of groundwater flow is from South to North within this area (along with surface runoff). Open surface water trenches/canals exist on the lower land parcels of the Wellfield Area, moving toward the Northern boundary.

Historically, flooding was and shall continue to be a concern toward the North, in the Perpall's Tract Wellfield Area (at the lower elevation). Typical karst geologic features (blue hole, caves, depressions, & solution features) may exist at site; however, surface water concerns & drainage must be addressed [for the lower elevations of Perpall's Tract].

Incorporation of the buildings into the 'unique' greenspace must be encouraged. For effective mitigation of potential stormwater flows toward the North (from the elevated developed areas); retention ponds may be incorporated into an ideal shared greenspace / bike trail area, for use by the neighboring communities & as an urban park / tourist attraction (throughout the lower elevation). Apart from the known hydrological benefit of the land, the rich natural biodiversity of the area must also be taken into careful consideration.

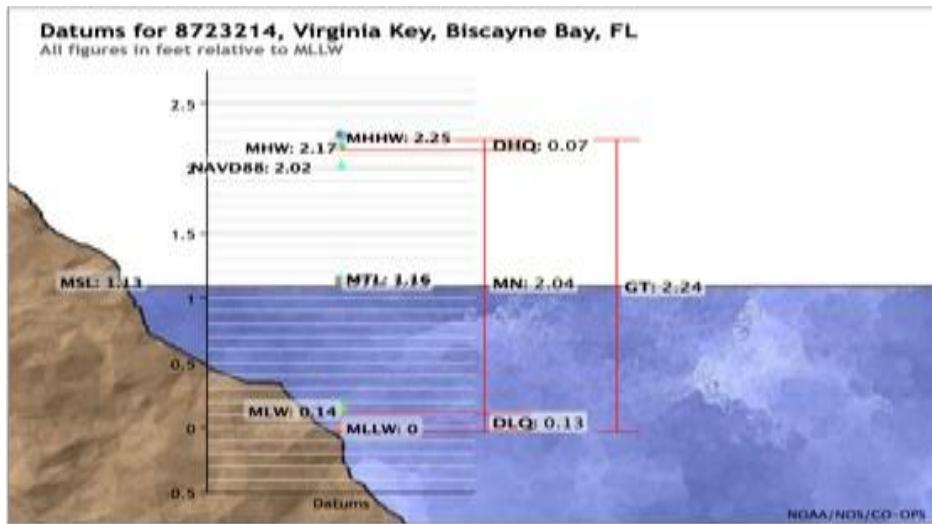
Additional site hydrogeological | water resources assessment(s) must be conducted to evaluate the available information & data achieves, assess the present limits of the freshwater lens, notate the existing conditions (against the historical) for the hydro-geological features, and also determine influences between the landform and the marine environment (groundwater levels vs marine/tidal level trends).

Preliminary Tidal Data: New Providence, Bahamas

A significant rise in the tidal level is possible | expected due to climate change, 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).

NOAA/NOS Mean Sea Level (MSL) is +0.00-Ft (+0.00-m) and Mean Lower-Low Water (MLLW) is - 1.13-Ft (-0.34-m). Tidal level readings / site assessment data can be correlated with the appropriate NOAA/NOS fixed data stations for future site projections, regarding tidal influence | groundwater levels.

See **Figure III.** below for the Datum (MLLW) @ the NOAA/NOS Station #8723214

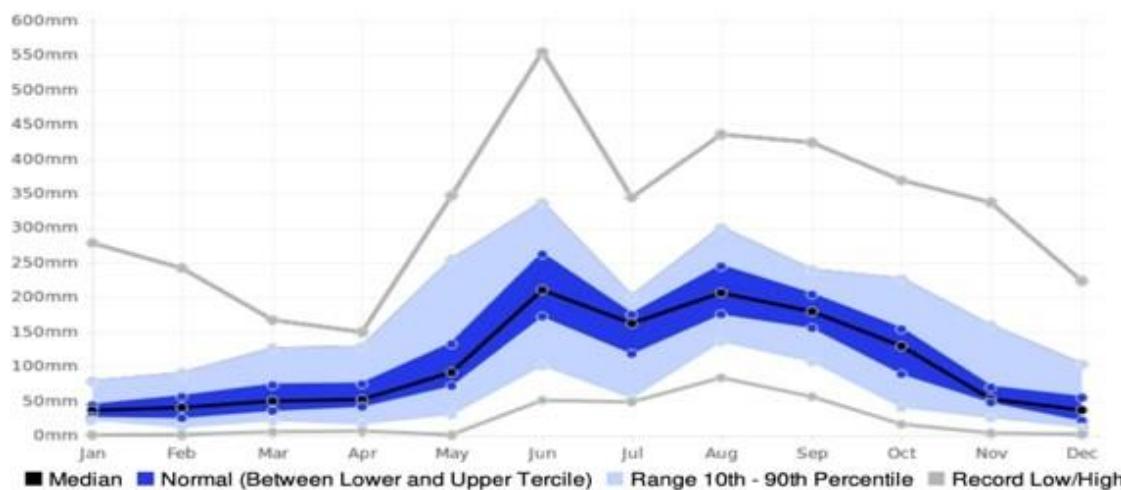


Coastal inundation of seawater by storm surges is a concern for the lower land parcel(s) of the Perpall's Tract Wellfield Area. **Runoff to the lower development from elevated land parcel may increase the flood hazard potential of the adjacent lower land parcels. With the continued development of the elevated portion of lands at the Perpall's Tract Wellfield Area, a water balance analysis for the projected surface water flows from the elevated South to the North shall be necessary.** Any water balance should be based on the long-term rainfall records from the Lynden Pindling International Airport (LPIA), along with coastal tidal surge projections at the lower elevated portions of the land.

See below **Figure IV.** for LPIA Monthly Rainfall [Projections]

LPIA, Bahamas - Monthly Rainfall

(Location: 25.1°N, -77.5°W; Period of record: 1981-2010)



For coastal management & infrastructure planning, the hydrologist may also track trends to understand how sea level and extreme water levels have changed. **The NOAA/NOS MLLW extreme water level trend = +1.04Ft (+0.316-m) in 100-Years, from the Virginia Key, Biscayne Bay, FL Station #873214 Datum [177-miles | 285-km NW of New Providence].**

Water Budget/Balance Assessment Guidance

Assessments to be conducted, utilizing the simplified method of calculations, for a small watershed [Retention Area Design Calculations]:

$$\Delta S = (P + Q_{in}) - ET - Q_{out}$$

where,

- ΔS** is change in water storage (for a lake/pond area)
- P** is precipitation (rainfall)
- Q_{in}** is water flow into the watershed (each lake area being a small watershed)

ET is evapotranspiration (sum of evaporation from soils, surface-water & plants)

Q

out is water from out of the water reserves shed (except

ss flows / lake overtopping to be directed to

National Rainfall Disclaimer [toward Water Balance Predictions] – The rainy season for The Bahamas is from May thru October. Monthly rainfall may increase to 21.85-Inch (555-mm), during the Atlantic Hurricane Season (from June thru November). Source: <https://rcc.cimh.edu.bb/caribbean-climatology/stations/bahamas/lpia-rainfall/>

“The Department of Meteorology in Nassau indicated that 1-1/2 inches of rainfall in six hours or less, typical of summertime, can cause flooding in New Providence.” (USACE Water Resources Assessment, 2004).

Preliminary Marine & Coastal Projections

Per the 2004 USACE Report, “both hurricanes and waves from the Atlantic Ocean, generally during high tide combined with storm surge, generate extreme wave conditions. Flooding and erosion typically occur during these wave conditions. The waves erode protective beaches and dunes and cause surge and flood damage to the adjacent lands, buildings, infrastructure, and groundwater especially significant since eighty percent of the country's land mass is only five feet (1.52-m) above mean sea level and more than 90% of the freshwater resources are within five feet (1.52-m) of the surface.”

CLIMATE VARIATION & SEA LEVEL RISE – PRELIMINARY

Climate variability and change is expected to greatly influence the existing weather and environment of the Bahamas. Problems that may be exacerbated in response to climate variability and change are the frequency and intensity of hurricanes and the potential of rising sea levels. Changes in the position and the distribution of fresh, brackish and saline groundwater is anticipated due to any rising sea level; combined with possible reductions in groundwater recharge from changes in rainfall distribution.

It appears that the sea has been rising at a rate in the order of 6 to 10 inches (152 to 254-mm) per 100- years in the Bahamas, not taking account of possible differences in the rates of uplift or subsidence at these sites. The observations are consistent with the model predictions, and it is generally agreed that the rate of sea level rise in the next century will be 2 to 5 times that in the last 100-years. In the Bahamas, rising sea levels will lead to considerably less fresh groundwater resources, accelerated erosion of coastal shorelines, and the deeper penetration of sea surges inland.

In addition to the general sea level rise predictions; there is also the direct effect to the underlying fresh/brackish/salt water resources, for consideration. One must expect and accommodate for the expansion of the existing wetland and ecological areas, as these water bodies are directly connected to & influenced by the marine conditions.

RECOMMENDED FOR THIS SPECIFIC SITE AREA that wherever possible, the placement of the critical infrastructure be located at the minimum higher elevation (+10 Ft).

Developments within the Perpall's Tract Area should have an approved Lake/Pond component

(Stormwater Retention Areas), for the collection of surface water flows. A simple water balance/budget analysis can be conducted to anticipate required drainage structures that are to be incorporated into the design of the Lake/Pond systems. All hydrological design efforts should be taken to mitigate the 'Potential Flood Hazard' for the lower elevation parcels that exists at Perpall's Tract.

GENERAL ENVIRONMENTAL PROTECTION & MITIGATION MEASURES

This assessment identifies the potential impacts due to the construction | operation of a proposed residential development – for groundwater | hydrology | water resources | wetlands | water quality.

Existing Environmental Hazards

Additional details should be made available in the Project's Environmental Impact Assessment (EIA) | Environmental Management Plan (EMP).

Existing Groundwater Use

Groundwater at site is fresh to brackish (Total Dissolved Solids < 600-mg/L up to 1,500-mg/L Chloride). **For the purposes of the assessment; it is understood that alternative freshwater supplies (a municipal water connection) exist from a desalination source, and shall be available for use.** Further, a wastewater treatment plant (WWTP) **is** required and proposed for the collection | disposal of all sewerage at site. The same has been confirmed with the Water & Sewerage Corporation (the National Regulatory Agency for Water Resources, Water & Sewerage).

Potential Flood Hazard | Mapping

The Lynden Pindling International Airport (LPIA) | Historical Rainfall Dataset for New Providence (NP) is located within 6.21-miles (10-km), to assist with flood predictions/mapping.

Flooding due to excessive rainfall, and/or during the passage of Tropical Storms is a concern for land parcels at the lower elevation of the Perpall's Tract Wellfield Area.

The average recorded rainfall for the area is 54.33-Inches (1,380.2-mm) @ LPIA, with wettest month on average in June = 8.76-Inch (222.6-mm). The wettest 'Year on Record' @ LPIA is 1995: 76.33-Inches (1,938.8-mm), with wettest 3-month period on record (June to August 1997) = 37.03-Inch (940.6-mm). **Source: <https://rcc.cimh.edu.bb/files/2015/09/Bahamas-LPIA-Rainfall.pdf>**

Additional projections should be made available in the Project's EIA | EMP. **Incorporation of retention/detention ponds in the project design is one method to mitigate potential flood hazards for the lower land parcel(s) within the Perpall's Tract Wellfield Area. The development cannot solely depend on standard drainage well structures for storm water controls.**

RECOMMENDATIONS | CONCLUSIONS

The hydrogeological survey involved the confirmation & status of freshwater resources in the vicinity of the project site. Recommendations have been made on minimizing negative impacts to the resources.

- The project site previously/presently has a blend of terrestrial vegetation of Zone-1 (Pine Forest) to Zone-2 (Broad Leaf Vegetation), and wetland features that benefit the freshwater resources. Specific effects of the development to the existing vegetation are to be detailed within the EIA | EMP. **A considerable vegetative cover is encouraged &**

expected to be maintained in the post development phase, for both the Specialty Hospital Project Site & Premier Estates-I Subdivision. For the existing Adastra Gardens #3 (upper SE housing subdivision), all the native vegetation has been removed; which previously would have assisted in surface flow retention.

- The groundwater lens configuration in the vicinity of the project site is best described as fresh to brackish water. Groundwater flow is from South to North, and the additional surface flows are naturally directed north. Alternative water sources are also available for connection throughout the area. It is recommended that the disposal of all sewerage be by way of a centralized wastewater treatment plant. Per the Bahamas Professional Engineer's Act of 2004, a Bahamian Engineer-Of-Record (EOR) shall be required for the design of the water & sanitation systems.
- The Premier Estates-I project area is within an existing water resources area, so both the groundwater & any surface water features are linked and functioning as a continuous hydrologic system. An 'environmental conscious' site development (with eco-friendly designed with mitigation measures), would not be expected to have an adverse impact to the water resources. **Based on the lower elevation land use, the impact of the project on the groundwater resources is determined to be HIGH | LONG TERM.** Wherever possible, the placement of the critical infrastructure is to be located at the minimum higher elevation (+10 Ft).
- A 'Potential Flood Hazard' for the low elevation parcels exists at Perpall's Tract: The Lynden Pindling International Airport (LPIA) | Historical Rainfall Dataset for New Providence (NP) is located within 6.21-mile (10-km), in support of flood prediction data. **Flooding due to excessive rainfall, and/or during the passage of Tropical Storms is a concern for the lower land parcel(s) of the 'Perpall's Tract Wellfield Area'.** Development of areas to the north further exacerbates surface runoffs, and potential flooding to the south. **An optional mitigation mechanism for the potential flood hazard is to utilize retention lakes/ponds for storage of runoff flows, and to alleviate potential flood conditions from the elevated parcels of land (like the 'Adastral Gardens #3' Area).**
- **Storm surge effect to the 'Premier Estates-I Subdivision' is HIGH | LONG TERM.** It is generically recommended that all key utility infrastructures be set at +30-Ft (+9.14-m) mean-sea- level (MSL). This shall not be possible, and additional hydrological data reviews shall be required for the general area: (1.) Groundwater level trends, (2.) Pump test | flow interpretations, and (3.) Projected Storm Surge Models.
- [The NOAA/NOS MLLW extreme water level trend = +1.04Ft \(+0.316-m\) in 100-Years @ Virginia Key, Biscayne Bay, FL Station #873214 \[177-miles | 285-km NW of New Providence\]](#). The proposed 'Premier Estates-I Subdivision' site is North of a ridge system, and a potential flood hazard exists for these land parcels.
- Additional hydrological assessments are required for the development – to include suggested retention pond design, and the requirements for all drainage structures (like under road pipe culverts, & special drainage wells to accompany each retention area). Further suggested that a pre-clearing of any land / pre-construction hydrological area assessment be conducted thru the responsible regulatory body, for the required purpose

of closing out the long-term water resources data set(s). A photo documentation of the historic trench systems should also be conducted.

- All hydrological design efforts should be taken to mitigate the 'Potential Flood Hazard' for the lower elevation parcels that exists at Perpall's Tract.
- While the area may no longer be appropriate for water production, the potential development of the 'none legislated & unprotected' national water resource areas remain a concern.

REFERENCES

AEES Consultant Report, CHEC North Abaco Port Tidal Gauge Hydrological Assessment Report (April/May-2016).

AEES Consultant Report(s) - Environmental & Hydrological Project Reports | Files - Varied project sites and developments within the Western District of New Providence (2017 thru 2020).

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**PERPALL'S TRACT WELLFIELD AREA HISTORICAL INFO/DATA
SET – HYDROLOGY**

WATER RESOURCE AREAS ON NEW PROVIDENCE

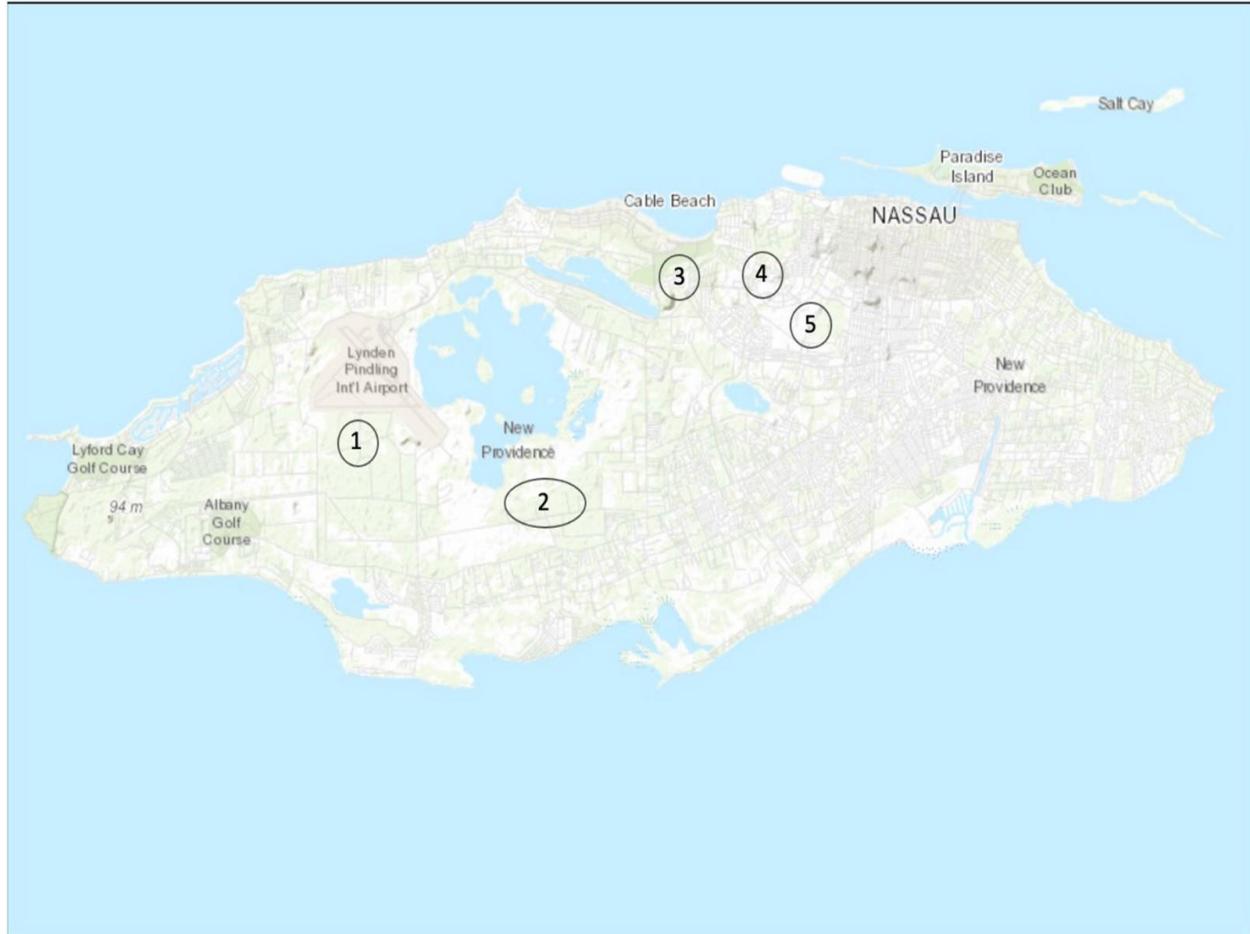
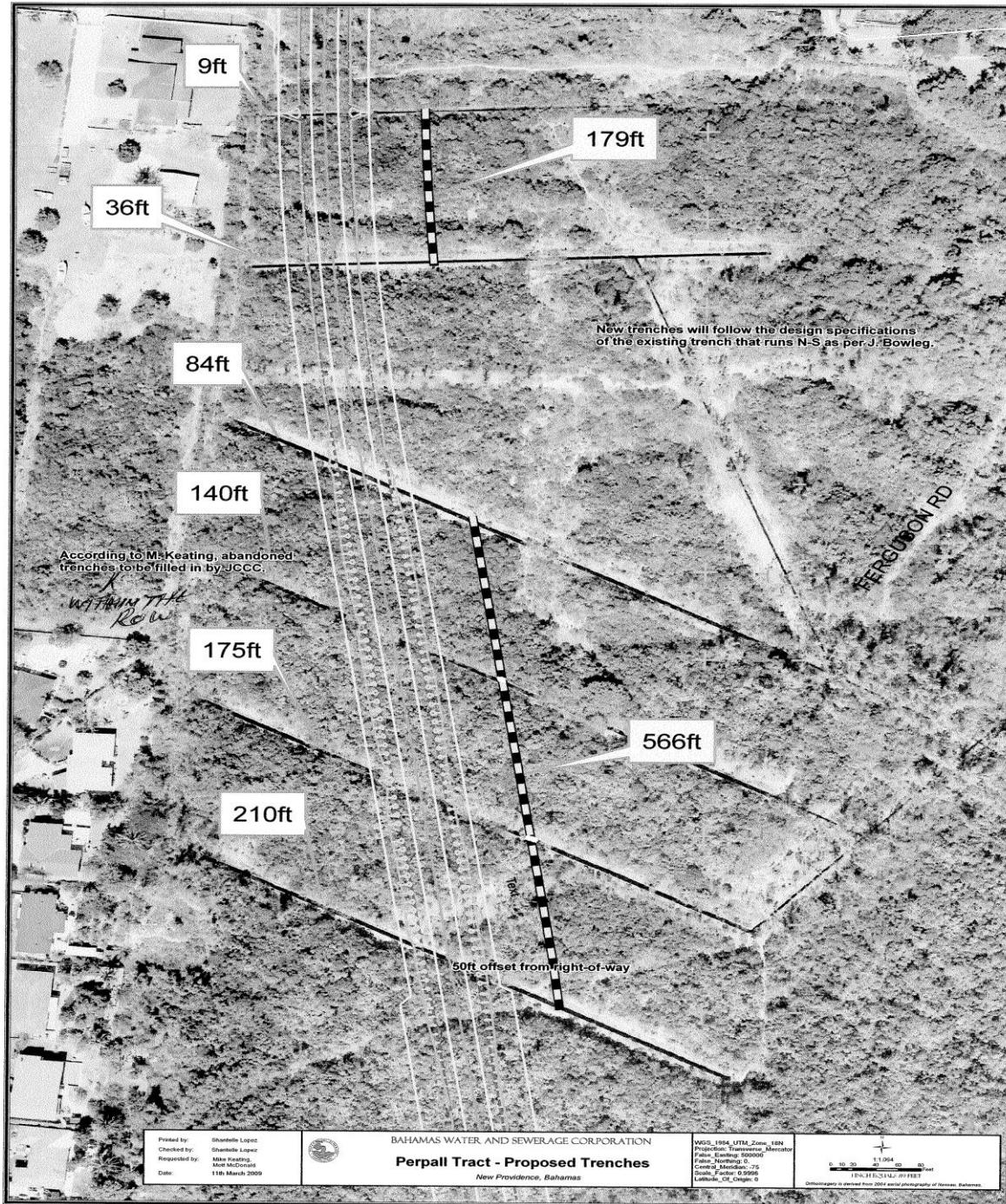


FIGURE 2

General locations of the five major wellfields in New Providence that have served as sources for public water distributed by the government. The wellfields include (1) Windsor Wellfield, (2) Southwest Waterworks, (3) Prospect Waterworks, (4) Perpalls Waterworks, and (5) Blue Hills Waterworks.

Source: Frontiers | Frontiers in Water Publication, Community Case Study, Intervention and solutions for water supply on small islands: The case of New Providence, The Bahamas (Welch | Bowleg, 2022), DOI: 10.3389/frwa.2022.983167

PERPALL'S TRACT WEST – PROPOSED REPLACEMENT TRENCHES (2009)



Source: Water & Sewerage Corporation, Water Resources Management Unit (WRMU) - 2009

PERPALL'S TRACT AREA – ARTICLE ON DEVELOPMENT CONSULT (2024)

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EDITOR, The Tribune

The Protection of Pepple was established by legislation in April around 1971 and during the period 1937-1942 140,442 or 212 acres of land was used for the welfare of the government by eminent domain. It was not until 1973 that the 19,700 due to the government with the use of the land was given to the people. The 19,700 was given to the people of New Providence, who were experiencing a scarcity of potable water and the water was barged in from Andros for several years. In the meantime, the people of New Providence were given the 19,700 acres of land to live on and farm.

In 1994 when BASH moved its drug racing facility to Chippingham, I was exposed to this amazing spiritual experience.

If you find a tree in a forest, will you know where it was tucked in on a corner of an island where only the youth in the immediate areas knew about it; there were no roadways around it and there was no way to get to it.

In 2004 a Rapid Vegetation Assessment conducted by Ethel Field PhD, found more than 150 species of native plants and more than 50 traditional medicinal plants in the forest. This natural forest was the first to be protected in the world and was the first to be protected under the first ever visionary eco-tourism plan (EARTH Village Ecotourism). With a small investment of less than \$5M, Earth Village Ecotourism would have created 1000 jobs, attract 100,000 tourists per year, and located just 15 minutes from Prince George Cruise port, this venture had (and still has) the potential to employ more than 500 workers and attract more than 10 percent of these cruise passengers who stay on the island. This would have been a win-win situation for the people of New Providence and the forest for not only its economic viability, then as least for its economic viability.

It is now with the people of New Providence that the government has finally reluctantly drafted a white paper for the protection of Pepple's, which we presented to the government.

To date the protection of Pepple's is mentioned in at least three pieces of legislation.

2001 Pepple's tract Pepple

2010 Pepple's tract Pepple

MPA Gazette 2021

The questions are:

Was an Environment Impact Assessment done?

If so, by whom and is this assessment accessible to the general public?

Has the government assessed all of the legal maneuverings necessary to discard and overthrow existing Pepple's Protection mechanism?

Did they consult those special interest groups who were the drivers behind the protection process? If they did, did they do so in a transparent and accountable manner? If not, why not?

Sadly, even the news media has missed the critical point in their addiction to sensationalism and short, pointed headlines. This argument is not just about the utilization of 50 acres of this protected forest for the hospital and the 1000 acre sub-division, but also the 14,000 acres of land that were the original 212 acres for the hospital and for a new sub-division. Is it perplexing that with all of the less space available, the people of New Providence, that the government insists on demolishing such a valuable ecosystem?

To the good Minister of State for the Environment I say this, and I'm sure you will agree. There are several ways to protect Pepple's, but the one that is best is to leave it alone.

We hear about it from someone else.

We read about it; or

We experience it.

What about the people of the official organ, I will ask the minister, did you hear about this forest, did you read about it, or did you experience it, because if you experienced it, and if you have ANY love or appreciation for the natural environment, knowledge, you would know, like those of us who know, that this was a gifted gift and it MUST be preserved.

I will say this unequivocally, you sir and your administration, are presiding over the destruction of THE MOST BEAUTIFUL FOREST IN THE COUNTRY. This forest is the last remaining forest in the country, the most diverse "natural native flora garden" in the country, with more than 15 of the plant native to Barbados.

What happens to us in these situations is that the people who are in place to oversee the protection of these spaces either fall silent during the discussion, they put their heads in the sand and hum human nature.

The cold fact is that, the fifty thousand trees in this forest that absorb thousands of tons of carbon gases from our atmosphere and turn them into breathable oxygen will be gone forever, and successive generations of Barbadians will be left with a lack of rainfall, disappearing indigenous bird medicines, and increasing heat in the city.

It is time to take action.

New Providence

September 19, 2024.

Comments

[View all 10 comments](#)

Mr. Miller is absolutely correct.

[Reply to my reply](#)

Mr. Miller, take to the airwaves, get the environmental people involved. Go online with a petition against the destruction of this vital ecosystem. Your vision of Earth Village must not end with the destruction of Pepple's. Let's work together to make Barbados a better place to become. An ecological green peace full area for the many thousands of tourists who looking for natural beauty and a healthy environment. Let's work together to protect the natural environment. Bahamian native wildlife including snakes and flamingos. Continue your fight to save this area. Lets hope the PLP destruction plan do not take place in the next two years, for this one reason they should be kicked out.

[Reply to my reply](#)

I believe an environmental impact was done if one note should be done. Sonds

and reports were same to be on the same page, there is a man who says this property belongs to him

[Reply to my reply](#)

Government doesn't care about the environment, apart from making the other countries pay them. They only care about staying in power. So we be able to show they break ground on a new hospital, but they will say they are very good and with the use of the land, they will have a hospital within 5 years. They will say they have a plan, but they have a special drive here and there. But until they don't care. They would build this on the port if they thought it would win an election.

[Reply to my reply](#)

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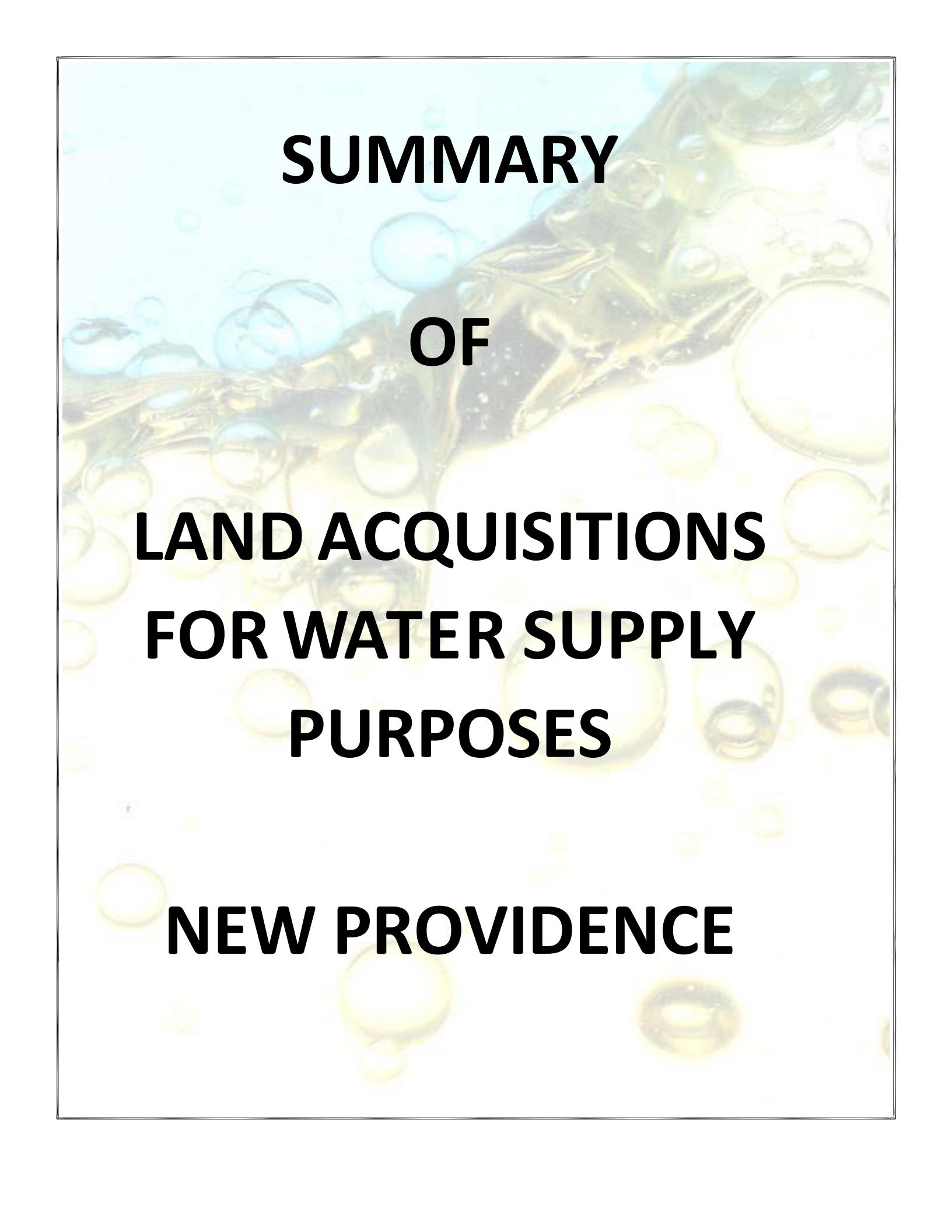
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SUMMARY OF LAND ACQUISITIONS FOR WATER SUPPLY PURPOSES

NEW PROVIDENCE

PERPALLS WATERWORKS

Perpalls Wellfield, an area of approximately 212 acres, was developed in March 1943 to supply water for the Military (Fighting) Forces. The water supply unit comprises 231 boreholes of various sizes, 2 monitor wells, and 33 abstraction trenches. The wellfield is located in an urbanized area of New Providence with private housing districts bordering the western, eastern, and southern boundaries. A garage depot and work- shop of BATELCO is located at the northern boundary of the wellfield.

During January 1991, the W&SC filed Writ of Summons against the “Morris Brothers” for trespassing and damaging the Corporation’s land at Perpalls (southwestern and northwestern portions). The “Morris Brothers” claimed that they were the lawful owners of Perpalls wellfield. The W&SC presented evidence showing the entire chronology of the acquisition of Perpalls by the Government under the Acquisition of Land Act. The legal battle spanned three (3) years until in January 1994, the case was awarded to the Water and Sewerage Corporation.

The land issues with regards to Perpalls will not go away. The proposed scheme to convert this wellfield to full gravity system was never completed. Only a small acreage of the wellfield is being utilized at present. The water quality has deteriorated in recent times due to saline intrusion of sea water during the Hurricanes of the 1999/2000 period. Heavy uncontrolled vegetation is widespread. Wellfield is rather run down with easy access (via foot) by the public due to its proximity to the urban areas on all side. This creates problems of security and vandalism. Fencing the boundary of the wellfield would help to eliminate the fears of well- field operators and technicians who carry out routine repairs and maintenance works in Perpalls. Pollution from garbage and cesspits poses threat to water quality in the wellfield. The land value is considered to be very high due to its prominent location.

Table 4 below shows the listing of the declaration of vesting in respect of land purchases at Perpalls for wa- ter supply purposes. An aerial view of the wellfield is shown on **Map 4**.

Table 4. Listing of Vesting Declaration for Perpalls Wellfield

R. G. No.	Vesting Document No. (Treasury)	Description	Date of Vesting	Purchase Price	Dimensions	Remarks
New Series Vol. 52 Pg. 474 to 477	1394	Declaration of Vesting under The Acquisition of Land Act for Perpalls Wellfield .	Feb. 14th, 1957	Not available as there were numerous claimants during the period 1942—1957	212 acres (surveyed as 203 acres in early 90's.)	Schedule described in the Official Gazette No. 15, Feb. 2nd., 1957

MAP 4. Plan of Perpalls Waterworks (2003)



E G Moss

BHA/74/004

TECHNICAL REPORT 1

GROUNDWATER STUDIES IN
NEW PROVIDENCE)

BAHAMAS



THE PRESENT STATUS AND FUTURE POTENTIAL Of Government Wellfields

O

UNITED NATIONS
DEVELOPMENT
PROGRAMME
OFFICE OF

TECHNICAL
COOPERATION
NEW YORK 1977

PERPALLS WELLFIELD

UN SURVEY DATE: December, 1975.

DEVELOPMENT TYPE: 220 boreholes, 13,000 ft trench.

AREA DEVELOPED: 210 Acre, SAFE YIELD 124,000 gallons/d.

MAXIMUM POTENTIAL AREA: 210 acres.

1975 PRODUCTION: estimated at 186,000 gallons/day.

PIPEWORK: galvanised iron.

PUMPS: Electric ~~and~~ ~~rotating~~.

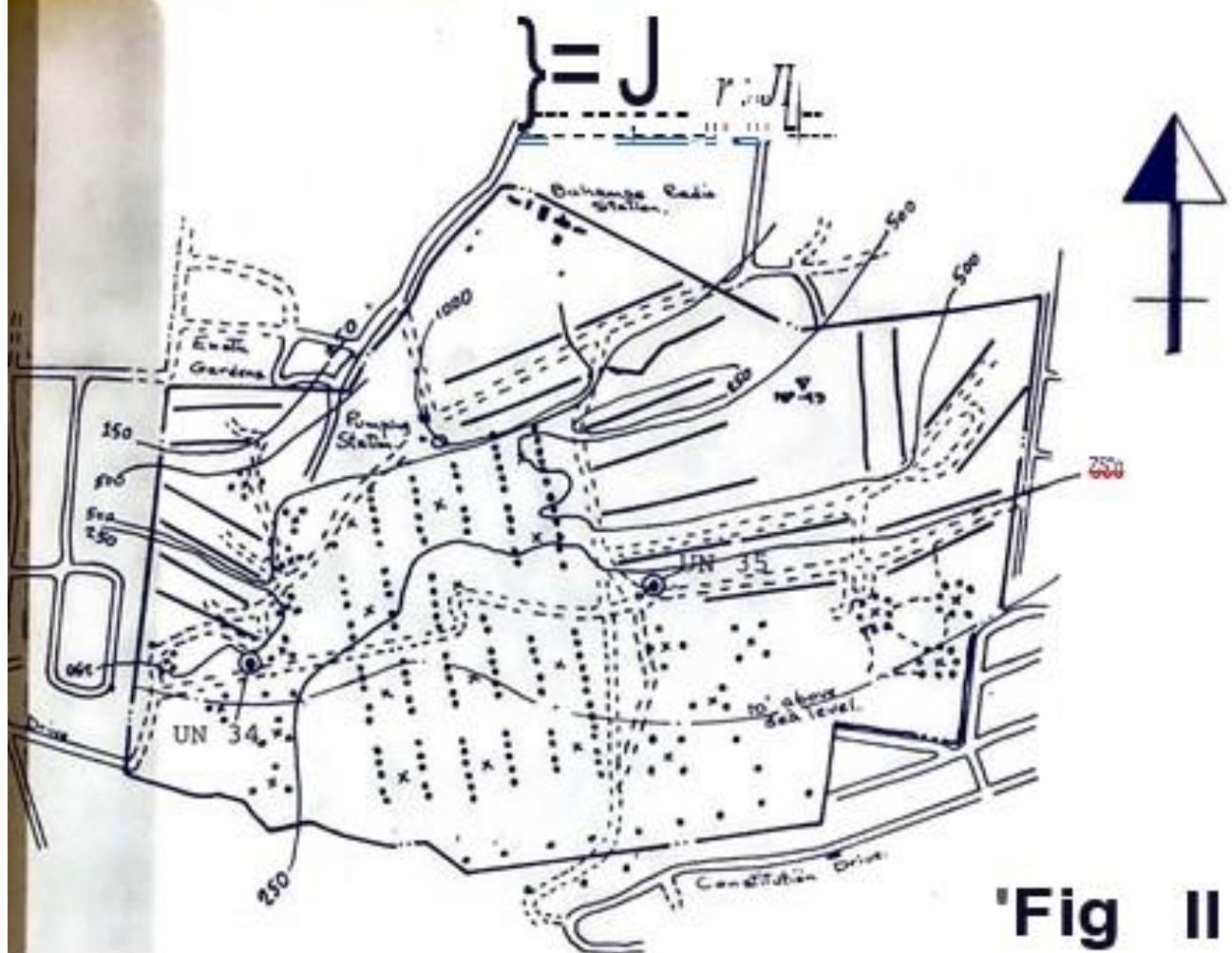
ELEVATION 65% is below 7 ft AMSL.

a. Boreholes

A variety of spiders and single wells (Figure 11) make up the 220 boreholes of which only about half were being pumped. The a are 14 spiders, each nominally having 12 ~~thirty~~ two inch wells. In addition, when the wellfield was first installed, there were 10 spiders each having 3 wells of small diameter, ~~operated~~ by one windmill, and on the high ground to the south, a further 12 or so individual wells, also windmill pumped. These twelve are now abandoned. Small subsequent additions were three spiders of 8 twenty-two inch wells, and a number of three, four and eight inch well spiders. All except 5", 6" and 8" wells have 9" high concrete curbs at the wellhead. About 25% of the smaller diameter holes are cased with steel: the balance and all 22" holes are unlined. Though individual groups of spiders are well laid out, the wellfield was progressively added to since it was first begun in 1943, and the final layout is rather ~~hazardous~~. About 40% of wells are insufficiently deep, and a further 24% are inaccessible, either due to heavy bush growth, or to the presence over the hole of old derelict pumps. Only a few wells that were accessible are too deep. Heavy uncontrolled vegetation is very common.

b. Trenches

22 trenches average 590' length: they are 3' wide, in good structural condition, and are more than



PERPALLS WELLFIELD

SCALE 1:10,000

KEY

- Telephone
- Land Boundary
- 250- C. above Sea level
- Test Well

300', apart. A 12" high concrete curb surrounds each trench. Most of them are hooked up to a pump in pairs, and the work is underground. Some 3 or 4 trenches contain P7Fped garbage in considerable amounts, including abandoned electrical appliances, bottles, rags and cans. A few also contain substantial algae.

c. Salinity Problems

Gross salinity has been steadily rising (see Figure 12) from which the following table is extracted.

TABLE 11

Perpalls Wellfield - Salinity Record

Salinity	Presumed Mean Daily				
	Average	Annual	mo:l Chloride	Pumpage Imp. Galls. 000's	
			max. min.		
1969	380		640	130	220
1970	440		710	170	265
1971	380		480	260	200
1972	450		520	360	200
1973*	520		700	280	185
1974	580		690	430	180
1975	610		770	400	182
1976	595		870	520	191

* Above average rainfall

In 1975, the main salinity rose above 600 mg/l for the first time, a sign of danger, and a clear indication of overpumping, mainly of 15 of the 22 trenches. As there is no separate meter, pumping was obtained by difference from the Combined Perpalls - Prospect production into Prospect Pumping Station, and there is some room for doubt. On the whole, considering the fairly restricted area being pumped (about 140 out of 210 acres) it is surprising that salinities are not higher: due to rather high horizontal rather than vertical (see (e) below) permeability water may be drawn from an area substantially larger than is apparent from the map. Individual pumping rates and etc. do not appear to be a problem in this wellfield, which on the whole has only a minor salinity problem compared with others. However, the maximum and minimum values of Table 5 are showing persistent

increase to dangerously high levels.

tens Data

TWO test boreholes were drilled to establish lens thickness, as follows:

TABLE 12
TEST WELLS - PERPALLS WELLFIELD

<u>Borehole No.</u>	<u>Depth ft.</u>	<u>Static Water Level</u>	<u>Lens lb.</u>	<u>Hard Crust Depth ft.</u>	<u>Specific Capacity at 20' +</u>
UN 34	38	10	26	35 - 38 +	6.67
UN 35	35	8	27	30 - 35 +	12.5

Both boreholes showed a healthy undisturbed lens of 26 - 27 ft, with a probable thickening ~~westwards~~ and thinning to north and south.

e. Hydrogeology

Geological mapping has shown the rocks underlying the area to be of very shallow marine origin, well bedded, moderate to poorly cemented ~~pelletty~~ and shelly rocks. They probably pass down into more muddy but permeable rocks of lagoonal origin. Groundwater movement is at least partly limited by the higher horizontal than vertical permeabilities arising from differing grain sizes and cementation between beds. Near surface rocks are tight but not especially impermeable, and a surface crust is uncommon, enabling ~~rapie~~ recharge where vegetation is thin. At depth, specific ~~capacities~~ of pump tests reveal quite high permeability. Hard crystalline rocks occur at 30-35' depth and appear to control the lens thickness.

f. Present Status of Wellfield

On the whole this wellfield is rather run down, even though its apparent production ranks ahead of Prospect, Blue Hills, Flamingo and Windmills wellfields. Nominally, about half the boreholes and all trenches were producing water at ~~time~~ of survey. The closeness of urban areas on east, west and now growing on the south, has tended to subdue water development interest. However, there is little sign of over-drawn effects resulting from private abstraction around the

periphery, though it is not known to what extent the rocks filter out the bacteria from cesspits, etc. A considerable problem is garbage dumped in the wellfield. There are four road entrances, all ungated, and a few dozen bush tracks entering the wellfield. The closing of all but the northern road entrance would result in an immediate reduction in abandoned vehicles, industrial, and domestic garbage.

One feature of interest is that the wide diameter of the majority of bores and trenches probably allows a higher safe pumping rate than would otherwise be possible. A further point is that this is the only wellfield in which pumps are placed in a masonry pump house.

From the pumping figures and salinity results, there is no clear indication that the reticulation is partly blocked; the lack of flow gauges in the wellfields prevents detection of major leaks, uneven pumping of wells and any other monitoring. It is difficult therefore to fully assess the status of the wellfield, except to say that considerable overpumping of the trenches is occurring.

g. Conclusions and Recommendations

- i) There are no EXTENSION possibilities; the main aim should be to fully utilise the existing area.
- ii) The BASIC DESIGN of the wellfield is unsound in that there are far too many boreholes for the area, and too dense a trench network. An optimal number would be 30 - 40 boreholes and 7,000 - 10,000 ft trench. This means scrapping 80 or so existing bores and 5,500 - 8,500 ft trench.
- iii) In MAINTENANCE, the vicinity of all wells should have bush cleared to a distance of 20'. The wells to be retained should be inspected for depth and deepened as necessary. All wells to be abandoned should be backfilled.

- iv) With a cut off level of 600 ~~mg/l~~ a SAFE YIELD in the order of 120,000 - 140, "galls/day is recommended.
- v) The DRILLING of about 10 new bores and the clean out of a further 20 is recommended. The rehabilitation would result in a slight decrease of production, but salinity is likely to fall somewhat.
- vi) ACCESS - close up all road entrances and discourage the public from entering the wellfield. If this wellfield is to remain in production, this recommendation is important. If access is not restricted, damaging pollution is certain to occur.
- vii) In MONITORING the rehabilitation should make provision for introduction of gauges and taps on each pump, and the entire wellfield production should be gauged.

Appendix C: Stormwater Management Plan

INTRODUCTION

In support of the rezoning and environmental applications for the proposed development, a Stormwater Management Plan for the proposed Subdivision Project is proposed below, and should be read in concert with **Appendix D** (Civil Design – Drainage) below.

The purpose of the Storm Water Management Plan is

- The protection of development and public interests
- The preservation of the natural environment
- The preservation of the existing stream, wetlands and drainage lines
- The management of the expected increase of surface runoff into natural drainage areas
- Protection of underground resources and water quality
- Conservation of water and making it available to the public
- The desire to provide optimum methods of controlling runoff
- Striving for a sustainable environment while pursuing economic development

EXISTING SYSTEM

Presently, the area proposed for the subdivision development existing land use is that of a natural Dry Broadleaf Forest ecosystem, and the site specific for the subdivision is rezoned residential by the Department of Physical Planning. Historically, the lands were disturbed (human altered) and used as wellfields and later developed naturally into a dry broadleaf evergreen forest.

PROPOSED SYSTEM



Figure – A: Proposed Swale System concept for Premier Estates I Subdivision.

a. Overview

The proposed storm water swale system must be designed to have minimal impact on the under ground fresh water resources, through the careful implementation of sustainable drainage systems (SuDS) and stormwater management systems.

The transformation of the undeveloped land to hardened surfaces increases the surface runoff from the transformed areas, which reduces the infiltration of surface water into the underground resources. All stormwater-related structures, pipes, and drains must be designed by the project engineer in consultation with the project Environmental Monitor for the project.

This can be achieved through stormwater management systems, namely:

- The construction of stormwater catchpits and pipes along the hardened road areas
- The development of swale systems in order to direct flow of water into catchment systems.
- Constant monitoring during all phases of the project to ensure compliance.

b. Erosion Control

The design of the storm water system must make provision for erosion protection, as the transformed area, after construction has a greater surface run-off that will contribute to higher flows. It is therefore essential that the transformed areas must be vegetated and rehabilitated as soon as possible after the completion of bulk earthworks, roadworks and foundation work. Erosion control measures could be a combination of attenuation ponds, grass sods, stone pitching, silt traps, geofabrics, gabion baskets and mattresses, energy dissipaters and grass lined drains.

Additional methods to minimize erosion within the development area include:

- Open exposed areas should be planted with grass or landscaped into gardens.
- Using natural rock and boulders to act as energy dissipaters.
- Reducing the velocity of all stormwater run-off through energy dissipaters
- Promotion of infiltration of surface run-off.

Surface run-off

Run-off from roofs should be collected in gutters and stored in rainwater tanks for the utilization of gardening and other domestic activities. Any overflow from the tanks or gutters will be dispersed into swales and thereafter directed and collected into attenuation ponds. Surface run-off from roads, parking areas and other hardened areas will be collected in kerb and channels along the roads and diverted into the two strategically positioned stormwater attenuation ponds.

The stormwater system must be kept separate from the sewage system and any contamination of surface runoff must be avoided.

INTERNAL ROADS AND PARKING AREAS

A site development plan has been produced by the architect and environmentalist, showing the various residential sites and road reserves in relation to the land development area. The hardened surface areas from the roads, house roofs and other buildings are the main contributing factors in the increased run-off within the development. Where possible, grass blocks and rain gardens should be introduced along roads and in parking areas to promote infiltration of storm water run-off.

The geometric design of the internal road network will include crossfalls that direct the run-off along kerbs into grid inlets and catchpits. Once collected, stormwater will be conveyed through underground concrete pipes, with an outlet into the respective stormwater drainage system. Methods of dissipating the kinetic energy of run-off and silt collection will be incorporated into the design of stormwater infrastructure serving the road network.

For sizing and design of storm water infrastructure, calculation of the anticipated storm water run-off will be determined on the assumption that all roofed areas, roads and parking are considered hardened with an appropriate run-off coefficient.

STORMWATER MANAGEMENT

The objective of a storm water management plan should be to manage the storm water resources of the collective watersheds to:

- Prevent flood damage or concentration of run-off
- Divert storm water and surface run-off from buildings, roads and parking areas into rainwater harvesting tanks, swales or a piped system
- Preserve and enhance storm water quality
- Attenuate the difference between pre and post development flows

The proposed storm water management system has been designed to be self-regulating with no external control. It will aim to collect run-off into rainwater harvesting tank, swales, underground pipes with an attenuation pond to attenuate and manage the increase in flow between the pre and post development stages from the transformed areas.

The run-off from the roofs, gutters and downpipes shall be collected in rainwater harvesting tanks taking into account any overflows being dispersed overland into swales and ultimately collected into underground stormwater systems. Hardened areas, like roads and parking areas will be routed overland, collected in curbs and channels and into grid inlets or catchpits where it is collected in concrete stormwater pipes and diverted into catchment systems

STORMWATER RUNOFF

Current storm water runoff volumes are based on the following information and assumptions:

Site Development Plan provided by the architect and engineers

Internal roads areas calculated from layout

The use of grid inlets and storm water pipe network to collect, transport and divert run-off into the drainage system

STORMWATER FLOW ATTENUATION

The need for attenuation of the storm water flow is recognized in order to minimize the peak flow across the property and from each of the buildings, hardened parking areas and roads before its eventual discharge.

The distribution of the increase flow is of importance to ensure that any downstream facility is not negatively affected.

The proposed development will be transformed from the existing dry broadleaf evergreen forest which is gradually sloped profile to levelled platforms. This transformation in ground profile will reduce the velocity as the new platforms will be flatter than the original ground profile. However, it's the transformation of natural vegetation to grass embankments, buildings, roads and parking areas that will increase the run-off and storm water flow. It is due to this increase from the pre-development flow to the post-development flow that attenuation of this increased run-off would be required.

MONITORING AND MAINTENANCE

a. Monitoring

The storm water system must be monitored during construction at regular intervals by the Environmental monitor. It is also critically important that the site is fenced off prior to construction, to ensure that the area outside the site development area remains in its natural condition during the construction process.

During the construction phase of the development, the construction process should be monitored and the Environment Management Plan should pay attention to the following aspects:

- Implementing temporary attenuation measures, such as earth berms to retain surface run-off until the attenuation areas are complete and functional.
- Providing a silt screen at all grid inlets to collect debris and silt during times of heavy rain.
- Controlling dust, especially during the construction of roads and house platforms.
- Placing topsoil and grass sods onto cut/fill embankments to reduce runoff and velocity, where embankments are steep.
- Planting of grass and other vegetation as soon as open areas are complete to prevent scouring and erosion of the low cohesion soils found on site.
- Fencing off the construction area and keeping all construction vehicles off the undeveloped portions of vegetation and buffer areas.

The post development monitoring process should be done at regular intervals (suggested 6 monthly) to include the following activities:

Product (catchpits, headwalls, concrete pipes, and rainwater harvesting tanks)

Type of maintenance (rehabilitation, improvement, new)

Urgency (immediate, next 6 months, next 12 months) and description of work to be carried out

b. Operation and Maintenance

The system as designed requires no manual operation, and is self-regulating. Maintenance work should be undertaken as required to restore and maintain the system to its original design, especially to repair and maintain scouring and erosion, especially at the outlets from the stormwater attenuation ponds.

During the construction period, it is important that surface runoff is monitored, controlled and temporary measures be implemented until the construction is complete and the system can function independently. This is therefore an important aspect to be monitored during the construction stage.

Routine maintenance will be the responsibility of the Department of Housing and should include:

Clearing of kerb and channels, catchpits, stormwater pipes and attenuation ponds

Removal of silt from collection points and attenuation pond

Plant/weed control

Cutting grass on embankments

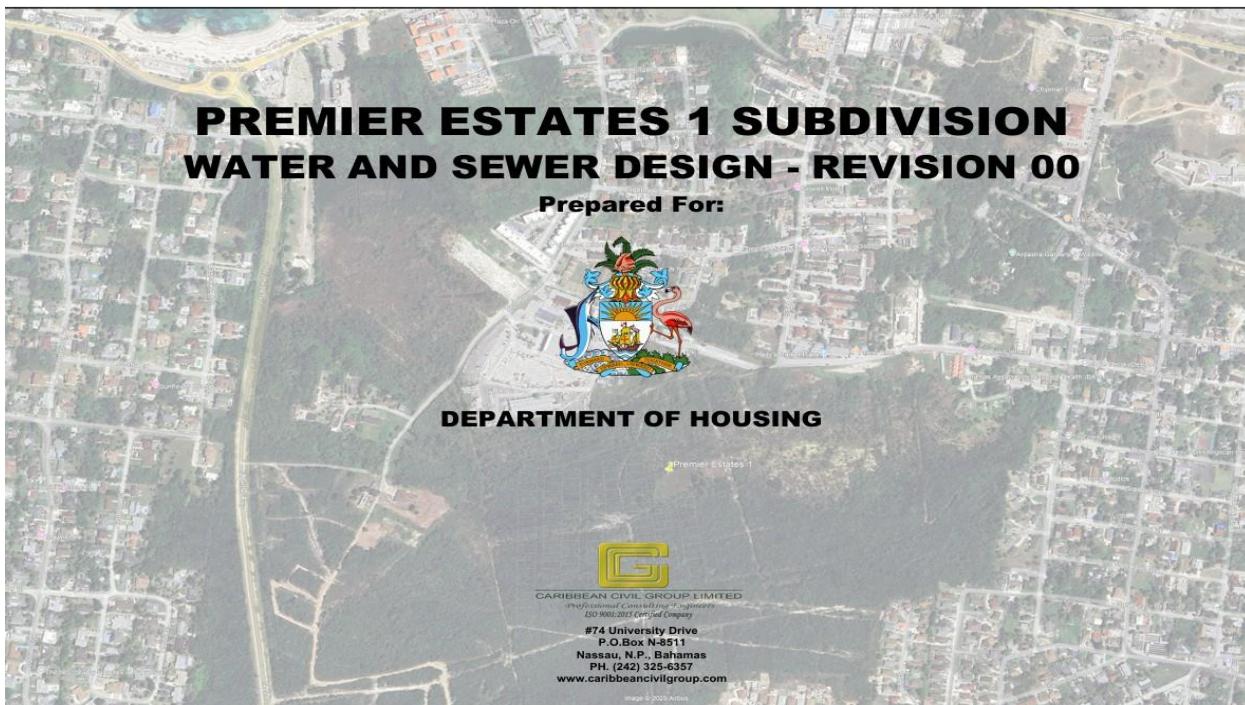
It is however recommended that specialist service providers implement more technical works like the replacement of storm water pipes and remedial work to the stormwater attenuation ponds, if required.

RECOMMENDATIONS

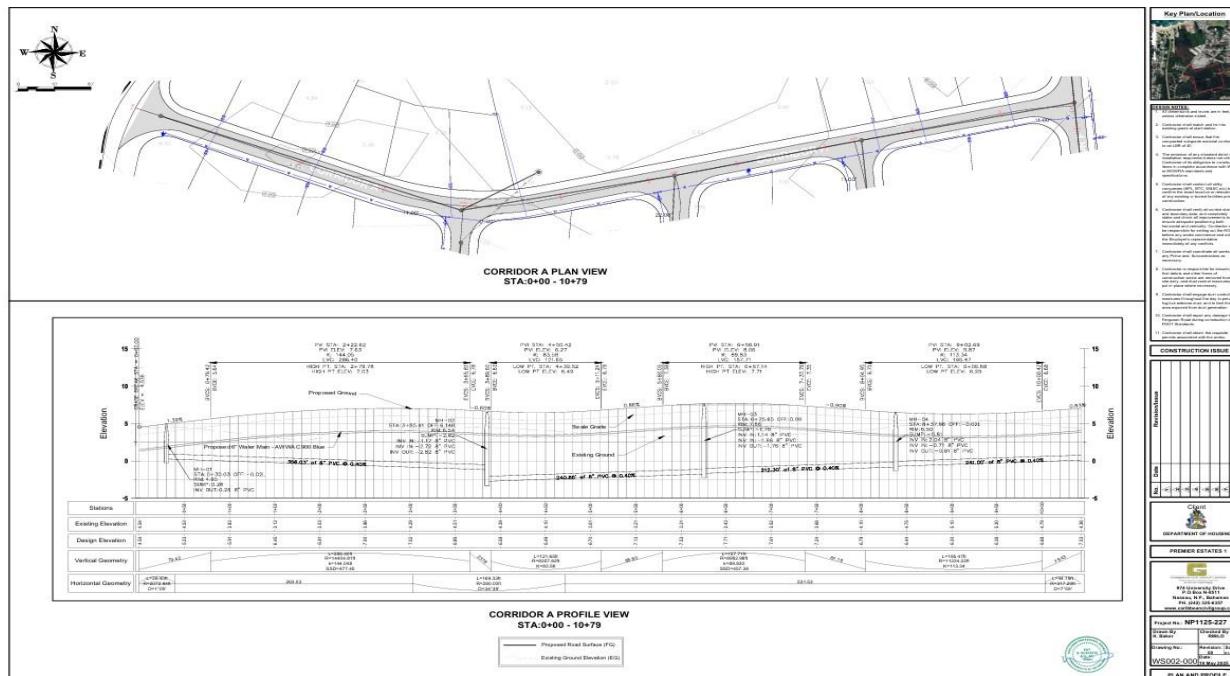
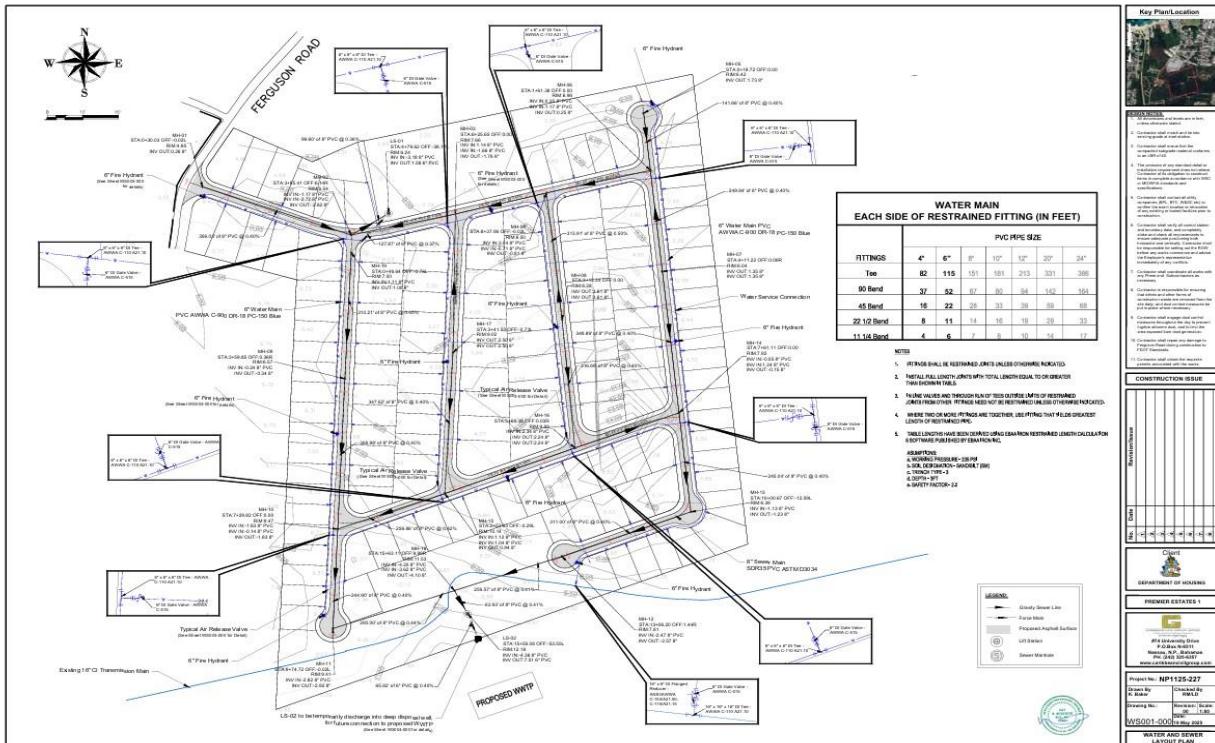
The following recommendations are made for the proposed development situated in the Premier Estates I subdivision:

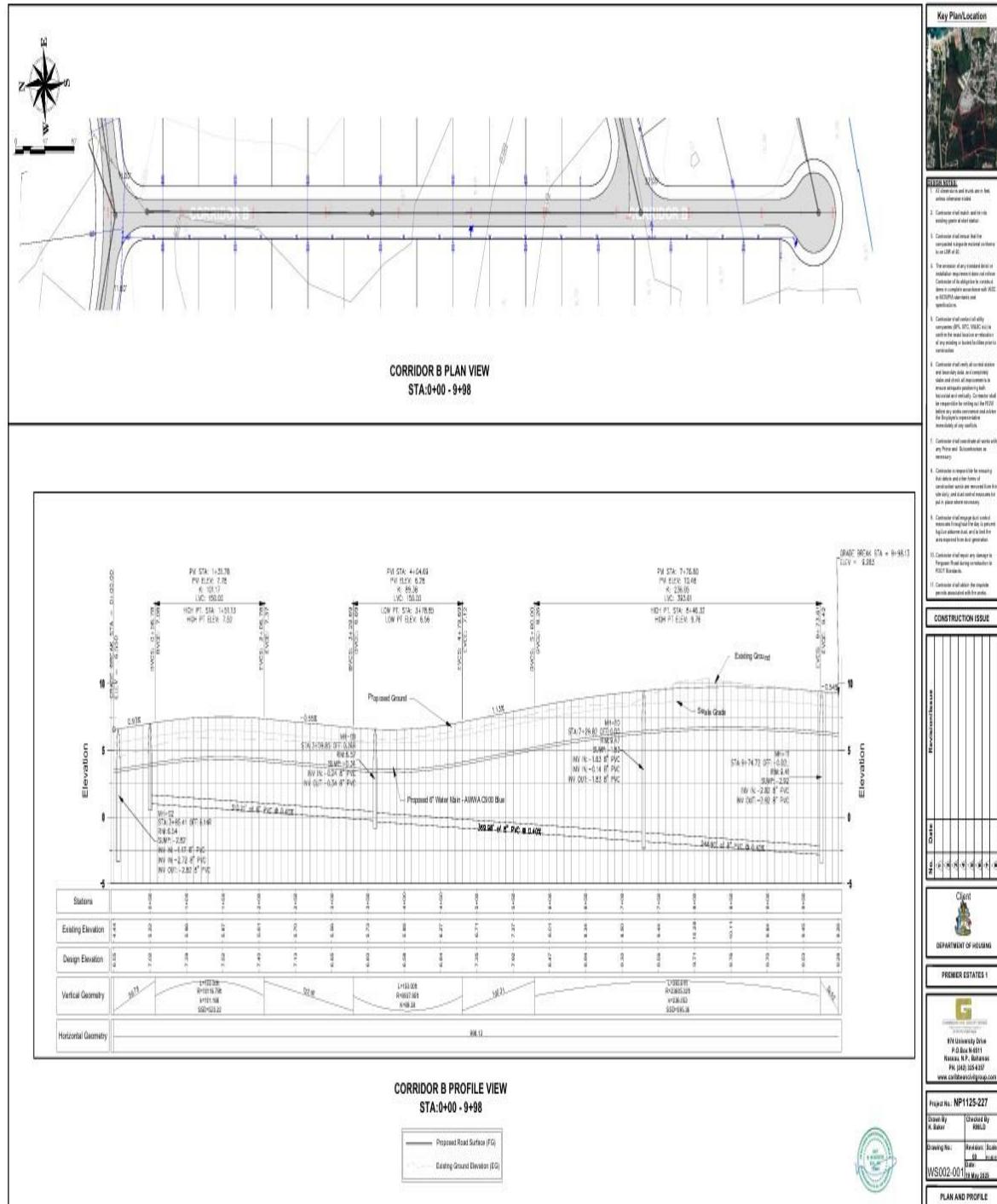
- That the storm water design parameters used in the design of the storm water management system are accepted and approved.
- The storm water system must be kept separate from the sewerage system.
- All chemicals, cement, fuel and other hazardous material used during construction should be stored in controlled areas and not lower than the internal road.
- Concentration of storm water should be prevented where possible, but energy dissipaters should be provided in areas of concentration.
- On completion of every construction phase within the development, comprising the construction of buildings, roads and parking areas, all remaining exposed embankments and open areas must be vegetated as soon as possible.
- During the construction phase, the following aspects should be closely monitored to ensure the contractor complies:
 - Temporary berms and cut-off drains must be provided on site to collect run-off, especially until the stormwater attenuation pond is complete and functional.
 - Silt screens must be provided at the catchpits during road/stormwater construction.
 - Topsoil must be conserved on site and prevented from entering the stormwater system.
 - Exposed embankments, cut/fill slopes and open areas must be vegetated as soon as possible to reduce runoff.
 - Dust control during construction must be applied at all times.
 - Excess spoil material from topsoil or bulk earthworks must be placed in areas or even removed entirely off site to minimize silt deposition, scouring and soil erosion.
 - Post construction, all exposed areas must be covered in vegetation, grass or landscape.

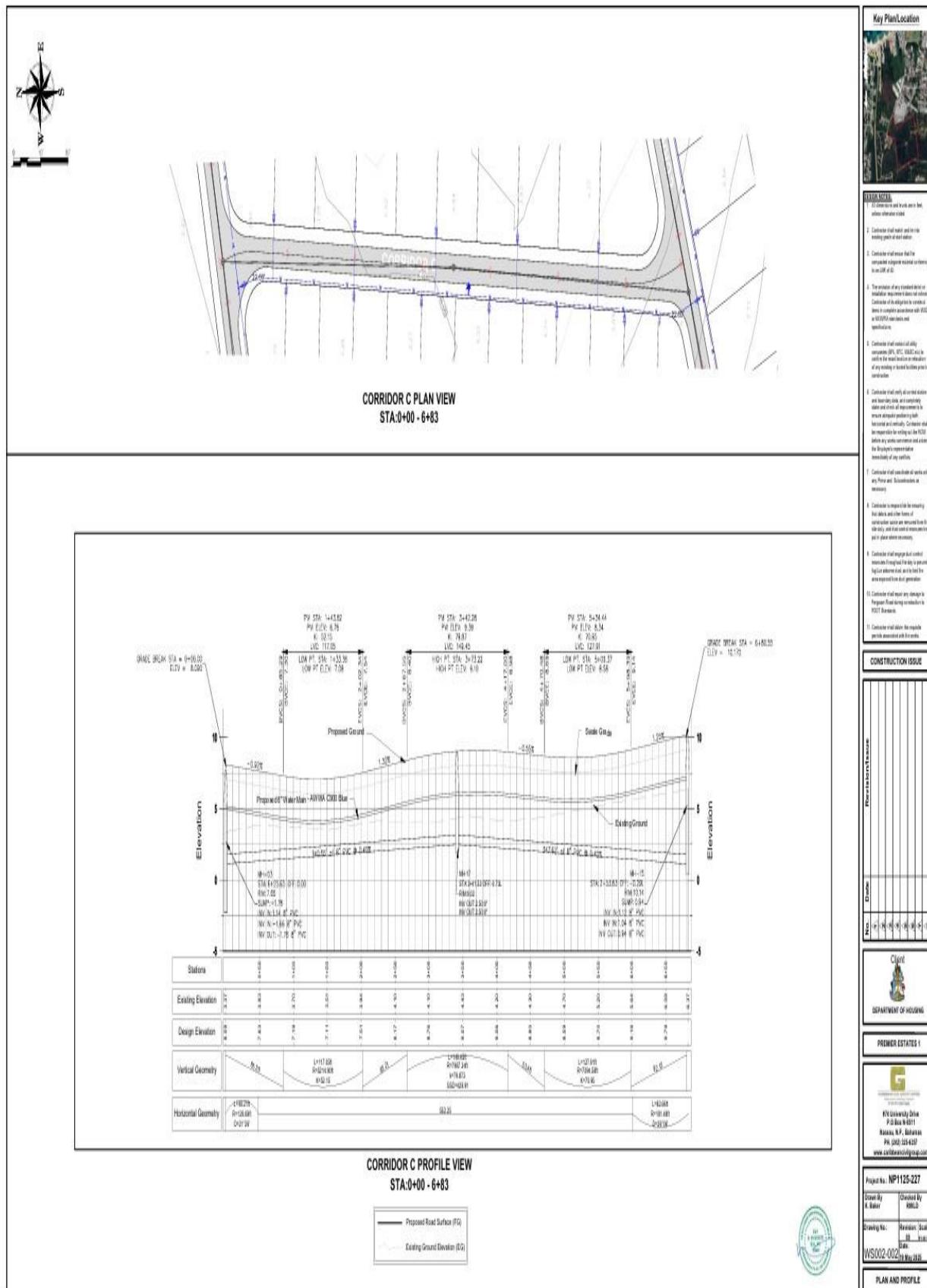
Appendix D: Water and Sewage Design Plan

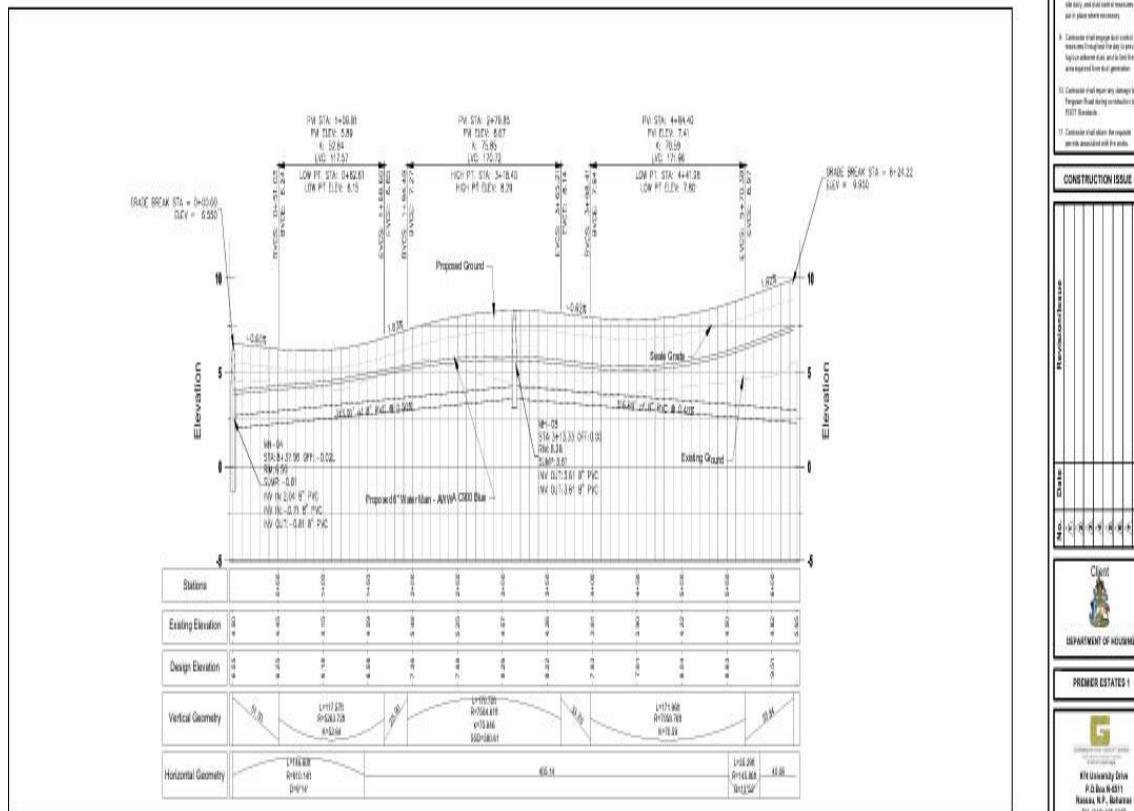
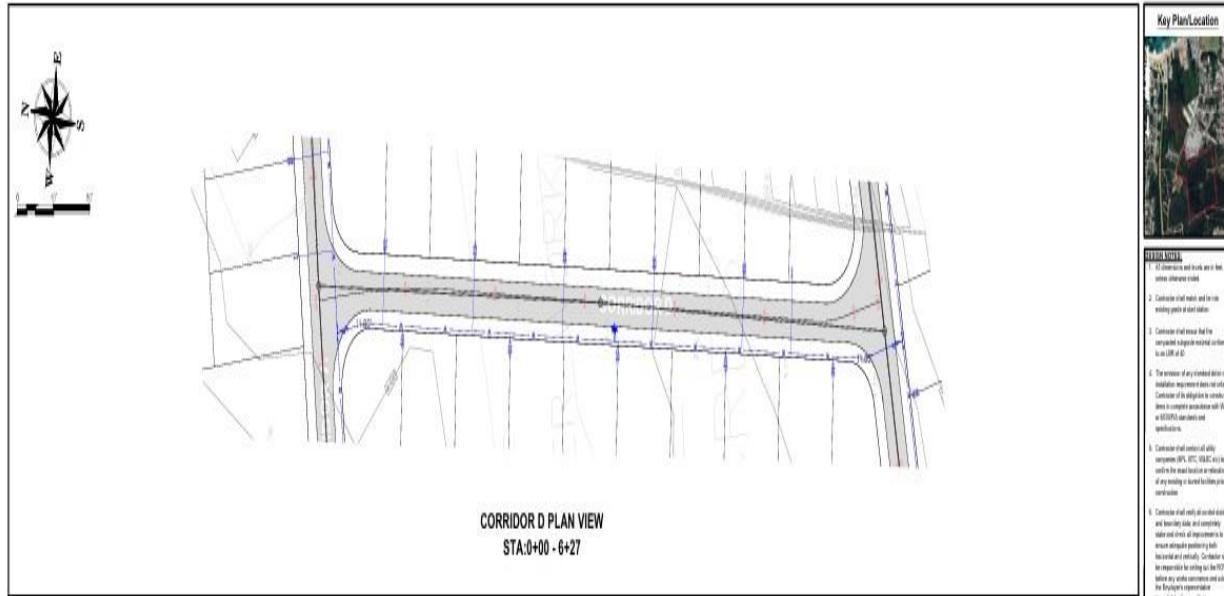


<u>DRAWING</u>	<u>SHEET TITLE</u>	<u>REVISION-00</u>
WS000-000	DRAWING INDEX	19 May 2025
WS001-000	WATER AND SEWER LAYOUT PLAN	19 May 2025
WS002-000	PLAN AND PROFILE	19 May 2025
WS002-001	PLAN AND PROFILE cont'd	19 May 2025
WS002-002	PLAN AND PROFILE cont'd	19 May 2025
WS002-003	PLAN AND PROFILE cont'd	19 May 2025
WS002-004	PLAN AND PROFILE cont'd	19 May 2025
WS002-005	PLAN AND PROFILE cont'd	19 May 2025
WS002-006	PLAN AND PROFILE cont'd	19 May 2025
WS003-000	POTABLE WATER DETAILS	19 May 2025
WS003-001	POTABLE WATER DETAILS cont'd	19 May 2025
WS004-000	SEWER DETAILS	19 May 2025
WS004-001	SEWER DETAILS cont'd	19 May 2025
WS004-002	SEWER DETAILS cont'd	19 May 2025
WS005-000	GENERAL NOTES	19 May 2025
WS005-001	GENERAL NOTES cont'd	19 May 2025
WS005-002	GENERAL NOTES cont'd	19 May 2025

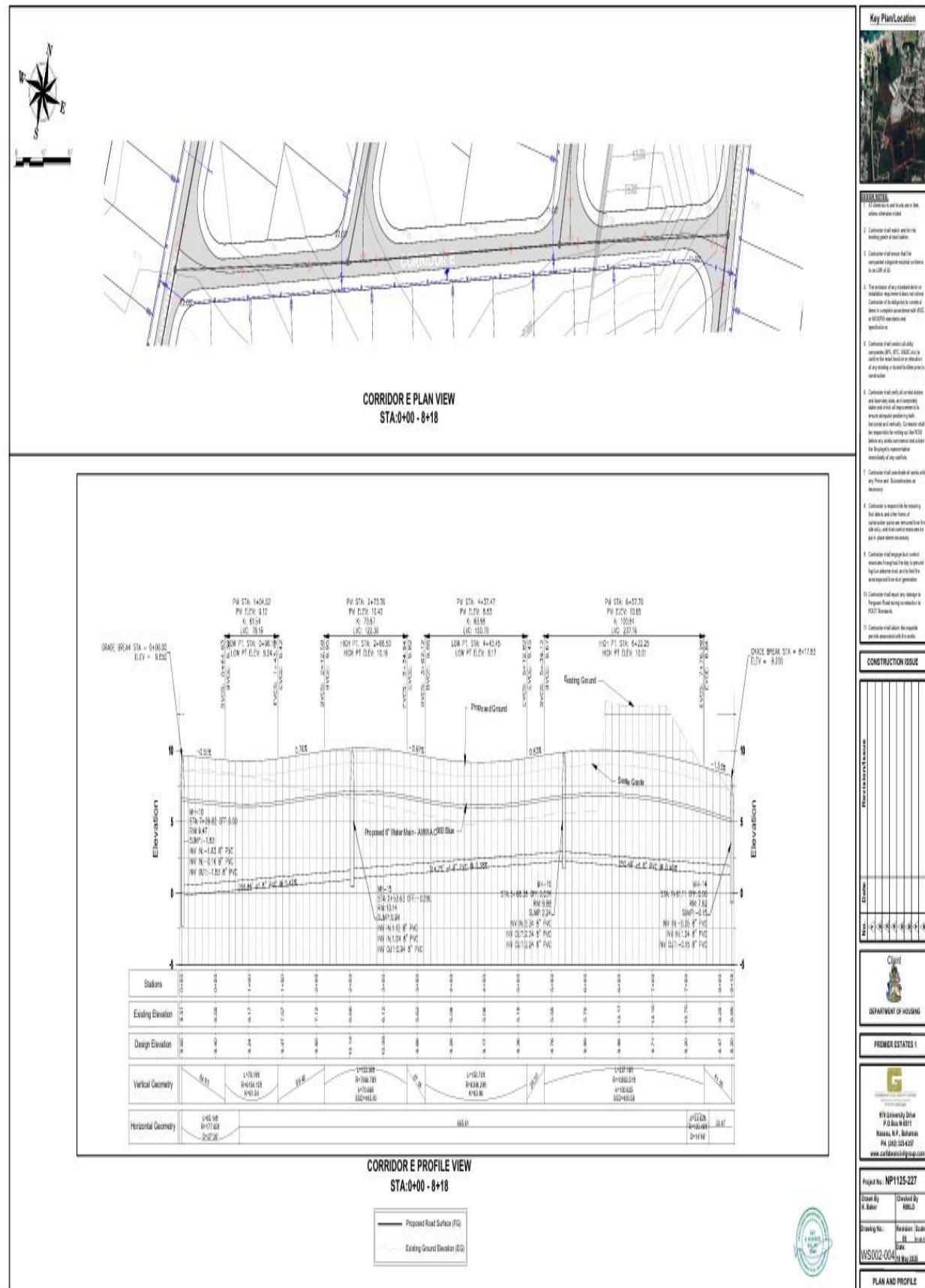


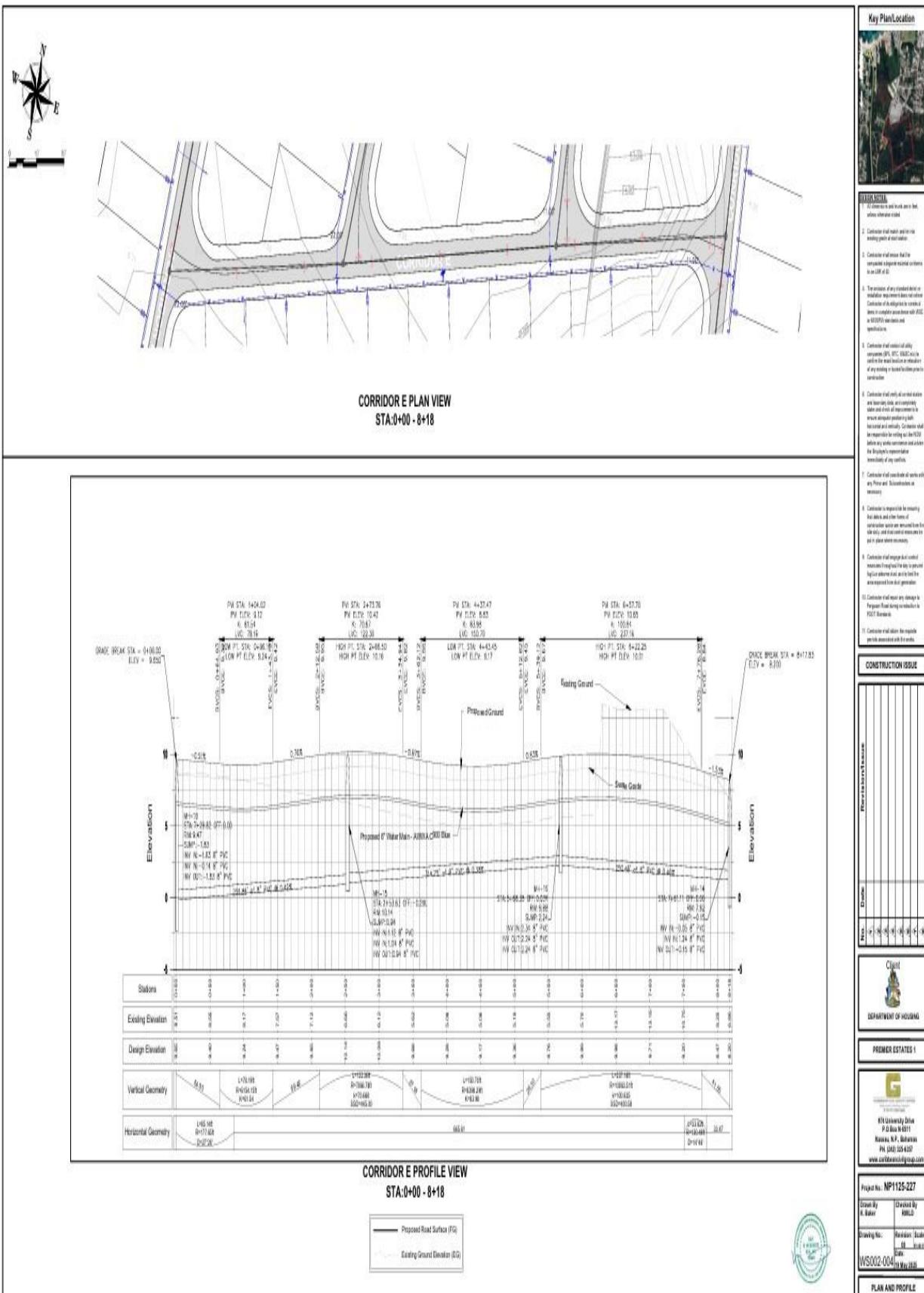


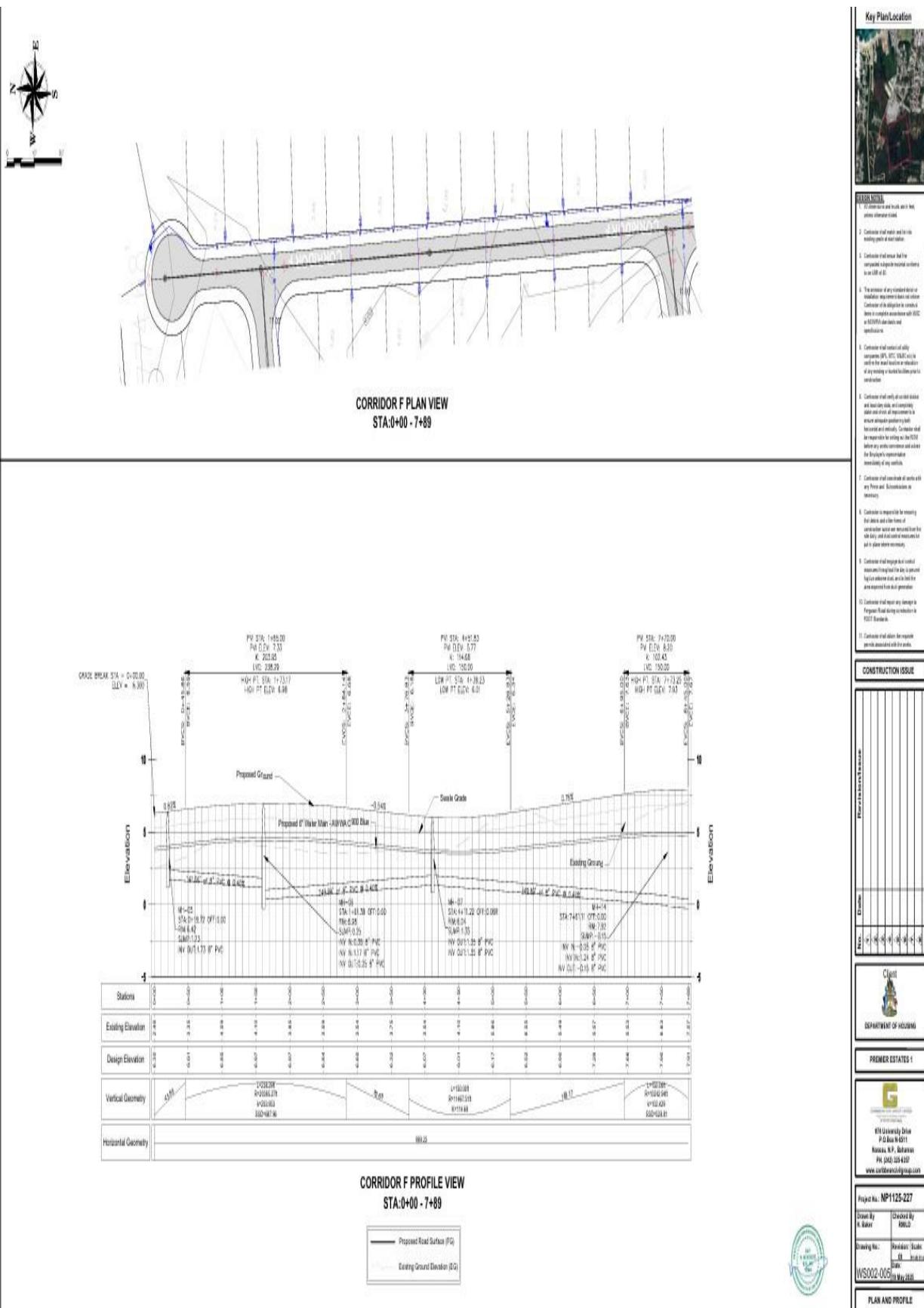


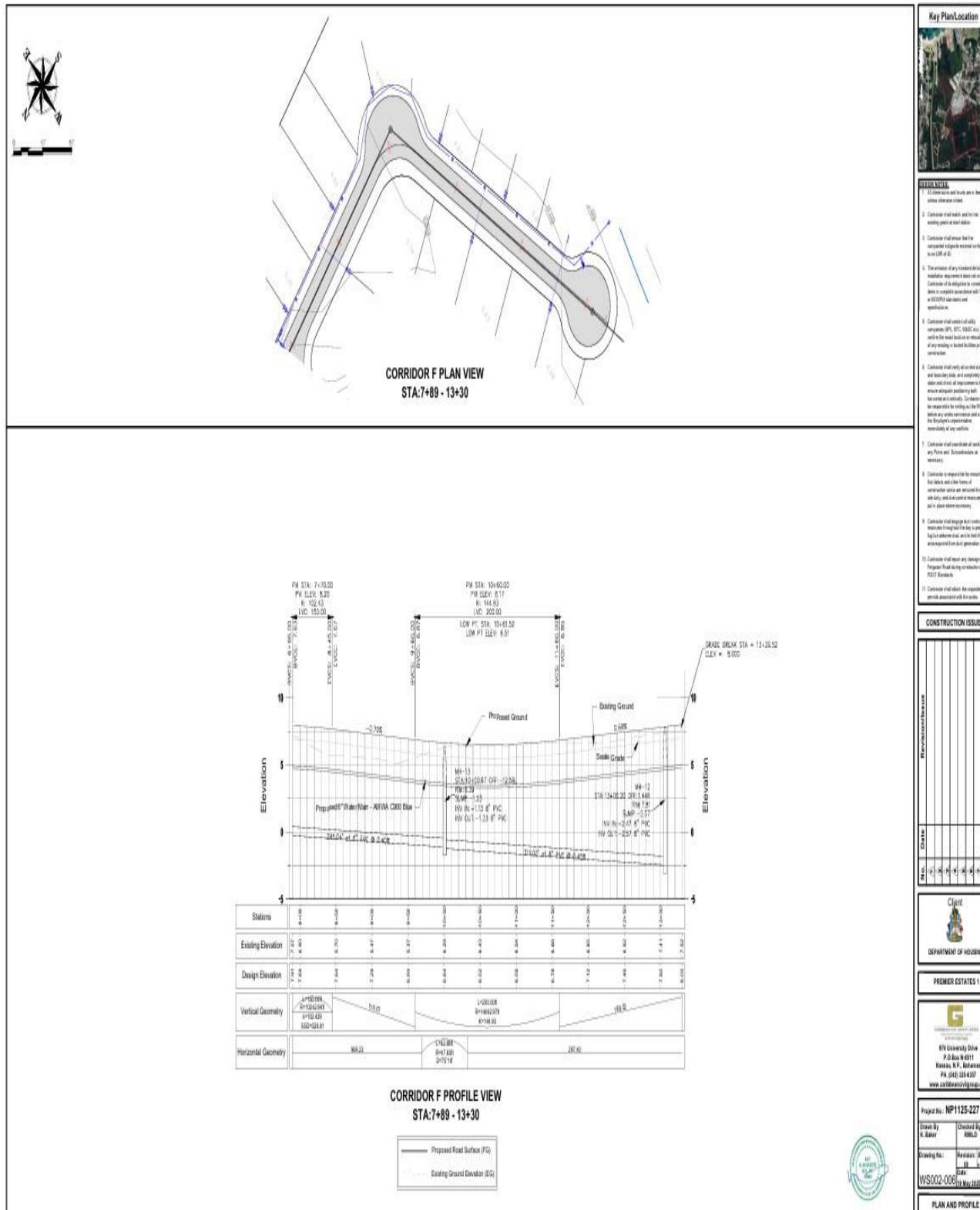


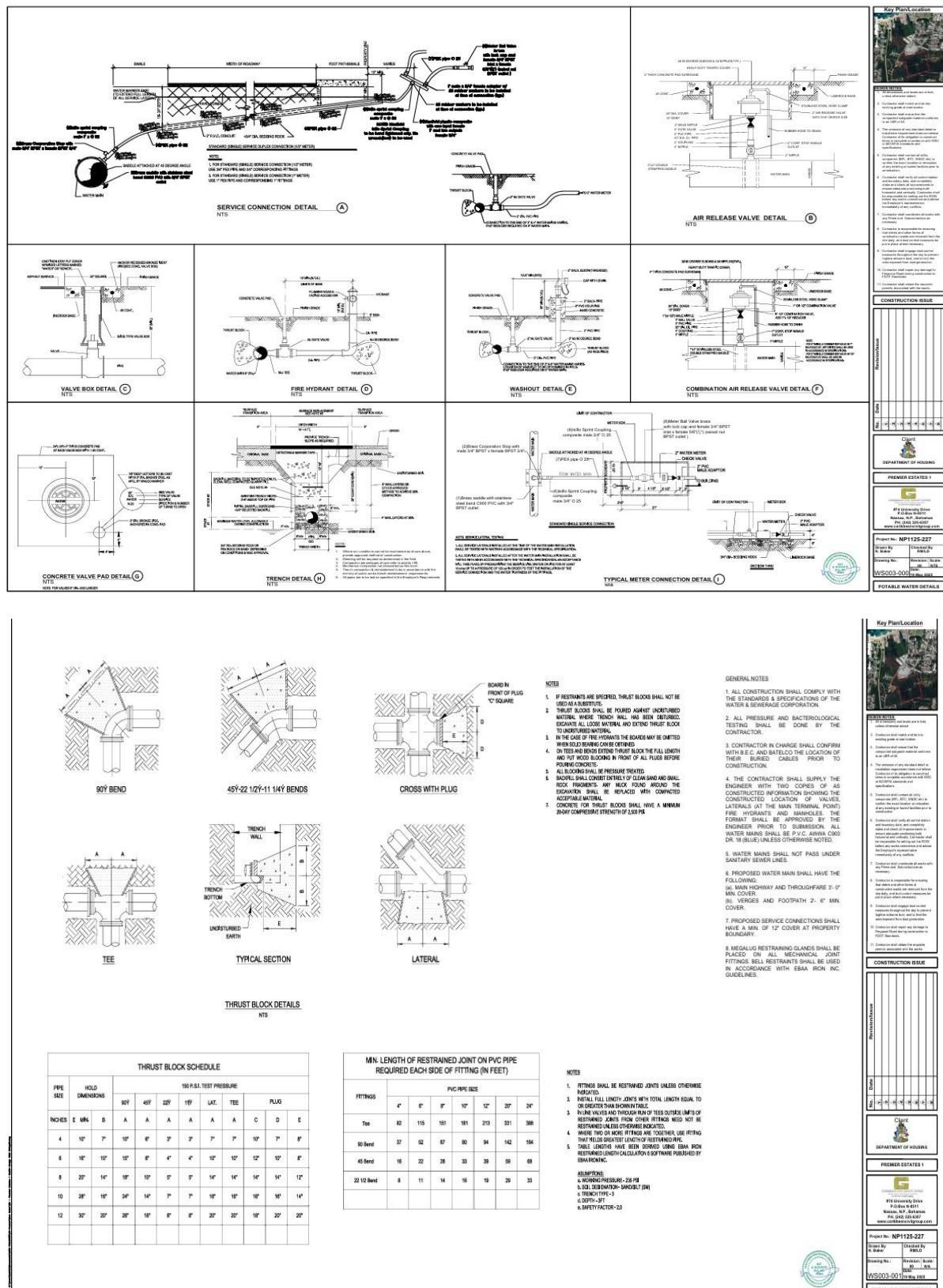
— Proposed Road Surface (RS)
— Existing Ground Division (EG)

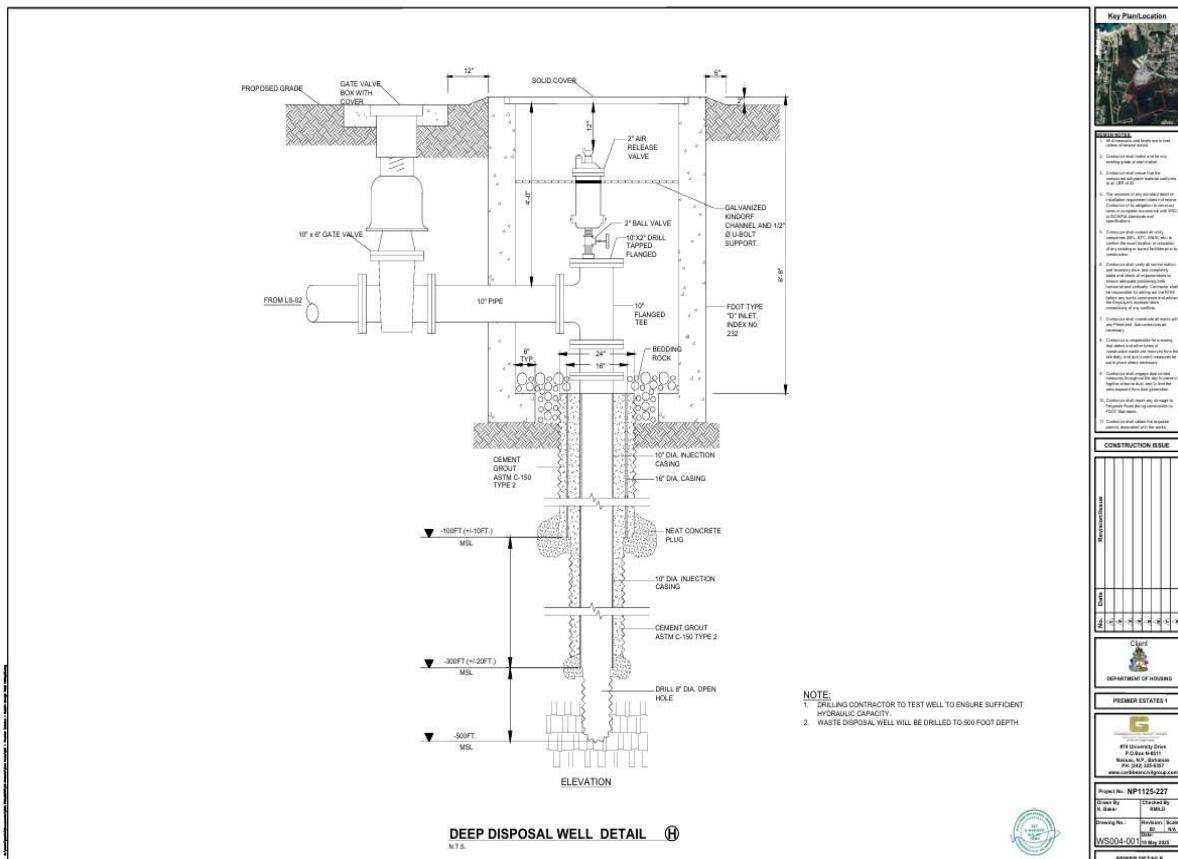
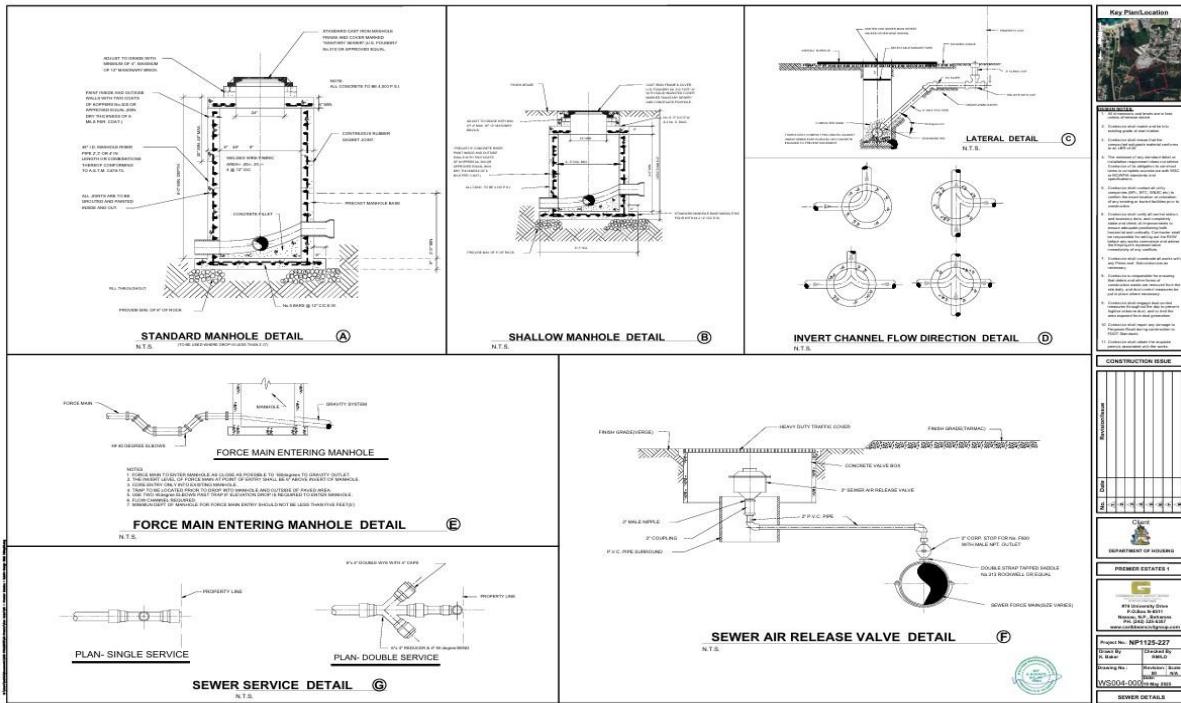


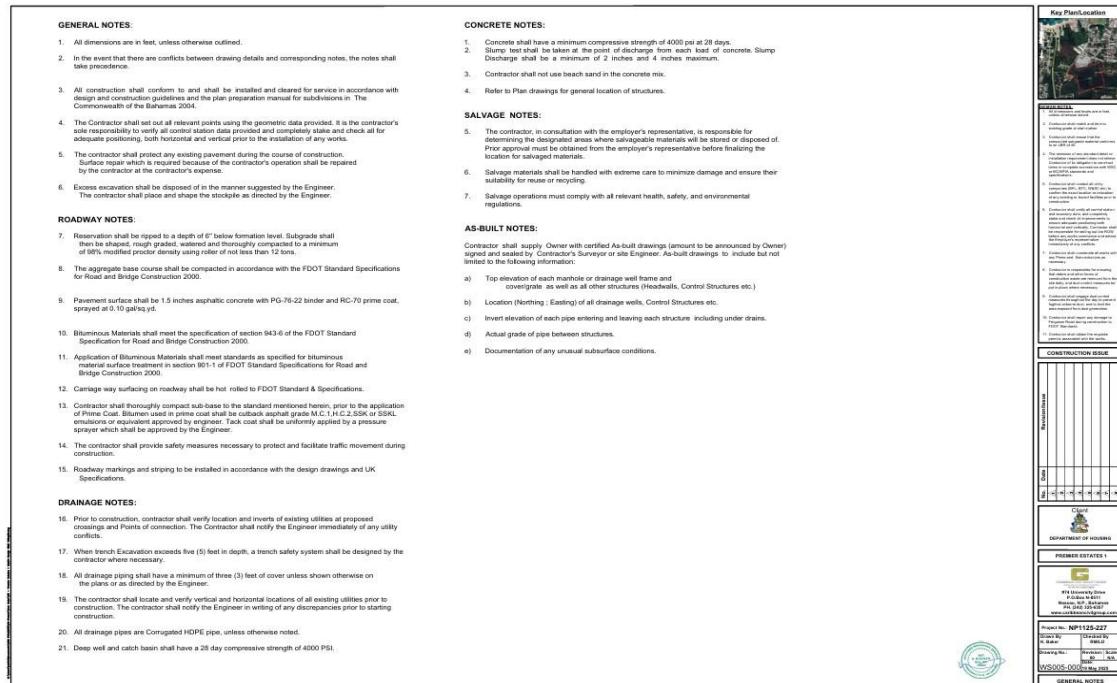
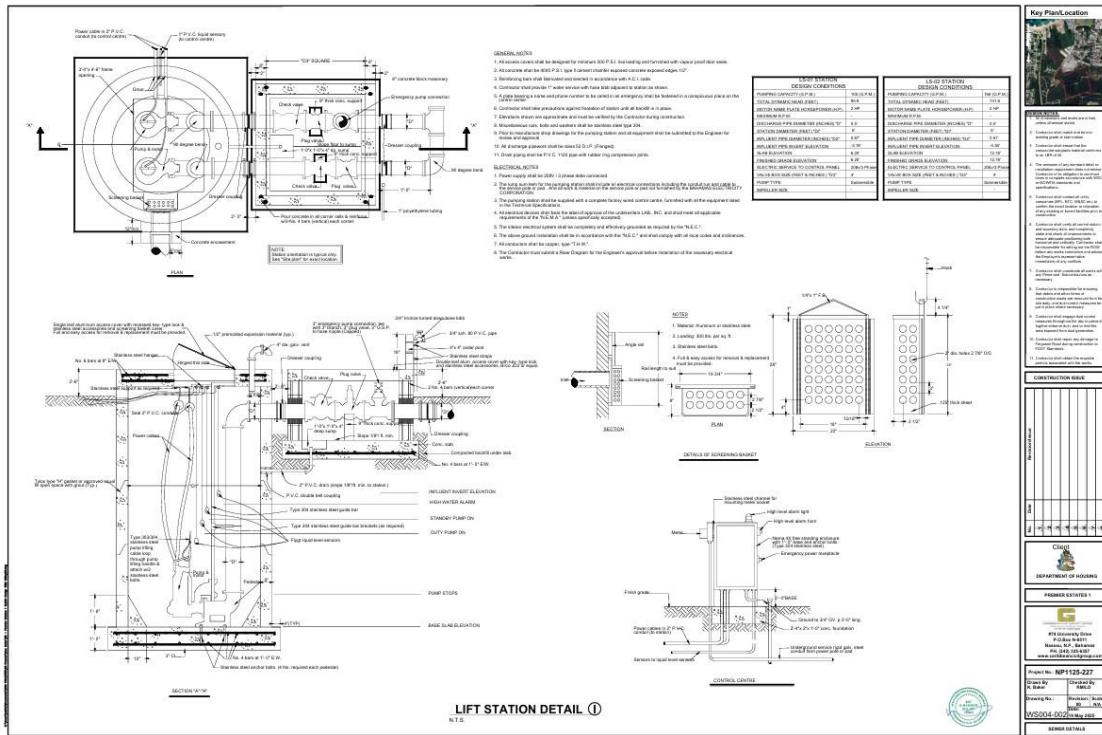












WATER AND SEWER NOTES

1. All construction shall comply with the standards and specifications of the WATER & SEWERAGE CORPORATION .

2. Water and sewerage service is provided by the WATER & SEWERAGE CORP.

3. All pressure and bacteriological testing shall be done by the Contractor.

4. The contractor shall supply the Engineer with two copies of as constructed information showing the constructed location of valves, laterals (at the main terminal point) fire hydrants and manholes. The format shall be approved by the Engineer prior to submission. All water mains shall be P.V.C. AWWA C900 DR.18 (Blue) unless otherwise noted.

5. All sewer force mains Shall be P.V.C. AWWA C900 DR.18 (Green) unless otherwise noted

6. All sanitary sewers 12" & less shall be P.V.C., SDR. 35.

7. A minimum cover 3'-0" shall be maintained on all forcemains & gravity sewer mains unless otherwise shown.

8. Sanitary gravity sewers shall be laid at least 10'-0" horizontally from existing or proposed water mains.

9. A vertical distance of at least 18" shall be maintained when a sewer pipe crosses under a water main. If this is not possible, then the sewer pipe must be encased in concrete for a distance of 20'-0" centering on the point of crossing or the sewer pipe must be of water main quality (ie. DR.18 AWWA C900)

10. It shall be the Contractor's responsibility to notify the Engineer of any changes or deviation.

11. The contractor shall take the necessary precautions to safeguard all existing structures and utilities. Any damages shall be repaired by the contractor at his own expense.

12. Existing water, sewer and drainage systems shall be verified by the Contractor prior to the start of construction.

13. Water main shall not pass under sanitary sewer lines.

14. All concrete shall be at least 4,000 p.s.i..

15. Sewage air release valve to be automatic pressure type by GA Industries, APCO or equal. Risers and valve box reers shall be placed and maintained in vertical position. All threads to be coated after installation with bituminous coating.

16. All connections to manholes shall be resilient type, similar to Kor-N-Seal as manufactured by NPC INC.

17. Detectable marker tape shall be placed in all forcemain & gravity sewer trenches.

18. The Contractor shall be responsible for conducting leakage tests on all pipe networks after installation. 3. Allowable leakage shall not exceed 200 gallons per inch diameter per mile per day

19. Contractor shall adhere to all guidelines for pipe installation as detailed by the pipe manufacturer, which must be approved by the WSC.

20. Suitable bedding material shall be clean, well graded, round coarse aggregate, selected fill (to the discretion and approval of the Water and Sewerage Corporation Engineer), or crushed rock of less than $\frac{1}{2}$ -inch maximum size and 3 $\frac{1}{8}$ -inch minimum size and be devoid of sharp stones and crushed rocks which would cause abrasion or significant scratching of the pipe. When tested in accordance with ASTM D422, it shall conform to the following gradation requirements:

- Passing a 1-inch sieve 100 Percent
- Passing a $\frac{1}{2}$ -inch sieve 90-100 Percent
- Passing a 3 $\frac{1}{8}$ -inch sieve 20-55 Percent
- Passing a No. 4 sieve 0-10 Percent

21. Suitable Bedding Material shall be placed as follows:

- a) For 4-inch diameter and less pipe sizes:
 - 4-inches minimum below the pipe and its bell mouth in the trench's foundation
 - 4-inches minimum from either side of the trench in the pipe zone
 - 6-inches above the top of the pipe and its bell mouth.
- b) For 6-inch diameter and greater pipe sizes:
 - 6-inches minimum below the pipe and its bell mouth in the trench's foundation
 - 6-inches minimum from either side of the trench in the pipe zone
 - 6-inches above the top of the pipe and its bell mouth.

22. Suitable bedding material shall be carefully placed by hand method and be fully worked under and around the sides of the pipe in 6" layers before the remainder of the trench is backfilled in the usual manner.

23. Suitable bedding material shall be compacted to a minimum density of 95% standard proctor utilizing hand tampers or impact tampers. If suitable bedding material is not available in sufficient quantity from the trench, the necessary material shall be imported to complete backfilling the bedding areas of the trench.

24. Where PVC pipe is being laid, natural washed sand or other approved material (Suitable Bedding Material) shall be used for bedding of the pipe and its bell mouth. Where natural washed sand is used, there shall be no need for hand tamping or mechanical tamping of the bedding material. For the purposes of this specification, natural washed sand shall be washed, free of organic material, clean sand excavated from the local benthos environment. When tested in accordance with ASTM C136 test method of soil classification it shall conform to the following gradation requirements:

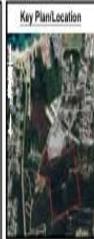
- Passing a No. 4 (4.75 mm) sieve 100 Percent max.
- Passing a No. 100 (0.15 mm) sieve 0 - 30 Percent max.
- Passing a 200 (0.075 mm) sieve 0 - 12 Percent max.

24. Backfill material shall be suitable fine material as outlined below in order to provide a firm and continuous compression layer above the pipe. Backfill material shall be placed by approved mechanical means, fully compacted; in layers not exceeding 6" thick layer beyond the first 12" above the pipe.

25. Backfilling material shall be an approved select granular aggregate material, free from organic matter and of such size and gradation that the desired compaction can readily be attained. When tested in accordance with ASTM D422, it shall conform to the following gradation requirements:

- Passing a 1-1/2-inch sieve 95 Percent (Min.)
- Passing a No. 200 sieve 10 Percent (Max.)
- Coefficient of Uniformity 6 or Greater
- Sand Equivalent 35 Percent or Greater

26. The maximum aggregate size shall not exceed three (3) inches and shall be compacted to the minimum density of 95% standard proctor utilizing hand tampers or vibratory compactors. Rolling equipment or heavy tampers shall only be used to consolidate the final backfill material, provided the pipe is covered by at least 12 inches of backfill material of the required density.

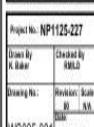


ANSWER

CONSTRUCTION ISSUE



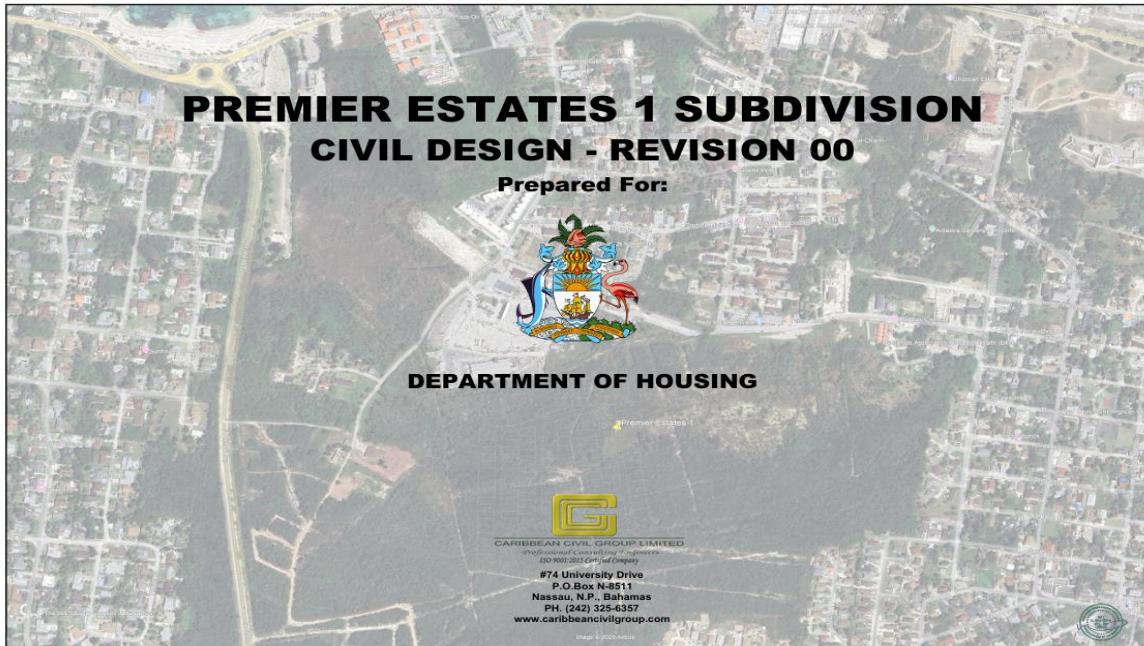
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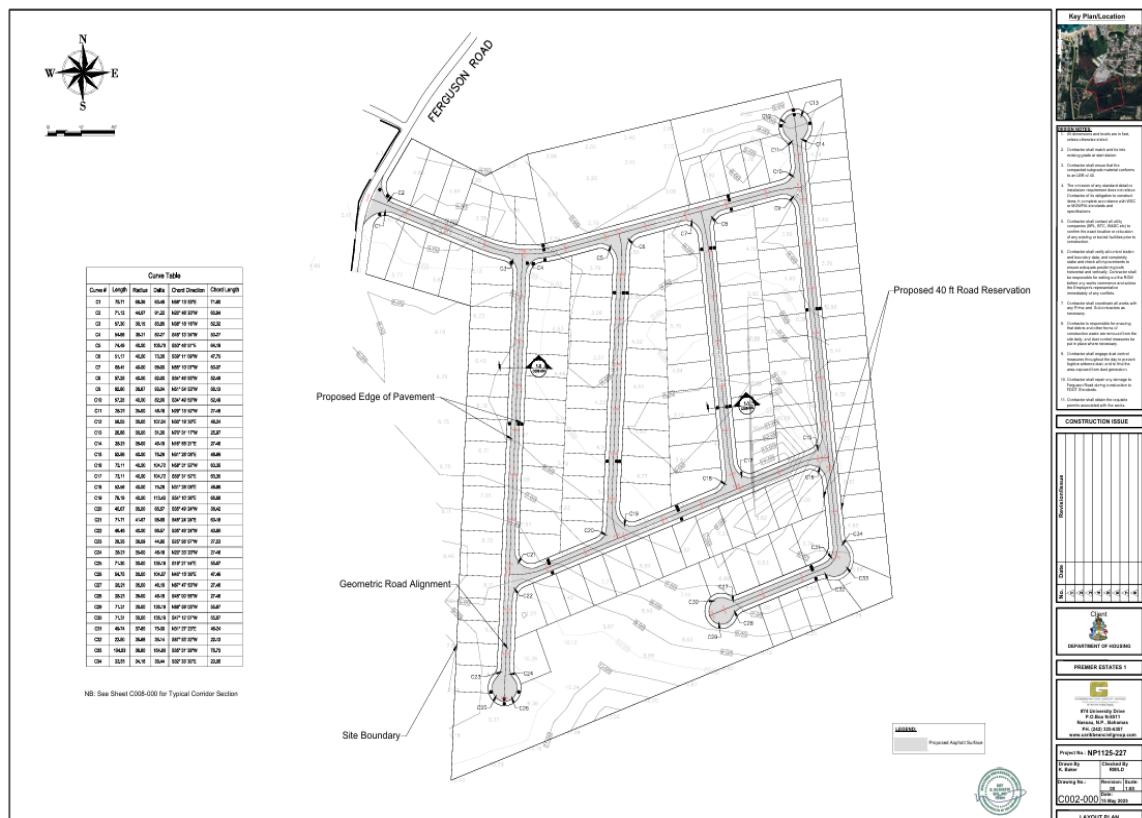
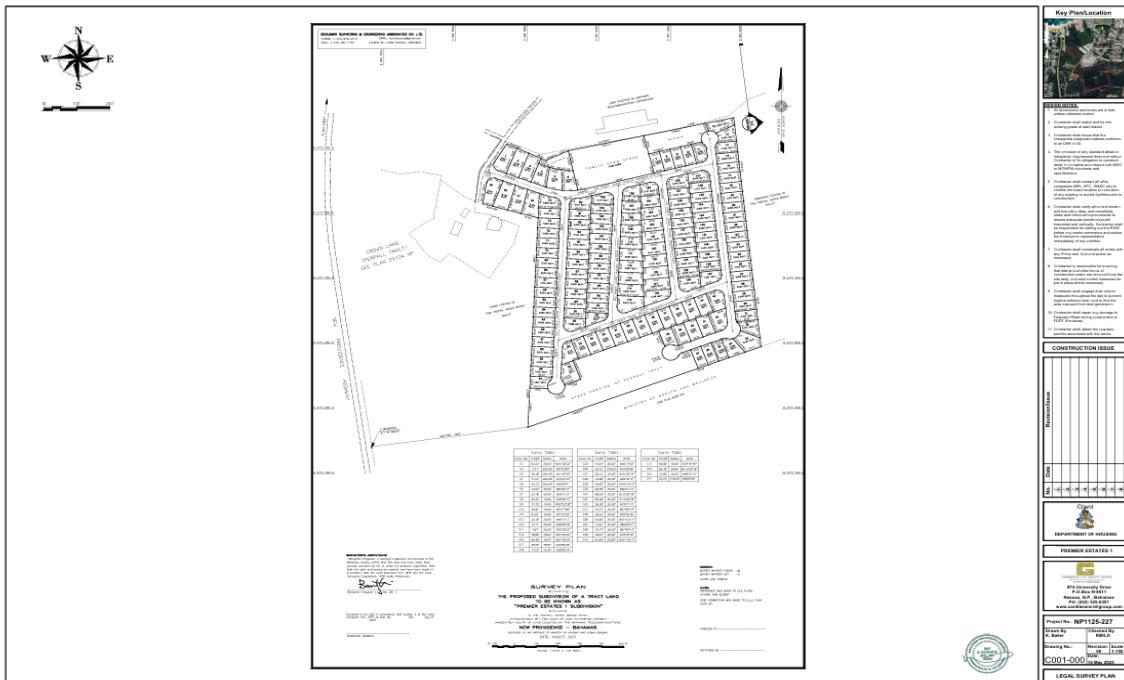
GENERAL NOTES

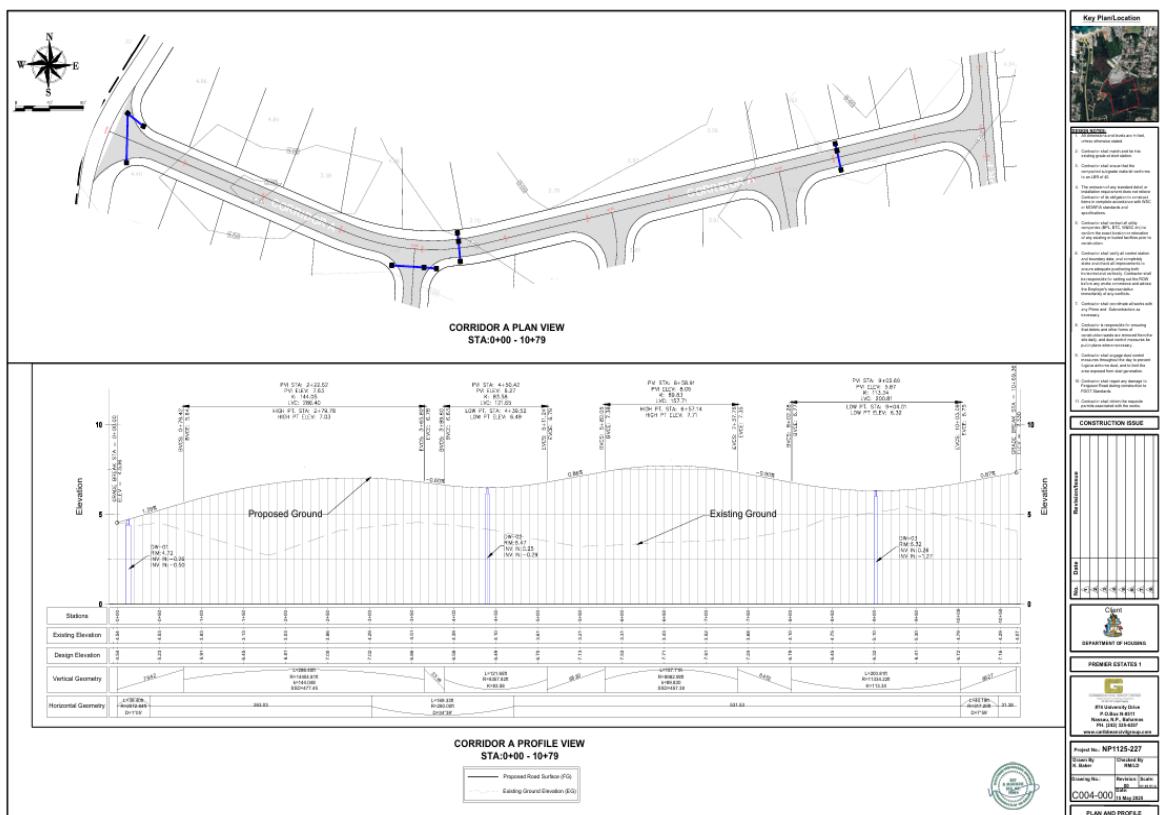
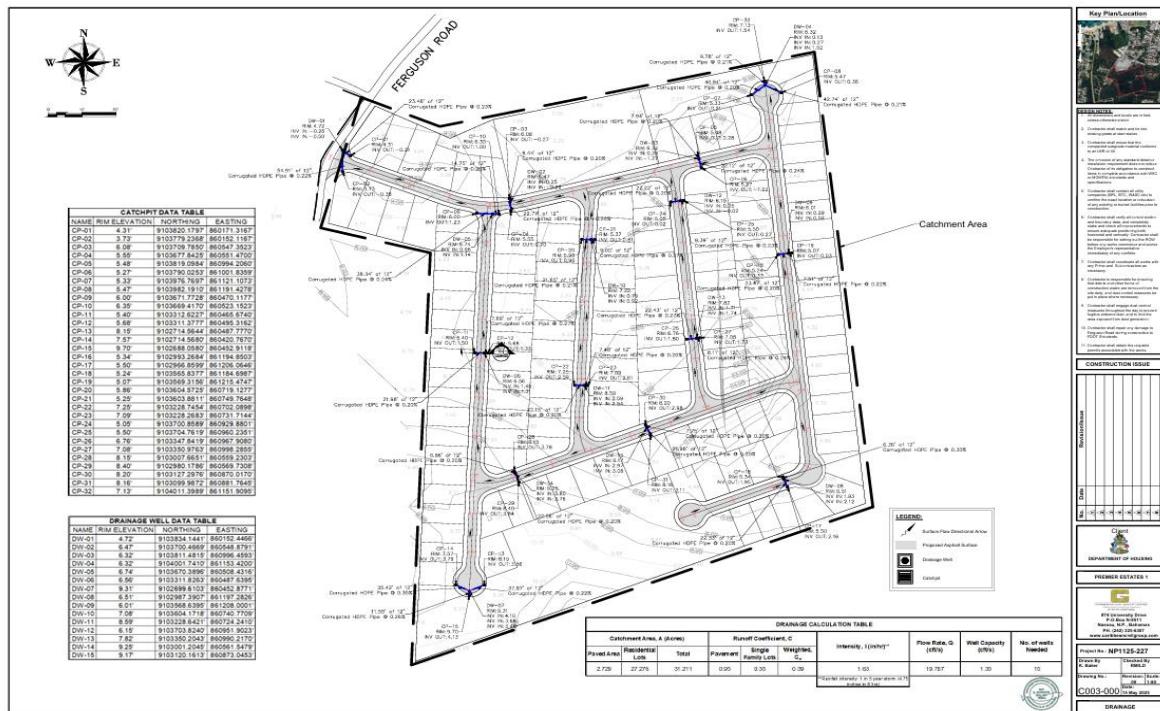
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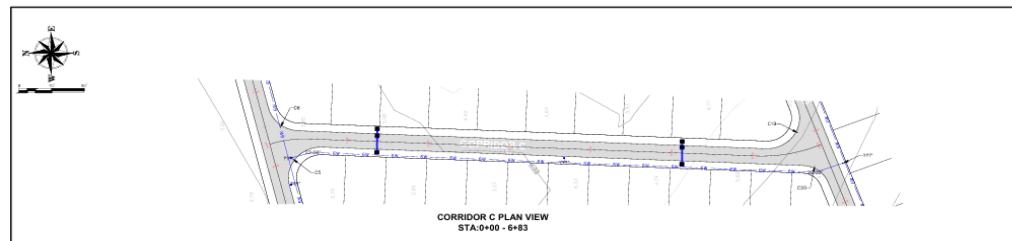
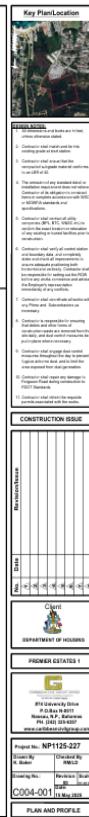
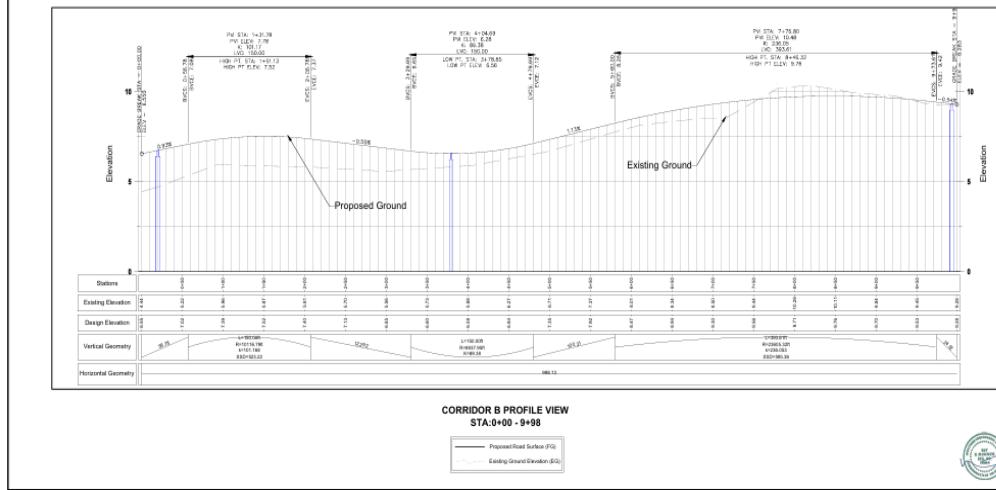
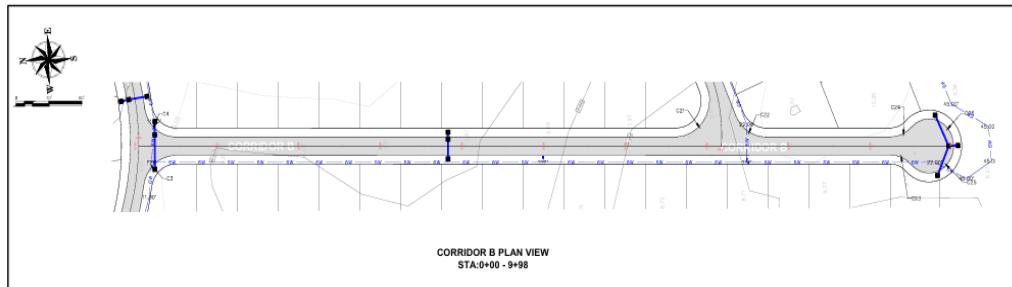
Appendix – E: Civil Design - Drainage

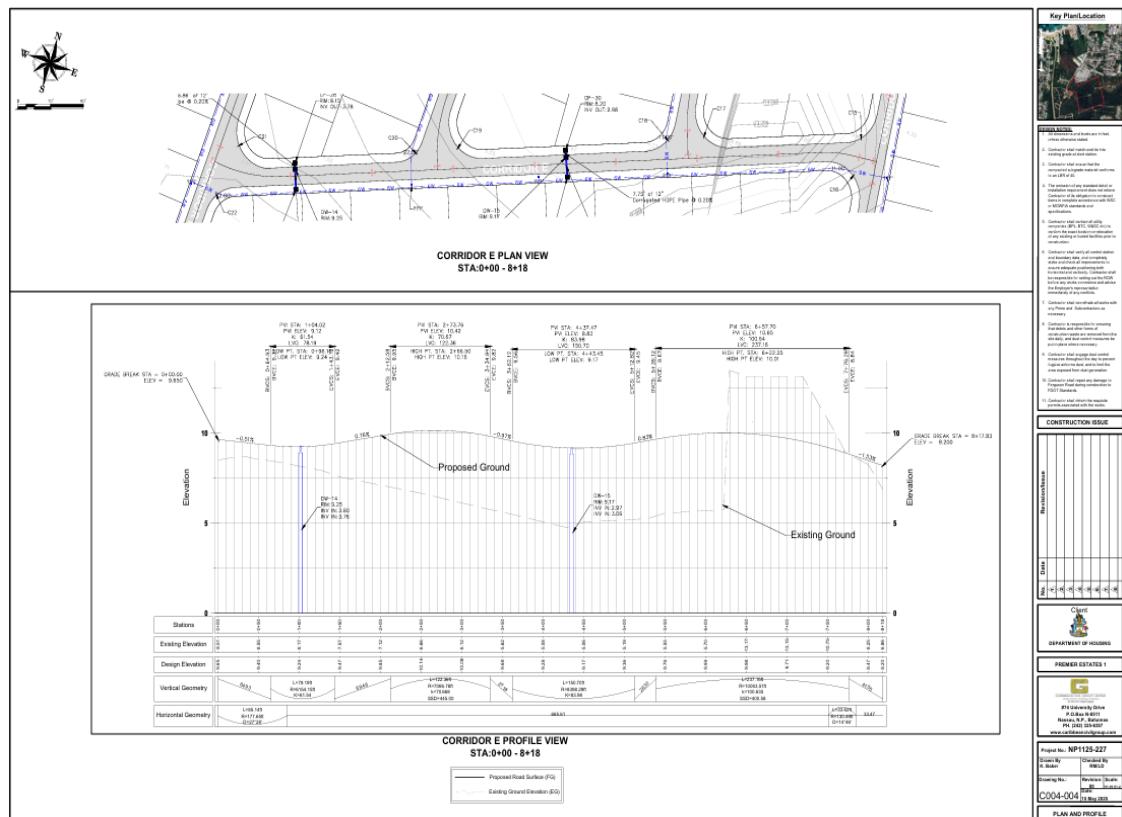
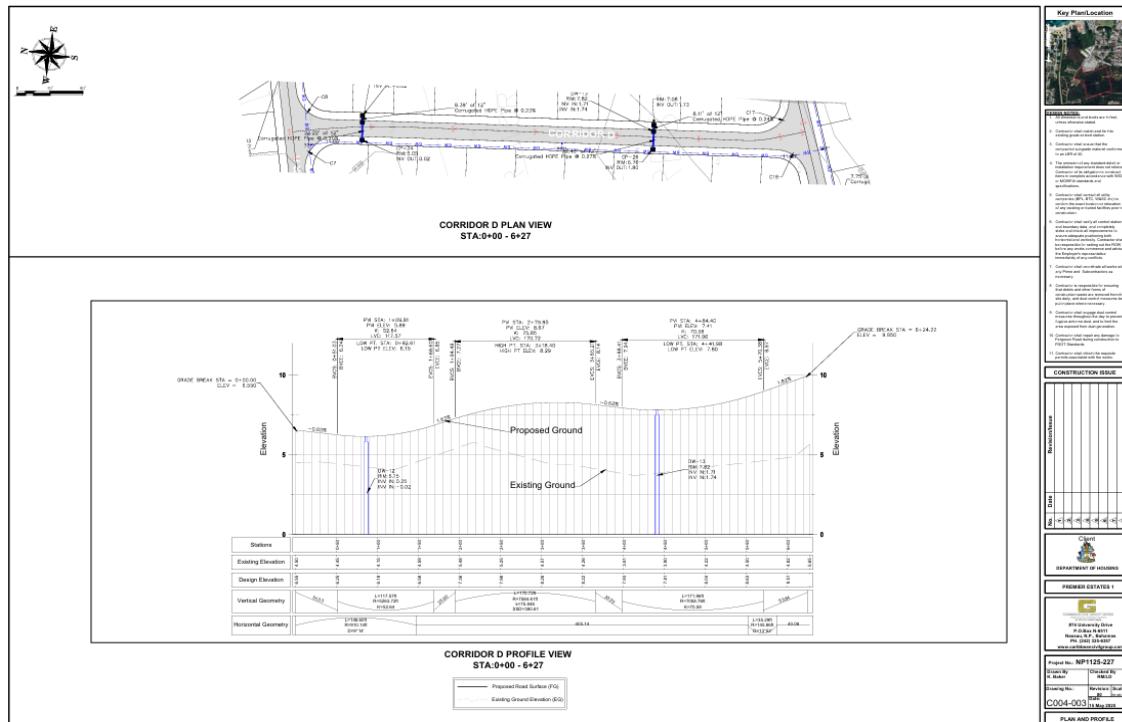


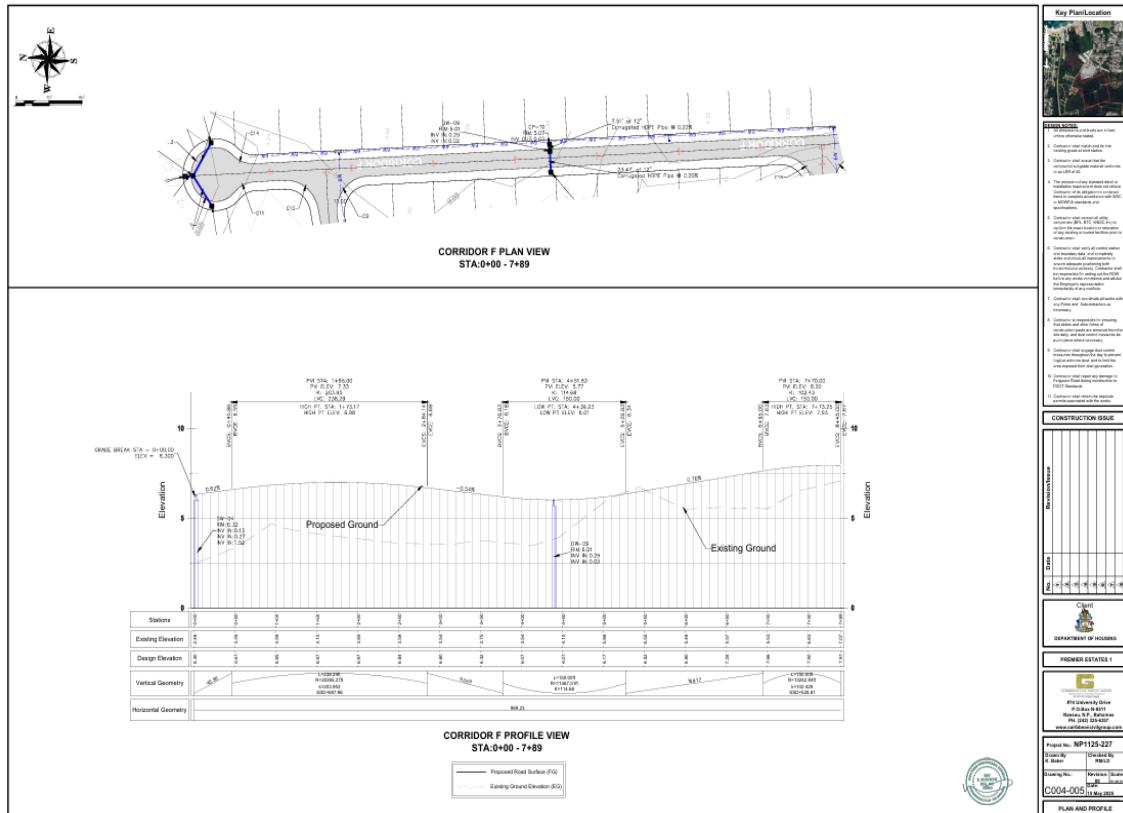
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C000-000	DRAWING INDEX	15 May 2025	
C001-000	LEGAL SURVEY PLAN	15 May 2025	
C002-000	LAYOUT PLAN	15 May 2025	
C003-000	DRAINAGE	15 May 2025	
C004-000	PLAN AND PROFILE	15 May 2025	
C004-001	PLAN AND PROFILE cont'd	15 May 2025	
C004-002	PLAN AND PROFILE cont'd	15 May 2025	
C004-003	PLAN AND PROFILE cont'd	15 May 2025	
C004-004	PLAN AND PROFILE cont'd	15 May 2025	
C004-005	PLAN AND PROFILE cont'd	15 May 2025	
C004-006	PLAN AND PROFILE cont'd	15 May 2025	
C005-000	CROSS SECTIONS	15 May 2025	
C005-001	CROSS SECTIONS cont'd	15 May 2025	
C005-002	CROSS SECTIONS cont'd	15 May 2025	
C005-003	CROSS SECTIONS cont'd	15 May 2025	
C005-004	CROSS SECTIONS cont'd	15 May 2025	
C005-005	CROSS SECTIONS cont'd	15 May 2025	
C005-006	CROSS SECTIONS cont'd	15 May 2025	
C005-007	CROSS SECTIONS cont'd	15 May 2025	
C005-008	CROSS SECTIONS cont'd	15 May 2025	
C006-000	VOLUME TABLES	15 May 2025	
C007-000	SIGNS AND MARKINGS	15 May 2025	
C008-000	TYPICAL SECTIONS	15 May 2025	
C009-000	DESIGN DETAILS	15 May 2025	
C010-000	GENERAL NOTES	15 May 2025	

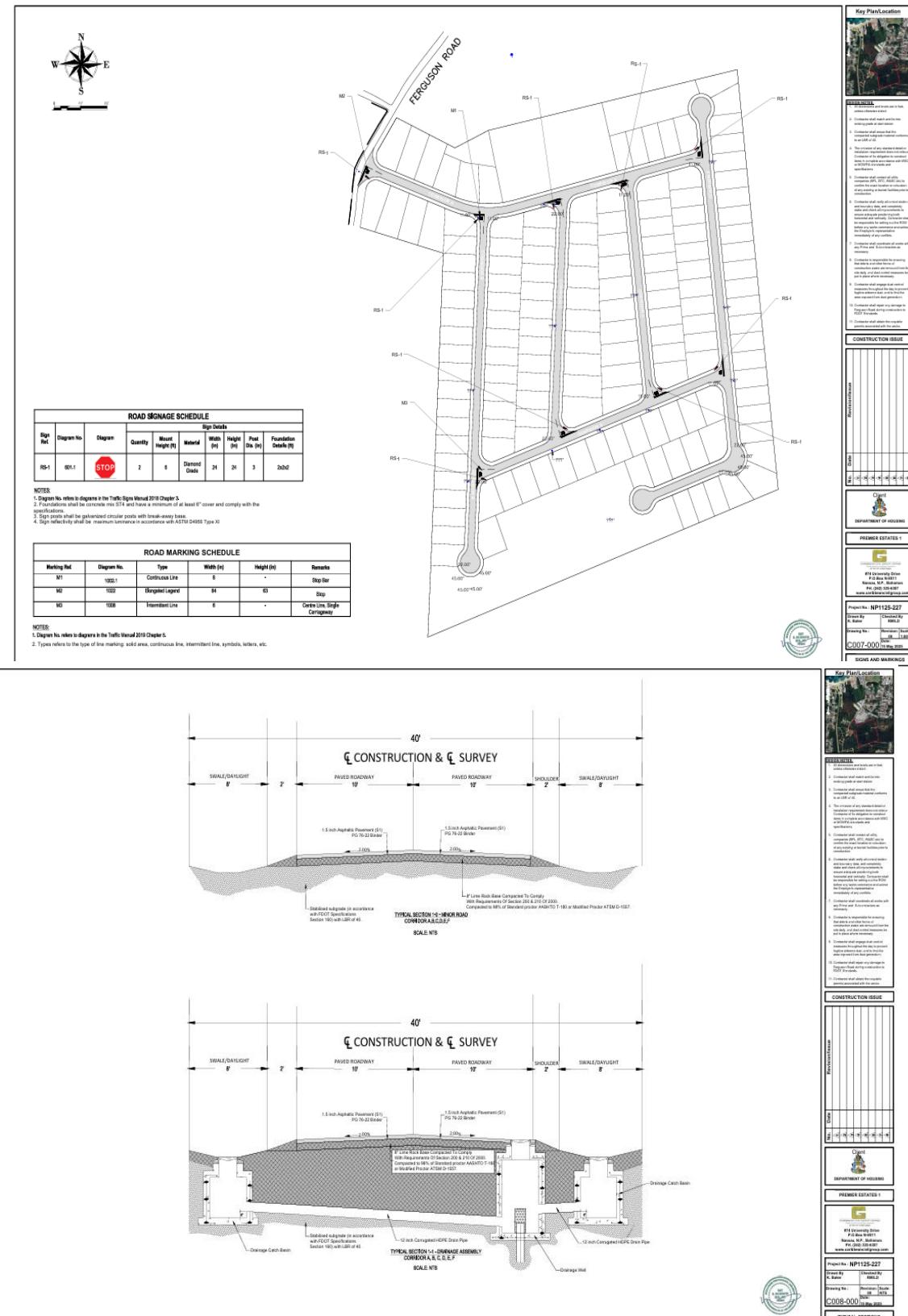


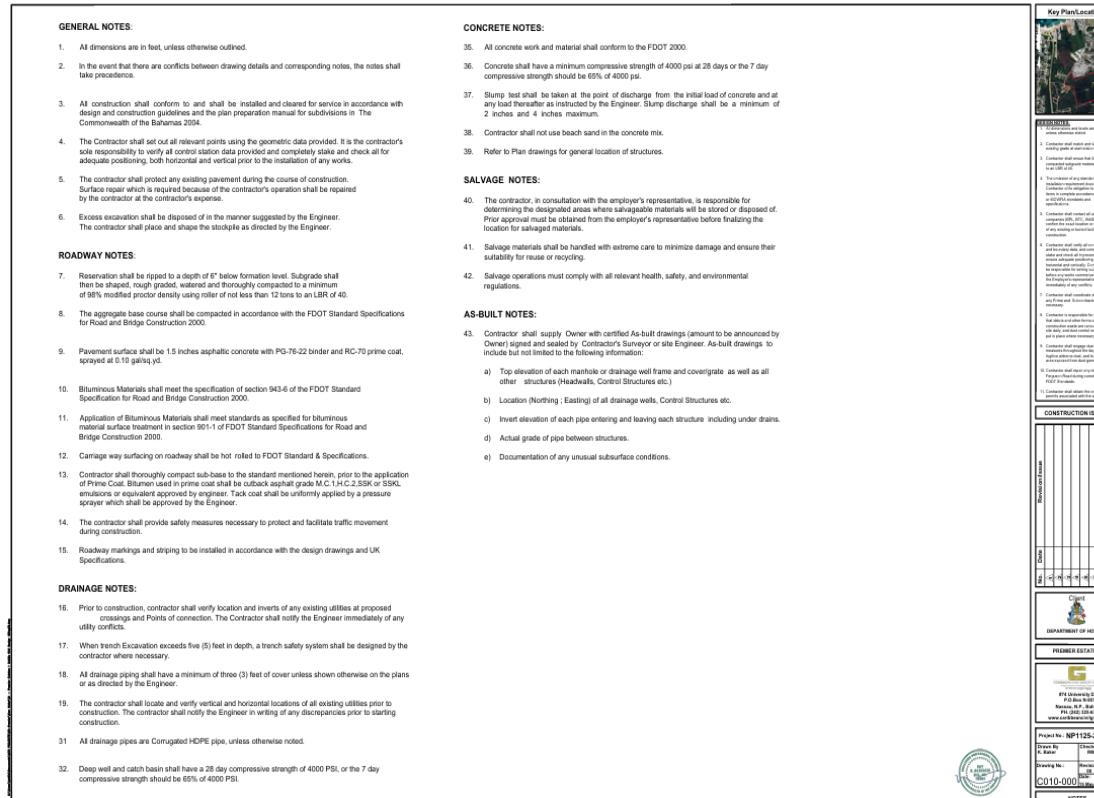
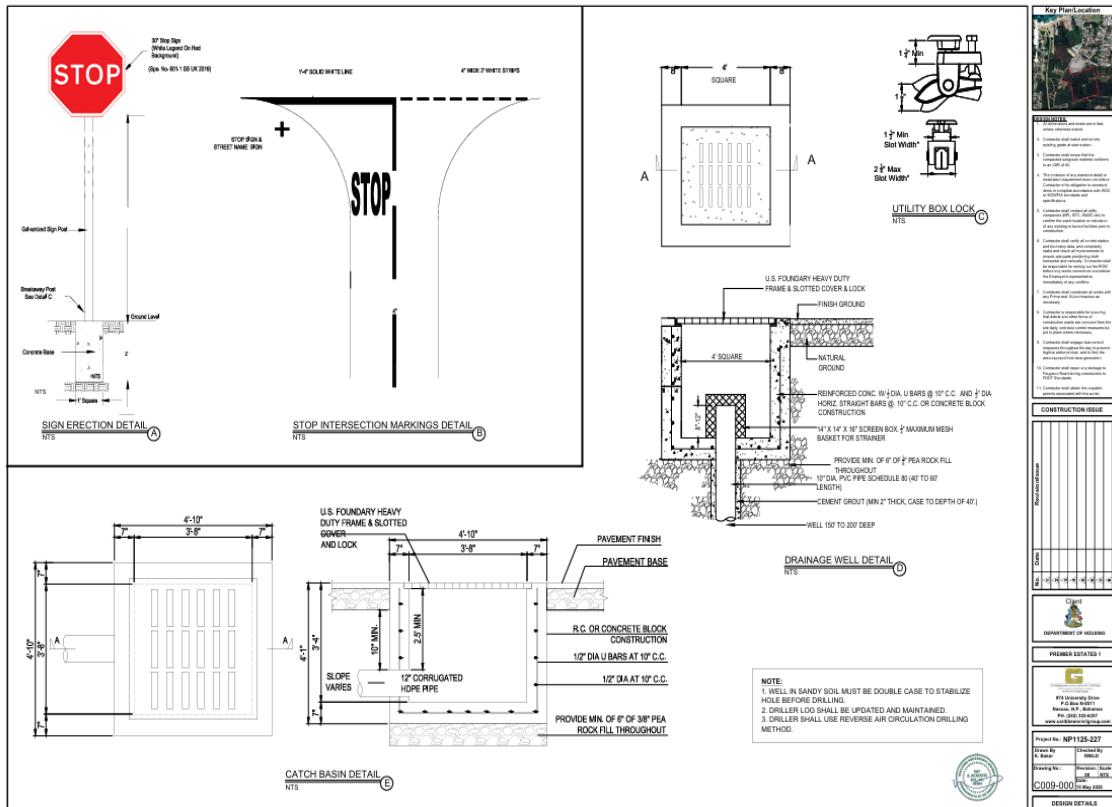






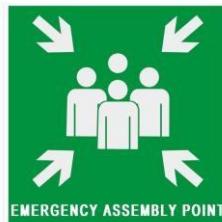






Appendix F: Health and Safety Plan

Section -1. Emergency Preparation- Sticking with the Plan



Emergency Response Planning refers to the methods, techniques, procedures, and actions KCDC has put in place to respond to potential emergencies (e.g., fire, explosion, etc.).

A company must have a response plan for any emergency that may require the rescue or evacuation of workers. Only through appropriate preparedness can the consequences of an emergency be minimized.

WHAT'S THE DANGER: If you've never experienced an emergency in your workplace, you might find it hard to imagine such a thing could happen. However, every day in job settings just like yours, something can go seriously wrong. Whether everyone survives and escapes injury often depends on how well they're prepared for an emergency.

EXAMPLE: You're on a construction site when someone shouts a warning. You look around and see a fire spreading on your worksite. Do you know where to find the fire extinguisher? Do you know how to operate it? Or if a coworker has an accident. Do you know what to do?

HOW TO PROTECT YOURSELF

Confusion and panic are often the first obstacles when an unplanned event presents a serious risk to life or limb. That's why an organized approach is the essential ingredient of an emergency response plan. Knowing what to do in case of an emergency can prevent panic and it can save lives.

Here are Four Things you must know:

- **The possible hazards.** You need to know what can go wrong. Are hazardous chemicals stored or transported near your workplace? Are you located in a flood zone etc.?
- **Evacuation procedures.** You must know how to get out of the building and reach safely. Right now, can you point out two exits from your work area? Do you know where to assemble point is? This aspect of the emergency procedure is important because if you don't show up there, an emergency crew might have to risk injury looking for you
- **Your duties.** Do you know what duties you're expected to perform in an emergency, such as shutting down equipment or checking for or assisting someone falling behind? Do you know how to call for help and who to call? Emergency phone numbers should be posted on a noticeboard.
- **The Alarm systems:** You should also be familiar with the various alarm sounds and lights in your workplace. Alarm systems typically have different signals for fire etc. There may also be specific alarms related to hazardous equipment, chemicals, gases and other hazards.
- **Responsibilities of key People:** Your Supervisor and First Aiders must be the first persons you contact in case of an Emergency. They will contact the Emergency Services, Health & Safety Personnel and Project Manager.



Section - 2. THE IMPORTANCE OF PPE SAFETY SHOES/BOOTS- 7 WAYS, THEY PROTECT YOU

Safety Shoes may not seem as critical to workplace safety as protective eyewear or gloves, but footwear provides many benefits. If anyone on the construction site doubts the value of investing in footwear, offer him or her some of the ways safety shoes can keep workers safe.

1. PROTECT FROM FALLING & FLYING OBJECTS

When workers carry heavy materials or work in dynamic environments where many people, machines and vehicles are operating at once, falling and flying objects are common hazards. Protective shoes like steel toe boots can effectively prevent crushing injuries to the feet.

2. PROTECT FROM PUNCTURES

When workers could step on sharp objects or be struck by sharp objects from above, shoes with heavy-duty soles and thick materials surrounding the foot offer the best protection. At construction worksites, for example, many sharp objects could be in someone's path. A soft-soled shoe might not provide enough protection.

3. PROTECT FROM CUTTING HAZARDS

Machinery that is sharp or contains moving parts can pose cutting hazards. Workers in the logging industry, for example, face dangers from chainsaws. If a chainsaw were to come in contact with someone's foot, the result could be catastrophic.

4. PROTECT FROM ELECTRICAL HAZARDS

Electricity poses a variety of risks in the workplace. Workers could face potential electric shocks or accumulate static electricity, which can lead to electric sparks in certain environments.

To reduce the chances of an electrical accident, non-conductive footwear made from leather, rubber or other materials that don't conduct electricity can be worn. In locations where the build-up of static on the body poses a hazard, anti-static or conductive footwear can be used. These options reduce the amount of static that accumulates on the body, preventing static electric sparks.

5. PREVENT SLIPS, TRIPS & FALLS

Slips, trips and falls can happen in any workplace and result in many accidents annually. Proper footwear can provide additional protection against slips, trips and falls.

Shoes with appropriate traction can help prevent falls on the same level in slippery environments. They can also prevent falls from ladders, which are all too common when people don't wear shoes with proper treads.

Footwear that fits well and feels comfortable can also improve balance, which will help prevent slips, trips and falls, too.

6. PREVENT FATIGUE

For workers who stand all day, especially on hard surfaces like concrete, fatigue can be a real problem. Muscles in the feet as well as the legs, back and other parts of the body grow tired, and the situation can be worsened when employees don't wear appropriate footwear. Shoes that provide adequate cushioning and arch support can make a person more comfortable, which alleviates strain on muscles. This means employees will grow fatigued less quickly. Employees who are less fatigued will be more alert, so they will likely do their jobs more safely and more efficiently.

Preventing muscle strain will also help protect against musculoskeletal disorders such as chronic lower back pain, too.

7. PREVENT BURNS

Burns from fire can happen in the workplace, but so can burns from chemicals and even from common workplace materials like cement. Footwear made from durable materials can prevent burns from chemicals splashes, molten metal splashes and other dangerous substances that could injure the skin on the feet.

Section - 3: Emergency Preparation- Sticking with the Plan



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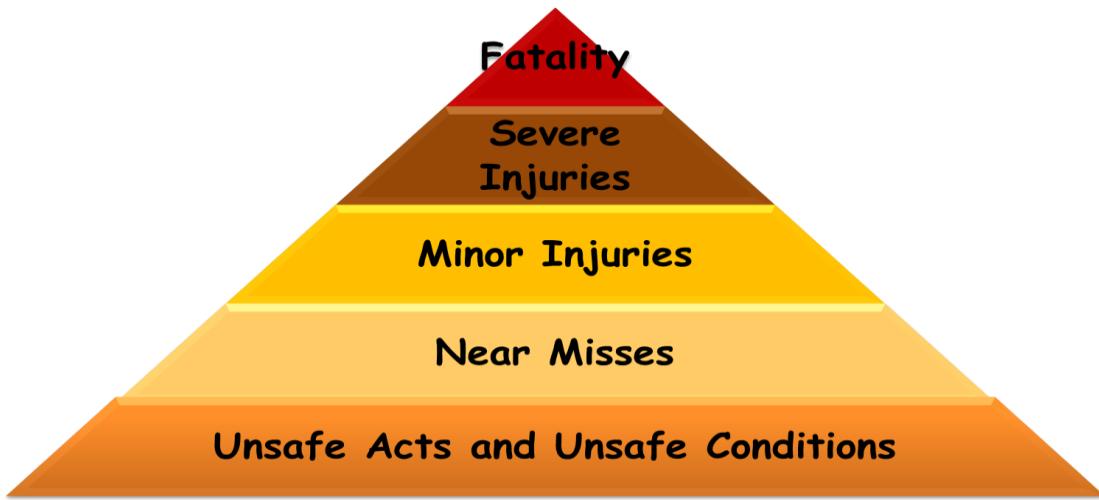
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Section - 4: THE ACCIDENT PYRAMID



This is a representation of the statistics about injuries within the construction industry and also other industries. Year after year injuries happen and they fall right into this pyramid.

Every day we ask ourselves how can we stop accidents from happening on our site? Let us take a look at the accident pyramid starting from the bottom and discuss how we can prevent accidents from happening.

- **Unsafe Acts and Unsafe Conditions:**

The following are examples of unsafe acts and unsafe conditions:

Unsafe Acts

- You not using your PPE or not using the correct PPE
- Working at heights without fall protection
- Ignoring safety procedures
- Disobeying warning signs
- Improper lifting
- Walking under suspended load

- Using defective tools

Unsafe conditions

- Open Excavations
- Defective Tools
- Poor Housekeeping
- Open Excavations
- Missing Machine Guards
- Damaged Equipment
- Lack of Proper Equipment
- Poor Lighting

If we eliminate the unsafe acts and unsafe conditions we can eliminate accidents.

- **Near Miss Incidents:**

A Near Miss Incident is an unplanned event that did not result in injury, illness, or damage but had the potential to do so. We continually ignore **Near Miss Incidents** and they are **Warnings** that tells us that something is not right. Near Miss Incidents tells us that we have unsafe working conditions on site or we are carrying out unsafe acts! All Near Miss Incidents must be reported so the necessary actions can be taken to prevent a serious accident from happening next time.

- **Minor Injuries:**

Minor Injuries are injuries that require basic first aid and also some that require more than basic first aid for example lacerations (cut) or wounds that require a few sutures. These injuries are not life changing and do not affect the workers daily work activities and worker is able to return to work the next day after the injury.

- **Serious Injuries:**

These are life changing injuries such as amputations, major surgeries, broken bones etc. These types of injuries will change your life and those who depend on you.

Finally, at the top we have fatality, statistics has shown that for every 30 life changing or serious injuries, there will be one fatality.

- **Fatality:**

A fatality is not something that we want to happen on our sites. Therefore, we must work on reducing the unsafe acts and unsafe conditions on our sites. If we eliminate these then we can stop the domino effect that comes with injuries. To eliminate serious injuries, we must eliminate unsafe acts and unsafe conditions on site.

Stop Unsafe Acts! Report Unsafe Conditions! Report Near Misses!

Be a Safety Hero and score Accident Zero!

Section – 5: AVOIDING BACK STRAINS AND SPRAINS



Back injuries including sprains and strains are one of the most common injuries found throughout a construction site and in

industry. A strain is an injury to either a muscle or a tendon, the tissue that connects muscles to bones.

A sprain is an injury to a ligament, the tough, fibrous tissue that connects bones to other bones.

With this Toolbox Talk we will address proper lifting techniques, how to reduce the risk of a back strains and sprains and some other general safety tips.

Preparation:

- Ensure that you are wearing proper clothing and PPE
- Steel toe shoes should always be worn when lifting heavy items to protect your toes from fallen loads.
- Gloves are also recommended when lifting certain objects
- Stretch before you attempt to lift a heavy object
- If possible, store materials at waist height to reduce the strain on your back
- Assess the object you are going to be lifting
- Determine the weight of the object before lifting
- Determine best place to grip the object
- Ensure that your travel path is free of slipping and tripping hazards
- Know your own lifting restrictions and capabilities

Get Help:

- Use carts, forklifts and hoists to move materials

- When lifting a load more than 50 lbs (22kg), get help from another worker
- Use carrying tools with handles to carry odd-shaped loads

Proper Lifting Techniques:

- Have your feet spread apart and 1 leg slightly forward to maintain balance
- Your feet should be close to the object
- Bend the knees; back muscles relaxed
- Get a firm grip on the object.
- Keep your back straight and elbows close to your body.
- Lift, keeping the back straight and the arms close to the body, letting the leg muscles take the strain
- At the same time tighten your stomach muscles to provide back support



(Don't hold your breath while doing this)

- While carrying the object **DO NOT** twist or bend at the waist, move your

feet when turning.

- Keep the load as close to your body as possible
- Do not carry a load which obstructs your view

(Use workers to demonstrate the lifting technique)

Other Useful Safety

Tips:

- Take your time! You are more likely to be injured when you are tired
- Lift as smoothly as possible

SECTION – 6: EYE AND FACE PROTECTION

Protecting your eyes is very important because even minor eye injuries can cause lifelong vision problems. For example a projectile such as nail if caught in your eye not only can damage your eye can also sometimes your brain. Cuts on your face can damage muscle tissues and leave life-long scars.



Always
make sure
that you
are using
the correct
eye

protection for the job, make that it fits properly and does not obstruct your view

Causes of Eye and Face Injuries:

- Splashes from harmful liquid chemicals such as acids or cleaning solutions
- Flying debris, chips and dust from grinding, hammering, sanding and windy conditions
- Flying projectiles from objects colliding, falling or being dumped

- Loose straps, cords or banding that breaks or snaps under extreme tension
- Extreme heat and light radiation from exposure to flames, welding or torches

Types of Personal Protective Equipment:

1. Safety Goggles: Enclose the area around the eyes to provide the highest protection against airborne particles, flying projectiles and splash hazards.

2. Safety Glasses with Side Shields: Provide protection against airborne particles and flying projectiles. Safety glasses are made of impact resistant material and many are available with UV protection &/or tinted lenses



3. Weld Masks, Dark Shields, and Torch Glasses: Protect the eyes and face from flying sparks, flash burns, and the intense light that occur during welding, torching, soldering and brazing operations. It is important to match the type and tint of the shade to the welding performed

4. Face Shields: Protect the face from grinding debris, flying projectiles, radiant heat and chemical splashes. Face shields should be used in conjunction with eye protection to be fully protected.



Always Remember! Be Safety Wise Protect Your Eyes!



Section - 7: FIRST AID



Points to Consider:

1. First Aid Treatment must only be provided by a trained and certified First Aider
2. No matter how minor your injuries are you must report it to the First Aider on site
3. Notify your Foreman or Supervisor of any injury
4. Do not leave site without informing your Foreman or Supervisor or Safety Officer
5. If taken to the Clinic or Hospital for treatment report back to your supervisor or Foreman once you are back at work.
6. **Do not remove a seriously injured employee! Notify a First Aider immediately so that they can give the necessary precautionary instructions.**
7. Keep your wound clean, have the dressing done daily
8. Personal hygiene is very important! Wash and dry the skin thoroughly to prevent rashes, irritations and infections.

Section - 8: FIRST AID REQUIREMENTS



Knowles Construction is required to provide first aid equipment to enable first aid to be given to any employee who are injured or become ill at work.

First aid may only be administered by a trained and certified first aider. If you are not trained to do first aid, keep clear and make room for the first aider to do his job.

The appointed first aider for your work site will control the first aid box and make sure that there is sufficient equipment available. All first aid kits must be inspected on a monthly basis. Record must be kept of all injuries reported to the Health and Safety Personnel.

Section - 9: HIGHLY FLAMMABLE LIQUIDS



Highly flammable liquids including petroleum-based adhesives are used extensively throughout the construction industry and carry with them the risk of fire, serious accidents and injury.

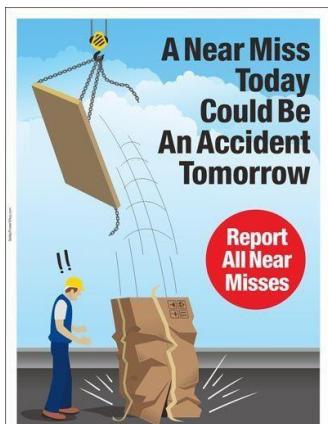
Keep the following in mind:

- **Always look for the hazard symbol and wording on containers.**
- **Keep only the minimum quantities at the place of work.**
- **Keep the remainder in suitable stores.**
- **Keep lids on the container if not in use.**

- Always follow the manufacturers instructions for use of the product.
- Keep away from source of ignition.
- Do not smoke when working with flammable liquids.
- Flammable liquids vapours are generally heavier than air and will accumulate at ground level if it cannot disperse. Beware of drains, excavations and any confined space, both when using and storing flammable liquids.
- Storage areas must be well ventilated and all applicable signage and fire fighting equipment must be placed at storage area.

IF YOU IGNORE HEALTH AND SAFETY THE NEXT PERSON INJURED OR KILLED COULD BE YOU!

Section - 10: NEAR MISS INCIDENT



What Really is a "Near Miss" -

A "near miss" is an unplanned event that did not result in injury, illness, or damage but had the potential to do so. Near Misses are accidents waiting to happen!

The Same Things That Cause Incidents Cause Near Misses

- **Unsafe Acts** - such as improper lifting; walking under an overhead load; working at height without fall protection, not using proper personal protective equipment (PPE).

- **Unsafe Conditions** - such as poorly maintained equipment, oil or grease on floors, welding leads that have been laid in walkways, unprotected excavation, trash and boxes that have been left in walkways.

We never know which “**Unsafe Act**” or “**Unsafe Condition**” will cause an accident injury. What that means is the more risks you take, the greater likelihood of a serious injury, or worse.

Near Misses are Warnings

Letting a near miss go unreported provides an opportunity for a serious accident to occur. Correcting these actions or conditions will enhance the safety on your site and provide a better work environment for everyone involved. Don't let yourself or your coworkers become statistics.

Consider the following examples:

- You trip over an electrical cord plugged into an outlet stretched across a walkway, but you don't fall.
- You drop a heavy object but missed your toes...this time!
- While working on a piece of equipment, you receive a shock, but are not injured.

Those are all near misses and you must take them as warnings! Heed those warnings and change your behaviour to work safer in the future. If possible, fix the problem by removing the hazard or report it to your foreman or supervisor immediately so they can take corrective actions.

If you can eliminate the near misses, you can reduce accidents and serious injuries!

Section - 11: Personal Protective Equipment (PPE)

Hard Hats



Workers must wear hard hats when overhead, falling, or flying hazards exist or when danger of electrical shock is present.

Maintain hard hats in good condition; do not drill; clean with strong detergents or solvents; paint; or store them in extreme temperatures.

Eye Protection



Workers must wear safety glasses, face shields or goggles for welding, cutting, nailing (including pneumatic), or when working with concrete and/or harmful chemicals and to protect against flying particles also when working in dusty environment.

Be sure to wear the proper eye protection for the hazard that exists.

High Visibility Clothing



High visibility clothing or vest is needed if you work when there is low light and poor visibility, especially if you are working around moving vehicles, heavy equipment (cars, trucks and machinery e.g. backhoe, excavator, wheel loader etc.) High-visibility items allow you to be seen by the drivers of those vehicles or equipment sooner and more readily.

Foot Protection



Residential construction workers must wear shoes or boots with slip resistant and puncture-resistant soles to prevent slipping and puncture wounds.

Safety-toed shoes are recommended to prevent crushed toes when working with heavy rolling equipment or falling objects.

Hand Protection



High-quality gloves can prevent injury. Make sure that gloves fit snugly. Always inspect gloves for cuts, tears and discoloration that might indicate excessive wear.

Hands must be clean before putting gloves on and always thoroughly clean gloves exterior before removing them.

Fall Protection



Use a safety harness system for fall protection, whenever you are working at 2metres and above.

Where fall prevention cannot be installed, use a "personal fall arrest system". A personal fall arrest system includes an anchorage, full body harness, and connector such as a lanyard or lifeline.

Body Protection



Clothing to protect the body should consist at a minimum of long work pants and a sleeved shirt. When hazardous liquids, gases, vapors or debris are present, the level of protection needed increases. This may include garments of Tyvek, PVC, Cotton Coverall etc.

For jobs that leave clothes very contaminated, bring a set of clean clothes to change into at the end of the day. Wash contaminated clothing separately.

Hearing Protection



Wherever it is not feasible to reduce the noise levels or duration of exposures, ear protective devices shall be provided and used.

Ear protective devices inserted in the ear shall be fitted or determined individually by competent persons.

Respiratory Protection

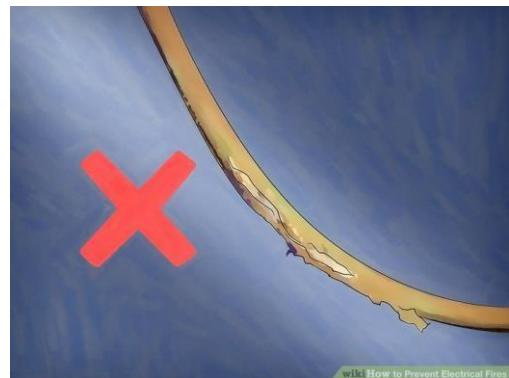


Dust Mask must only be used to for protection from "dust"

Select the correct respirator based on the hazard. Respirators must be used for protection from chemicals. Inspect the respirator for missing or worn respirator parts. Depending on the type of respirator, the employee must be medically cleared, trained and respirator fit tested prior to respirator use.

Do not share respirators and only use the respirator that you have been fitted for.

Section – 12: Preventing Fires Caused by Electrical Cords



Electricity is something we all take for granted. It does its job day after day without us seeing it or even giving it a second thought. But this complacency can lead us to ignore potentially unsafe conditions that, if left unchanged, can lead to a fire starting, or even an electrocution.

Here are a few examples of such conditions that you must **NEVER** do:

- **Using staples, nails or similar devices to attach electrical cords to wall**- Nails, staples, wire and similar objects can break

through the insulating jacket of electrical cords; either immediately when they are applied or later after months or even years of wear and tear. This could eventually lead to sparks or excessive heat building up and igniting a fire.

- **Running electrical cords through doorways or windows**- If the door or window gets closed, the cord could become pinched which can damage the outer protective coating of the cord. This too could eventually lead to sparks or excessive heat build-up, igniting a fire.
- **Using electrical cords rated for indoor use outdoors**- Cords intended for indoor use only are not designed to stand up to extreme outdoor conditions- such as cold, ice wetness or excessive heat. These conditions can weaken the cord and cause it to deteriorate, which can lead to sparks or excessive heat build-up igniting a fire. Check the tag on the cord or the packaging it came in to determine where it is and is not designed to use.
- **Overloading an electrical cord**- Electrical cords are designed to provide for a certain amount of electricity to be drawn through the cord (usually expressed as "amps" or amperage) Overloading a cord by using it to power equipment that draws too much current can cause it to over-heat, possibly starting a fire. Check the tag on the cord or the packaging it came in to determine the maximum amperage for which the cord is rated and compare that to the amperage drawn by the equipment attached to that cord.
- **Leaving unsafe electrical cords in service**- If you find a cord that is being used improperly or is damaged, please notify your

Safety Officer or Supervisor immediately or turn into the person responsible for replacement or repair. **DO NOT** try to repair a cord unless specifically authorized. Your quick action could prevent an unfortunate accident from occurring.

Always remember that defective or damaged electrical cords must be taken out of service!

Section - 13: PREVENTING POLLUTION



Pollution not only threatens today's generations, but also those of tomorrow - our children and in turn their children. Not only is there a legal obligation to prevent pollution there is a moral one.

Pollution has an effect on the air, ground and water. Pollution comes in the form of smoke from factories, fumes and vapors from chemicals used or outlet from vehicles, fuels and oil being spilled, these are only but a few of the forms of pollution which causes harm

to our environment. We contribute to pollution by waste generated and not recycling.

How can we prevent pollution?

- When using hazardous chemicals use them with care do not dispose of it into drains or dump it in a land fill site.
- Large fuel tanks used on site must be placed in a bunded area which could hold 110% of the content of the tank.
- Turn off plant and machinery when not in use; avoid the running of engines if not required.
- Maintain all plant and machinery in a good running condition.
- Repair oil and fuel leaks on plant and machinery immediately.
- Contain any spills and clean up immediately.
- Avoid wasting water, use it wisely.
- Wash vehicles only in designated wash bays.
- Make use of approved waste collectors to remove any hazardous waste from your work area or site.

Section – 14: SAFETY IS COMMON SENSE



According to safety professionals, four of five serious injuries are the result of workers not being thinking on the job and taking unnecessary chances.

Common sense on the job is irreplaceable. Most of us have worked around people that are accident prone. They aren't jinxed; they aren't very common-sense smart. Today we want to talk about using common sense to avoid accidents in the workplace.

Common Sense "smarts"

- Always wear the proper personal protective equipment (PPE), hard hat, safety glasses, safety boots, gloves etc.
- Organize and clean-up your work area as you work
- Guard power tools and moving electrical and moving machine parts
- Check electrical cords and wires for any damage
- Inspect portable ladders to make sure they are secure and don't shake or wiggle.
- Don't overextend yourself when on ladders and risk losing your balance.
- Don't overexert yourself, get help with heavy tasks
- Fire Extinguishers must be properly mounted and readily accessible
- Put rails on all stairways
- Label chemicals when removed from original container - Always use the proper tool for the job.
- Concentrate on your work.
- Look for unsafe acts or unsafe working conditions and then report them.

- Watch out for others; remember you are part of a team.

Ask yourself the following questions before you begin to work:

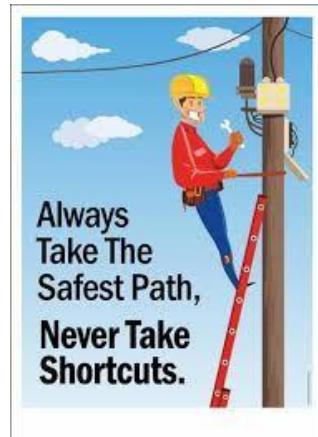
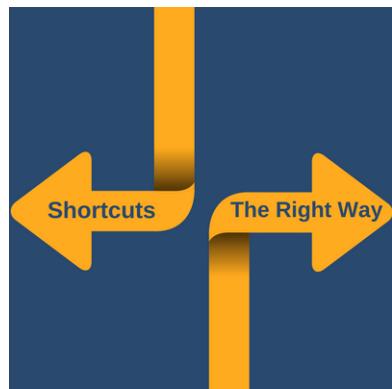
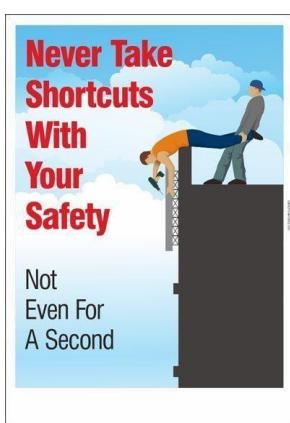
- Are the conditions safe to do the work?
- Are the methods we are going to use safe?
- Does everyone know what to do?
- Does everyone know how to do it?
- Can I fall, get struck by, get caught between or under or get electrocuted on this job?

Reminder:

By remembering and following common sense rules and by asking yourself about the conditions, methods, job site hazards and knowing what to do, you should be able to decrease your chances of being injured.

Be “common sense smart” and prevent accidents, not cause them.

Section - 15: SHORTCUTS



Question: Nearly everyone we know uses short cuts to get the job done?

Answer: Generally, yes.

Basically, most of us are just thinking about getting the job done and we tend to not rationalize the risk of getting injured. We think to ourselves that we have done this job many, many times this way and nothing bad has happened. Therefore, nothing bad will happen to us today.

Common Safety Shortcuts:

Taking shortcuts when it comes to safety can manifest in many different ways. Some common types of safety shortcuts that occur in many workplaces:

- **Not implementing all necessary safeguards.** Almost every work task has several safeguards that are to be implemented prior to work beginning. Each safeguard that is implemented is one more way to protect yourself and others from injury.
- **Not wearing the necessary and correct PPE.** PPE is the last line of defense for workers. You never know when you may need it.

- **Rushing during tasks or not taking the necessary time to do certain tasks.** Many things can be missed when rushing during a work task. This can lead to incidents occurring.

Ways to Avoid Taking Shortcuts:

- Hold yourself to a higher standard. Do not take the easy way out. Take the time and energy to perform tasks correctly. Make it a habit to follow safety policies and procedures.
- Help set the expectation that shortcuts are unacceptable when it comes to safety. If coworkers see you taking shortcuts, they are more likely to do so themselves.
- Realize that shortcuts affect more than just you. They can result in negative impacts on production, property damage, as well as injuries.
- If facing a perceived time pressure, evaluate whether it is a self-imposed time pressure. Many times individuals put pressure on

themselves to perform a task faster when there is no real outside pressure to get a work task completed.

- Preplan work tasks well ahead of time so the necessary tools, training, personnel, safety equipment, time, etc. are available. Having all the necessary items for work tasks can help to avoid the urge to take shortcuts.

Remember: Although we all use short cuts in our daily routines, we must be aware of the dangers that short cuts expose us to.

Section - 16: The Importance of Risk Assessment

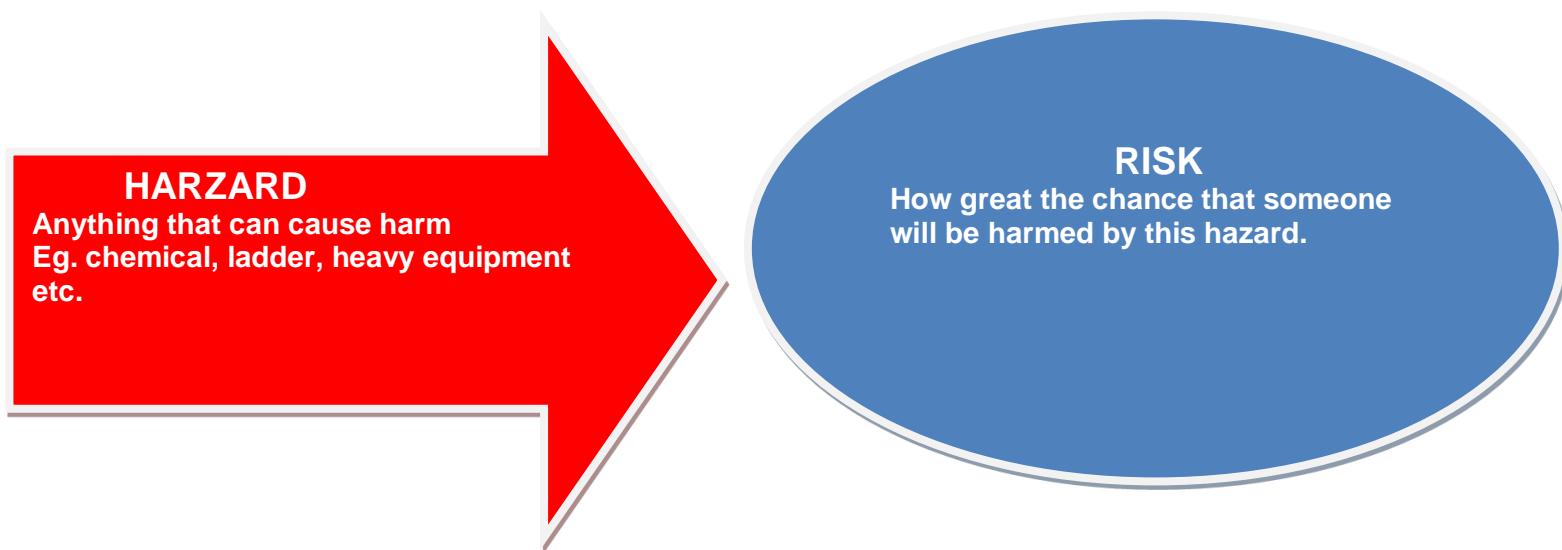
What is a Risk Assessment

Risk assessment is understanding and sometimes rating how serious a given risk might be for a worker. Primarily, a risk assessment identifies the chance of harm or loss occurring due to a hazard.

Why do Risk Assessments

Before starting any task you must stop and think:

- What are you about to do?
- What are the potential hazards associated with the task, or what can potentially hurt me?



- How may the risk from these hazards be controlled?
- Have you been given any rules or instructions which relate to the job?
- What is the safe way of doing the job?

- Are you entirely happy that you can do the job in a safe manner? If you have any doubts or concerns after asking the questions, stop and consult your Manager or Supervisor.

These are important questions that can be address by using a Risk Assessment. It is always important to carry out a Risk Assessment before starting the job.

Risk Assessment- Recognize the hazard- Assess the risk- Implement Control measures- Document it.

SECTION - 17: TOOLBOX TALK - TRAFFIC SAFETY



Highway and street construction workers are at risk of both fatal and nonfatal injuries when working near passing motorists, construction vehicles, and equipment. Each year, more than 100 workers are killed and over 20,000 are injured in the highway and street construction industry.

JACK'S STORY

Jack was working as a flagger on a construction crew of 11 workers paving the northbound side of a six-lane highway. A motorist did not see him. Jack was hit by the car and ended up in the hospital.

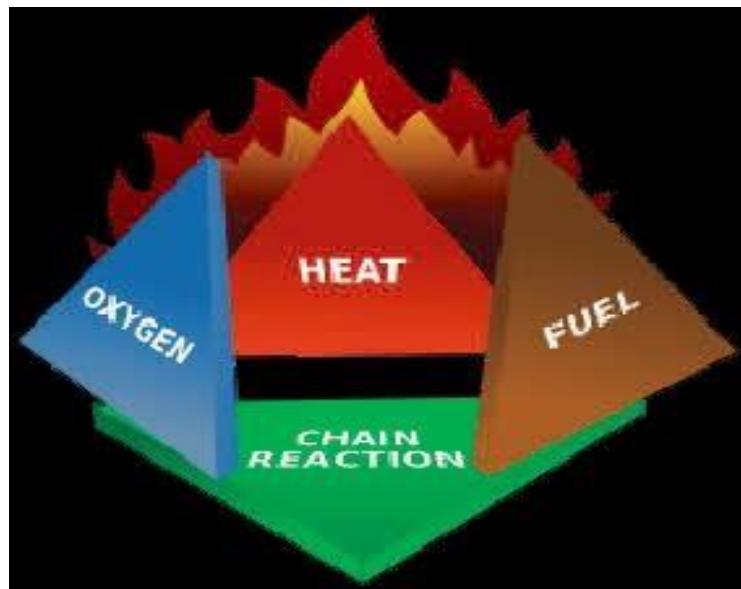
Have you or someone you know been injured or nearly injured while working on a highway or street project? If so, what happened?

REMEMBER THIS

- To reduce their risk of injury from road traffic, workers and crew leaders can take the following actions:
- Wear high visibility clothing with a fluorescent background or reflective materials, including vests, arm bands or hats.
- Be aware of your surroundings, and identify potential hazards.
- Stay out of lanes or areas where walking is prohibited.
- Make sure you are aware of and understand hand and other communication signals that will be used on the jobsite.
- Listen for reverse-signal alarms.
- Ask your supervisor about closing the road, rerouting to control traffic or setting up barriers (concrete is more protective than cones).
- Have a traffic control expert walk or ride through the jobsite to look for evidence of near misses, such as skid marks or damaged barricades.

- Use traffic control devices such as signs, warning signals, and concrete barriers consistently throughout the entire work area.
- Have flaggers use devices that increase their visibility. For example, a flashing Slow/Stop paddle with a mounted strobe light has been found to be effective.

Section -18: FIRE SAFETY



Basic fire safety knowledge is an important skill that can save your life on or off the job. Here we will breakdown basic characteristics of a fire, important fire safety tips, what to do if you find yourself involved with a fire and some discussion points for your group.

Characteristics of Fire:

- To support a fire, you must have; **HEAT, FUEL, OXYGEN**, and **SUSTAINED CHEMICAL REACTION**

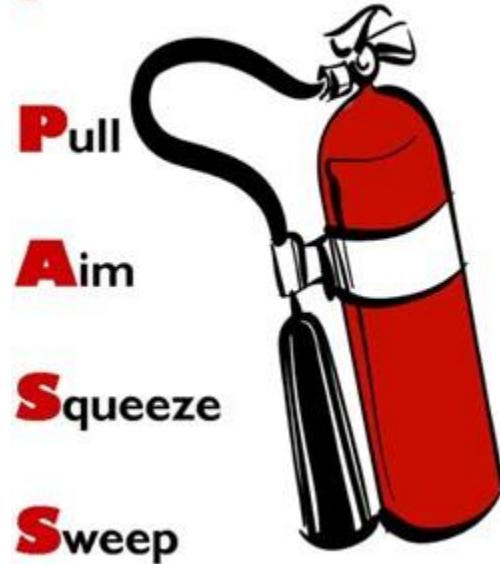
- A small fire can grow out of control in as little as 30 seconds.
- A room with a fire can have a temperature of 100°C at floor level and 600°C at eye level. In less than 5 minutes a room can flashover.
- Fire starts bright but will quickly turn the room pitch black from releasing smoke and toxic gases. Be familiar with your surroundings and evacuation routes!

Fire Safety Tips

- An important fire safety tip is to look for and eliminate any potential fire hazards before they become a reality!
- Know where the extinguishers are located.
- Time is the biggest enemy, get out of the building!
- If there is a fire, pull nearest fire alarm if available, if not, call for help from a safe location outside.
- If there is smoke, stay as low to the ground as possible.
- If you are in a building, if it is safe to do so. close all doors behind you as you leave the building.
- Don't use the elevator for evacuation because the shaft can act as a chimney. Elevators also present an entrapment hazard if they fail.
- Never return to a burning building.

Familiarize yourself with the nearest fire extinguishers!

Remember!



Section – 19: BASIC ELECTRICAL SAFETY



With this toolbox talk we will shed light upon basic electrical safety geared towards non-electricians.

Extension cords/Power Strips

- Extension cords should not be used in place of permanent wiring.

- Ensure that cords are in proper working condition (the outer insulation should not be cracked/broken, the ground pin needs to be intact). Discard unsafe extension cords.
- Only licensed electricians are authorized to replace plugs, or splice cords.
- Extension cords need to be protected from motor vehicles, forklifts, pallet jacks, heavy pedestrian traffic, etc.
- Power strips should not be permanently mounted to a wall or any other structure, even if the power strip has specific mounting fittings.
- Power strips or extension cords should not be connected to each other. Doing this can overload the circuit creating a potential fire hazard.

Circuit Overload Protection Devices:

These devices are designed to protect the wiring in a house/building and to prevent a potential fire.

- **Fuses**- Break the circuit when too much current is flowing through the circuit. A small conductor inside the fuse heats up and melts when it reaches a specific temperature.
- **Circuit Breakers**- As current increases in the circuit, an electromagnet inside the breaker generates increased magnetic force, eventually being great enough to pull the switch on the breaker from the "on" to the "off" position.
- **Ground Fault Circuit Interrupters** GFCIs are designed to protect people from an electric shock. A GFCI works by detecting a current drop from the hot to the neutral wiring in a circuit. The GFCI detects energy that is escaping the circuit. GFCIs should be

installed wherever a water hazard is present. You will commonly find GFCI plugs on hairdryers, wet vacs, etc. GFCIs can be at the breaker, the outlet, incorporated with the plug of the appliance/piece of equipment, or part of a short extension cord.

Other common Electrical Safety Issues

- Discard any piece of equipment that gives you even the slightest shock. If the resistance through your body is lowered i.e. standing in water or touching metal, even the slightest shock can be deadly.
- Never use electrical equipment in or around water.
- Junction boxes and electrical panels need to have proper covers in place to conceal all wiring.
- Hard wiring should not be exposed/accessible to non-electrical employees.

Section – 20: BREAKING **BAD** HABITS AND MAKE **SAFETY** A HABIT

"Habit is the deepest law of human nature"

Most of us would probably agree with that. People are quite often influenced by habit. Habit and job safety is also closely related. If you form safe work habits, it's going to reflect positively in everyone's job safety. There are seven (7) common "human factors" related to developing safe work habits. Let's review them.

- Hazard Recognition

Recognition of hazards is an important factor. By constantly being on the lookout for hazards you enhance your own safety. In watching for hazards, you must consider not just the obvious ones, but also hazards which might suddenly appear through some action of another person or a chain of unusual circumstances. Whenever a hazard is detected, report it to someone who can make the change.

- **Avoiding Indifference**

Avoiding indifference on the job is important to safety. An individual might know the right way to do his or her particular job, and just ignore it. Sometimes the most experienced person who has had the safety related training might tend to avoid doing the job the right way. Or there may be the employee who does not know the safety procedures and instead of finding them out chooses to also ignore them. These kind of indifferences on the job can and do lead to trouble and accidents.

- **Eliminating "Daredevil" Behavior**

Ok admit it, have you ever done or known anyone who has done a daredevil stunt or taken a quick chance? How about standing on the top rung of a ladder? Everyone knows you should not do that, sometimes the ladder is even posted "do not stand above a certain level" but we do it anyway. Eliminating "daredevil" behavior is another human factor that can prevent injury on the job and at home.

- **Setting a Good Example**

Setting a good example is another factor to consider. We have all heard this statement before. "If you set a good example then others will follow". Think about how your actions at work and at home may affect the attitudes of others. The actions of all of us have an influence on the safety-mindedness of others. Think of it this way, when you are in your car traveling to one place or another do you leave room between cars or do you have a tendency to tailgate? Think how the other person may feel, stressed, I bet. If a veteran employee follows the safety rules then the newer employee may follow their lead but on the other hand if we condone the unsafe acts of others then that behavior may be what we now call the culture of the company.

- **Avoiding Impulsiveness**

Another link in the chain of job safety is avoiding impulsiveness or being in a hurry. Haste is a trait that often leads to accidents. We are using our time foolishly if we don't take the time to be safe. Many valuable timesaving suggestions are contributed by employees each year, but, these timesaving suggestions should be reviewed and approved before they are used. Haste can result in injury!

- **Controlling Impatience**

Controlling impatience and temper is equally important to job safety. If we let emotions get out of control, an accident can easily occur. Statistics prove that on-the-job violence is on the increase in our country. Do you have programs in place that identifies potential problems before tempers get out of control? What kind of programs do you have established to get help for your employees.

- **Proper Training and Instruction**

Finally, one of the most important human factors related to safe work habits is training. From the day we are born we are being trained. Some of this training or learning may have been good, and we probably picked up some bad habits along the way. Job training and safety go hand in hand. While the supervisor is responsible for training, each employee must be responsible to ask questions if instructions are not clear or if there are any doubts about procedures. Unfortunately, some experienced employees may be so familiar with their jobs that they become inattentive, and this too is hazardous.

Proper "Work Habits" can assure "Job Safety"

Overall, the responsibilities for developing safe work habits really belong to each of us. By being aware of the "human factors" we've just reviewed, safe work habits can be formed and job safety assured. This can and does affect your bottom line.

Section – 21: HAND & POWER TOOLS



Often we overlook the hazards associated with the common tools that are used on a daily basis. With this talk we hope to bring some awareness to the potential hazards of these tools and how to minimize these hazards.

Training:

- Each employee using hand and portable power tools must receive initial training and an annual refresher.

Pre-Inspection (To Do before every using every tool):

- Damaged or cracked housing, power source, or bits/accessories
- Dull blades are often more dangerous than sharp blades
- Missing guards or protective devices
- Leaking gasoline, oil or other fluids
- Tool appears to be in poor condition
- Does the tool have a 3-wire cord; if not is it double insulated?

- Ensure area is free of any potential trip hazards
- Do not underestimate the importance of a clean work area

Proper Use:

- Ensure you are wearing the correct PPE
- You should always wear eye protection
- Use the proper tool for the job
- Follow the manufacturer's instructions
- If unsure about use, ask a supervisor or coworker for clarification
- Ensure tools are not pointed at or operated in close proximity to other individuals
- Use spark resistant tools when working near a fuel source
- Do not use excessive force to cut/drill through hard materials
- Gasoline/Mixed Fuel Powered Tools must be off and cool when refueled, use only in well-ventilated areas.

Storage:

- Drain fluids (gasoline) if equipment will be in storage for an extended period of time
- De-energize tool prior to storage (includes removing air pressure, hydraulic pressure).

- Store electric tools in dry areas

Group Discussions:

- Has anyone in the group been injured by a power tool or had a close call? How could this injury have been prevented?
- What tools present the greatest hazard in your work environment? How can you minimize these risks?
- Are there any tools that need to be repaired or discarded? If so, take time to do this immediately after this talk.

Section – 22: HARD HAT



Your head is the most important part of your body. You think, feel, talk, smell and hear with your head. Therefore, it makes sense that you should protect your head from any injury.

Wearing a hard hat is the first line of defense against head injuries on the job site.

A hard hat can protect you by;

- Acting as a rigid shell that resists and deflects blows to the head.
- Shielding your scalp from any falling or projecting objects.
- Protect your head against the hazards of falling materials and guards against accidental bumping.

- Act as a shock absorber by softening any blow and distributing its impact over a large area.
- Shields your scalp, face, neck and shoulders against spills or splashes.
- Act as an insulator against electrical shocks.

The ability of a hard hat to protect a worker depends on the shock absorber space between the shell and head provided by the suspension. Therefore, it is important that the sweatband and the suspension strap be adjusted properly to obtain maximum protection.

Sunlight and heat can rot the sweatband and suspension straps; therefore, don't leave a hard hat on window ledge of your car. Don't drop it, throw it, write on it, paint it or use chemicals to clean it.

Take good care of your hard hat

Section: 23: HAZARD RECOGNITION



Safety is a way of life and should be thought about so often that it simply becomes second nature. Recognizing the hazards is an important part of keeping you and your co-workers safe.

Making Hazard Recognition Second Nature

- Review safety procedures for your job and work area daily
- Understand how unsafe acts can lead to accidents
- Participate in safety training every opportunity you get
- Use your safety knowledge in all aspects of your job, every hour of the day
- Help instruct new workers in identifying potentially hazardous situations

Identify Unsafe Acts

- Be aware of your surroundings
- Many hazards are obvious to those who open their eyes and minds to see them

Correct Potential Hazards

- Hazard recognition is valuable only when corrective action is taken
- Report all potential hazards to your supervisor
- Work with your supervisor to make sure hazard is corrected and communicate with co-workers so they don't cause any potential hazards
- Be a safety coordinator for your work area and stress the importance of safety to your co-workers.
- If you are not sure what to do, **ASK**

It helps to remember the Five P's: Prior Planning Prevents Poor Performance!

Identify Hazards! The following questions should be asked, to help predict what could go wrong and how risks might be controlled:

- Are the necessary materials available to perform the work safely?
- Does everyone have the proper tools to perform the tasks at hand?
- Are there enough workers to handle the job? Have they all had safety training?
- Are environmental conditions such as light, noise and weather a factor?
- Are there too many people in the area to work safely?
- Has everyone on the job been notified about hazardous tasks or materials?

Don't wait for accidents to occur! Think and plan ahead!

Anticipate, Evaluate and Control Hazards!



SECTION – 24: HOUSEKEEPING IS SAFEKEEPING AT WORK



— GOOD —
HOUSEKEEPING
PROMOTES
SAFETY
DO YOUR PART



"You never get a second chance to make a good first impression." Never has this phrase been so true as when it comes to housekeeping at work. The negative impressions and implications of poor housekeeping can affect you and co-workers for a long time to come. Morale is lowered for most people who must function every day in a messy, disorderly work environment, although they may not be aware of the cause.

If your housekeeping habits are poor, the result may be employee injuries or even death and even difficulty in securing future work. How can such a "minor" issue have such serious consequences?

Here are some results of poor housekeeping practices:

- Injuries, when employees trip, fall, strike or are struck by out of place objects;
- Injuries from using improper tools because the correct tool can't be found;
- Lowered production because of the time spent maneuvering over and around someone else's mess, and time spent looking for proper tools and materials;

- Time spent investigating and reporting accidents that could have been avoided;
- Fires due to improper storage and disposal of flammable or combustible materials and wastes;
- Substandard quality of finished products because of production schedule delays, damaged or defective finishes, ill-equipped employees, etc.
- Lack of future work due to a reputation for poor quality;

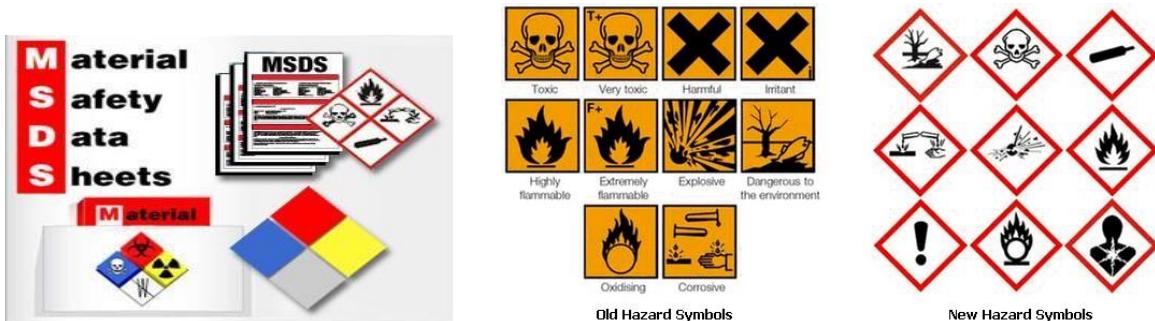
General Housekeeping Rules to Remember are:

- Clean up after yourself. Pick up your trash and debris and dispose of it properly or place it where it will not pose a hazard to others. Institute a routine cleaning schedule.
- Keep your work area clean throughout the day. This will minimize the amount of time needed to clean a "larger mess" at the end of the day.
- Dispose of combustibles and flammables properly. If improperly discarded, they will increase the potential for a fire.
- Remove protruding nails and other sharp objects or hammer them flat to prevent someone from stepping on them or snagging themselves.
- Stack materials and supplies orderly and secure them so they won't topple.

Do you value your health and safety, your work reputation, as well as your future employment? If you do, practice these general housekeeping rules.

**An uncluttered workplace shows respect for those who work there.
Help keep it that way!**

Section – 25: IMPORTANCE OF SAFETY DATA SHEETS



Section 1, Identification

Includes product identifier; manufacturer or distributor name, address, phone number, emergency phone number; recommended use; restrictions on use.

Section 2, Hazard(s) identification

Includes all hazards regarding the chemical; required label elements.

Section 3, Composition/information on ingredients

Includes information on chemical ingredients, trade secret claims.

Section 4, First-aid measures

Includes important symptoms/effects, acute, delayed; required treatment.

Section 5, Fire-fighting measures

Lists suitable extinguishing techniques, equipment, chemical hazards from fire.

Section 6, Accidental release measures

Lists emergency procedures, protective equipment; proper methods of containment and cleanup.

Section 7, Handling and storage

Lists precautions for safe handling and storage, including incompatibilities.

Section 8, Exposure controls/personal protection

Lists OSHA's Permissible Exposure Limits (PELs); Threshold Limit Values

(TLVs); appropriate engineering controls; personal protective equipment (PPE).

Section 9, Physical and chemical properties list the chemical's characteristics.**Section 10, Stability and reactivity** lists chemical stability and possibility of hazardous reactions.**Section 11, Toxicology information** includes routes of exposure; related symptoms, acute and chronic effects; numerical measures of toxicity.**Section 12,**

Ecological information provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment.

Section 13, Disposal considerations provide guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices.**Section 14, Transport information** this section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail or sea.

Section 15, Regulatory information this section identifies safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS.

Section 16, Other information, includes the date of preparation or last revision. Other useful information also may be included here.

Section – 26: INSPECT YOUR SLINGS



Inspecting your synthetic web slings prior to use is one of the easiest ways to prevent a serious accident from occurring. By adhering to the following suggestions, you can spot potential problems before you find yourself, literally, over your head in trouble.

1. Inspect your equipment before, during and after use.

This increases your chance of catching a defective sling before anyone uses it.

2. What do you look for when you inspect a sling?

Look for obvious abnormalities in the integrity of the material. Run your hands along the fabric and feel for irregularity such as tears, holes, snags and frayed areas. If your sling is exposed to sharp edges, broken and/or worn stitches may be evident. Most slings are made with a red warning string in the core of the material. If the sling is heavily worn, the warning string will show through. Also, check the fittings to make sure they are not distorted out of normal shape.

3. What if you find something defective about a sling?

Take it out of service immediately. Don't use it for even one more pick. Cut it into pieces and throw it away! Also, do not use it at home! If you wouldn't use a defective sling at work, why would you use it at home?

3. Do chemicals or heat affect slings?

Yes! Slings can be affected by chemicals without showing any real signs of wear. This is where a good visual and hands-on inspection can pay off. Know what chemicals your slings are contacting and how they affect the material your slings are made of. Check for burns or melted areas when working around hot work operations. Remember, your sling is made from man-made materials, and all synthetics break down after prolonged exposure to the ultraviolet rays of the sun. Inspect carefully for such damage.

4. Know the rating of your sling

Your sling is marked to show the trademark or name of the manufacturer, the stock number and most importantly, the Safe Working Load (SWL).

If the specifications on the sling do not match what you will be doing with it, this sling is not rated for your purpose! Do not use if it isn't rated for the capacity you need!!!

5. Document your sling inspections.

Maintain documentation on all sling inspections that you perform while the sling is in use. This ensures that inspections take place and lessens the chance of an accident due to sling failure.

Slings are expected to wear out and be replaced at regular intervals. How heavily they are used, and how they are used, should indicate how often they need to be replaced. A good sling inspection program will ensure that slings with the potential of causing an accident are not being used in your operation. Don't risk damaging goods--or worse yet, injuring workers--due to a worn-out sling!

Take Good Care of Your Equipment!

Section – 27: LOOK OUT FOR YOUR COWORKERS



Look around at your co-workers. Some are your friends during work hours, and even after work. You know about their families, what they like and don't like, and what they do for fun.

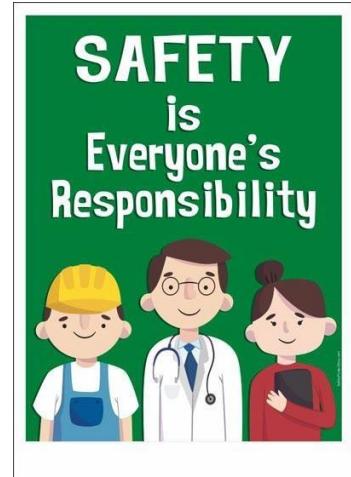
So, be on the lookout for unsafe conditions and correct them, or report them to your Supervisors as soon as possible. Help your fellow workers get through the day without an accident by saying the following:

- I will help you lift those heavy items, so you don't have to do it by yourself. I know a back injury can mess up your home life, as well as your ability to work.
- I will be sure to inspect those slings before you lift a load. I know that you are depending upon them to hold the weight of the load until it is set down.
- I will inspect that ladder and make sure it is in good condition before I set it up for you to use. I will set it at a good 75 degree angle so it won't slip while you're on it.
- I will be certain that the guardrails, mid rails and toe boards are in place before you get up on that scaffolding, because I know a fall could lead to your serious injury or death.
- I will make sure that all passageways and walkways are clear so you won't slip, trip or fall.
- I will label all containers in the workplace, so you don't use the wrong product for a job by mistake.
- I will check the backup alarms on our heavy equipment, because I can't always see you, and I want to make sure you can hear me.
- When I'm welding, I will always set up the welding shields so the flash won't burn your eyes.

- I will tag and report all tools that aren't working properly so you won't be injured by plugging in a tool that has a faulty wire.
- I will know and practice the emergency evacuation procedures, so we can both get out of an unsafe condition together.

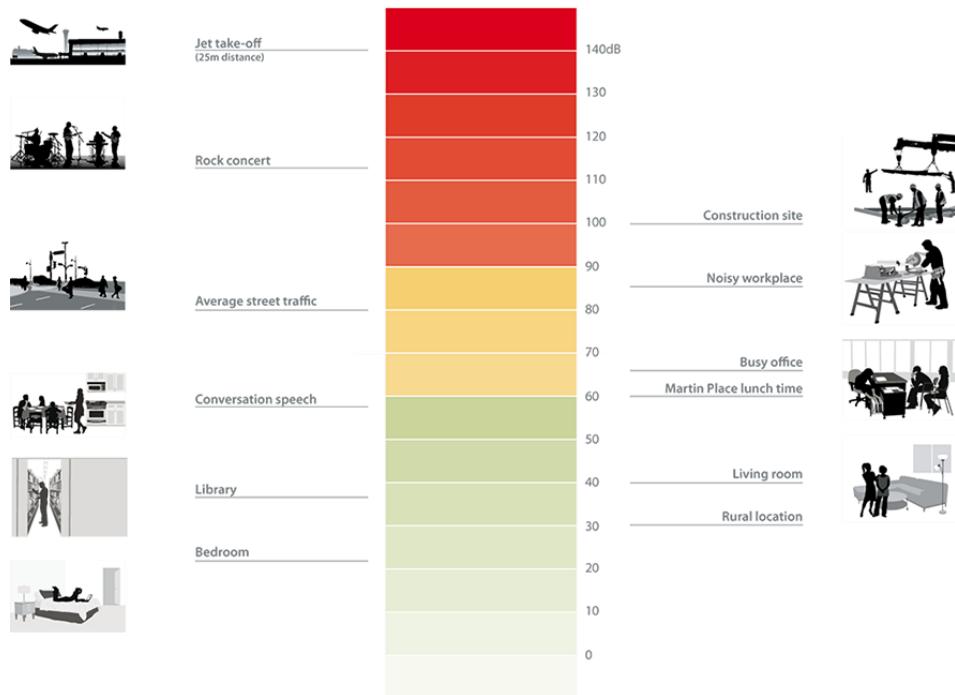
Finally, I want to see you leave work exactly the way you arrived. So, if I see you doing something the wrong way, I'll show you the right way to do it. Of course, I expect you will do the same for me-after all, shouldn't everyone on the team watch out for each other?

Always Remember Safety is Everyone's Responsibility



Section - 28: NOISE AND EAR PROTECTION

Example noise levels



Hazardous noise is unwanted sound that is capable of harming hearing. Hazardous noise is usually loud, but some high-pitched noises can harm the ears without being heard. Hazardous noise can cause pain and even nausea when the exposure is severe, and can lead to hearing loss. This noise induced hearing loss is 100% preventable but once acquired, hearing loss is irreversible.



1. Wear ear protectors if the noise is 85 dBA or more
2. Do not enter a noise protection zone without the required PPE
3. Keep machine covers closed when operating the machine
4. Do not keep machinery running unnecessarily
5. If possible, shield noisy processes
6. Make sure that the earplugs fit into both ears that they are inserted correctly
7. Only use disposable earplugs
8. Hands should be clean when handling all types of earplugs



9. The ear protectors shall have a good fit to the head and the collars shall fit tightly to the ears

- Hearing Loss is usually painless and the symptoms can be hard to identify and may go unnoticed
- Noise that causes pain in the ear is an indication that the noise is at a too high level
- Any exposure to the ear at 140dB or higher can cause immediate and permanent hearing loss.

Do's

- If possible, restrict noisy activities to certain times of the day
- Adhere to working hours - some sites are only consented to work at certain times
- Plan deliveries by arranging routes and times to minimize potential nuisance to the local community
- If possible, keep noisy plant away from public areas
- Minimize drop heights into hoppers, lorries and other plant
- Use local screening where necessary noise can be reduced if a screen is placed between plant and a nearby sensitive location, i.e. house screens can be straw bales or ply board
- Use silenced generators and tower lights where necessary
- Minimize vehicles and plant reversing -try to park facing out

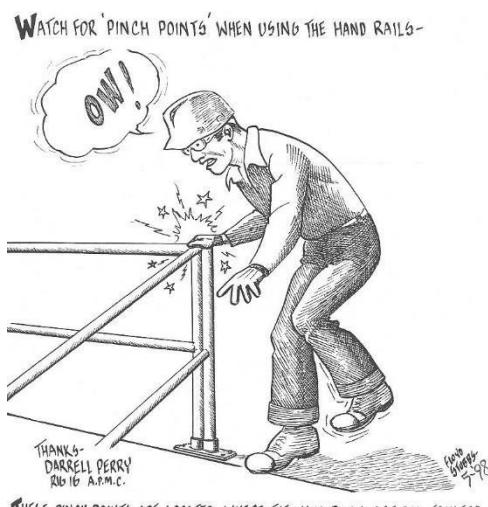
Don'ts's

- Undertake noisy works outside of normal working hours, in the evening, at night or early in the morning

- Leave doors and hoods open on plant
- Leave plant running unnecessarily
- Use poorly maintained plant
- Shout or talk loudly where this could cause annoyance
- Undertake activities that could cause damage to nearby structures through vibration unless approved by your Supervisor



Section – 29: PINCH POINTS



THESE PINCH POINTS ARE LOCATED WHERE THE HAND RAILS ARE DIS-JOINTED AND NOT INTER-CONNECTED. WARNING PAINT SHOULD EMPHASIZE THE DANGER.



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A pinch point is produced when 2 objects come together and there is a possibility that a person could be caught or injured when coming in contact with that area. Pinch Points commonly impact fingers/hands, but can impact any area of the body. The injury resulting from a pinch point could be minor as a blister or as severe as an amputation or death. Conveyors, gears, loaders, compactors and other moving equipment are examples of machinery with pinch points.

Common Causes of Injuries from Pinch Points:

- Not paying attention to the location of hands and feet
- Walking or working in areas with mobile equipment and fixed structures
- Poor condition of equipment and guarding
- Dropping or carelessly handling materials or suspended loads
- Not using the proper work procedures or tools
- Reaching into moving equipment and machinery

Safety Control for Pinch Points:

- Machine guarding: verify all guarding is in place and effective
- Personal Protective Equipment: Heavy-duty gloves, metacarpal guards, forearm guards etc. **DO NOT WEAR GLOVES AROUND ROTATING EQUIPMENT**
- Pre-work inspection: identify potential pinch points before starting work
- Always make sure mobile equipment operators know your location
- Lock Out/Tag Out Always make sure mobile equipment is de-energized before starting any maintenance work

- Alertness: Drowsiness leads to inattentive works habits and shortcuts
- Operating manuals and work procedures: Always review these before starting work; pinch points may also be identified in these documents

Section - 30: Toolbox Talks Master List

No.	Title	Category
1	7 Ways How Safety Shoes Protect You	H&S
2	A Good Safety Attitude	H&S
3	Accident and Incident Reporting	H&S
4	Accident Pyramid	H&S
5	Avoiding Back Strains and Sprains	H&S
6	Eye and Face Protection	H&S
7	First Aid	H&S
8	First Aid Requirements	H&S
9	Highly Flammable Liquids	H&S
10	Near Miss	H&S
11	Personal Protective Equipment	H&S
12	Preventing Fires Cause by Electrical Cords	H&S
13	Preventing Pollution	ENV
14	Safety is Common Sense	H&S
15	Shortcuts	H&S
16	The Importance of Risk Assessment	H&S
17	Traffic Safety	H&S
18	What does an Accident Cost	H&S

19	Working Around Heavy Equipment	H&S
20	Barricades and Warning Devices	H&S
21	Basic Electrical Safety	H&S
22	Breaking Bad Habits and Making Safety a Good Habit	H&S
23	Emergency Response Preparation Sticking with the Plan	H&S
24	Fire Safety	H&S
25	Hand and Power Tools Safety	H&S
26	Hard Hats	H&S
27	Hazard Recognition	H&S
28	Housekeeping is a Safe Keeping at Work	H&S
29	Importance of Material Safety Data Sheets	H&S
30	Inspect your Slings	H&S
31	Look Out for Your Co-Workers	H&S
32	Noise and Ear Protection	H&S

No.	Title	Category
33	Pinch Points	H&S
34	Safe Lifting Signalers and Riggers	H&S
35	Storage of Compressed Gas Cylinders	H&S
36	Three Point Rule	H&S
37	Why Take a Chance	H&S
38	Working in Hot Weather	H&S
39	Working Safely with Chemicals	H&S
40	Working with Cement and Concrete	H&S

Appendix G: Curriculum Vitae of Environmental Consultants

ENVIRONMENTAL CONSULTANT – 1

CV - STATEMENT OF QUALIFICATIONS

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

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 (EIA)
 - Environmental Baseline Assessment (EBA)
 - Environmental Management Plan (EMP)
 - Environmental Monitoring (EM)
 - 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 Manager (CIPM)
Fellow, American Academy 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) a 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.
- Russell, Christopher. *Country Report on Forest Policy in the Bahamas*. Consultancy Report, GCP/RLA/132/EC TF No. 64335, FAO, Rome, Italy. 1997.
- Russell, Christopher. The Future of Forestry in the Bahamas. *Bahamas Journal of Science*. Volume 5, Number 3. June 1998.
- Russell, Christopher. *Forestry Policies in the Caribbean, Volume – 1: Proceedings of the Expert Consultation*. Contributing Consultant. FAO, Rome, Italy. 1998.
- Russell, Christopher. *Forestry Policies in the Caribbean – Volume – 2: Reports of 28 selected Countries and Territories*. Contributing Consultant. FAO, Rome, Italy. 1998.
- Russell, Christopher. *Bahamas Country Report: Forestry Outlook Study for the Caribbean*. FAO, Rome, Italy. 30pp. 2000.
- Russell, Christopher. *Bahamas Country Report: The use of Forest for Ecotourism*. Caribbean Regional Workshop on Forest for Ecotourism, FAO, Castries, St. Lucia, May 2003.
- Russell, Christopher. *Position Paper on Forestry Development in the Commonwealth of the Bahamas*. Department of Lands and Surveys, Office of the Prime Minister. Nassau Bahamas. 2007
- Russell, Christopher. *The Status of Forestry Development in the Commonwealth of the Bahamas*. TNC Pine Rockland Conference. “Rockland Forest in a Changing World”, Miami, Florida and Andros Island, Bahamas, February 2008.
- Russell, Christopher, et. al. 2010. *Report on the production of the First Order Existing Land Use and Zoning Maps for the Island of New Providence*, Bahamas. Ministry of the Environment, Nassau Bahamas, 2010.
- Russell, Christopher; Miller, ~~Ingeria~~; Daniels, Mark. *Cost Benefit Analysis of Casuarina Species Management at Governors ~~Hawks~~ Eleuthera Island, Bahamas: A Case Study*. Proceedings from MTISAIC Conference. Policies Strategies and Best Practices for Managing Invasive Alien Species (IAS) in the Insular Caribbean, Trinidad and Tobago, 2014.
- Russell, Christopher; Miller, ~~Ingeria~~. *Post Hurricane Dorian impact on the pine forest resources of Abaco and Grand Bahama Islands: A Rapid Resource Assessment Report*. Forestry Unit, Ministry of the Environment and Housing, Nassau, Bahamas. 2019.

- Russell, Christopher. *The Impact of Hurricane Dorian on the pine forest ecosystem on Abaco and Grand Bahama Islands*. TNC Pine Rockland Working Group Virtual Conference, Miami, Florida, USA, 2020.
- Russell, Christopher; Curry, Andrew; Rodgers, Terrance. *Environmental Baseline Study (EBS) for the Carmichael Village Subdivision*, Carmichael Road, Nassau Bahamas. Department of Housing, Ministry of the Environment and Housing. 2021
- 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.
- Russell, Christopher. *Environmental Impact Assessment (ELA), Ki'ama Bahamas Project*, Elizabeth Island, Gt. Exuma Island. ~~EcoIsland~~ Elizabeth Ltd. 2022
- Russell, Christopher. *Environmental Management Plan (EMP), Ki'ama Bahamas Project*, Elizabeth Island, Gt. Exuma Island. ~~EcoIsland~~ Elizabeth Ltd. 2023
- Russell, Christopher. *Environmental Impact Assessment (ELA) for Goldwyn 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.
- Russell, Christopher. *Environmental Management Plan (EMP) RUBIS Big Game Fuel Station*, Bailey Town, Bimini, Bahamas. 2024
- Russell, Christopher. *Environmental Baseline Assessment (EBA) Pine Crest II Subdivision*, Department of Housing, Ministry of Housing and Urban Renewal. Nassau Bahamas. 2024
- Russell, Christopher. *Environmental Management Plan (EMP), RUBIS Fuel Station, Mackey & Madeira Streets*, Nassau Bahamas, 2024

ENVIRONMENTAL CONSULTANT – 2

JOHN A. BOWLEG, PE C.Eng, C.Env, C.Sci (Hydrology)

Chartered Water and Environmental Manager

M.ASCE, M.BSE, M.CIWEM

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PO Box EE-17345, Nassau, The Bahamas|Fort Lauderdale, Florida 33309

Mobile #'s: (242) 557-2775 Email: JBowleg@AEESconsultants.com

EXPERIENCE:

6/05 – Present CONSULTING PROFESSIONAL CIVIL-ENVIRONMENTAL ENGINEER |
HYDROLOGIST | ANALYST

ADARIE Engineering & Environmental Services [AEES] | AEES Consulting Group, LLC
{Since Sept-2021}

Fort Lauderdale, Florida USA | Atlanta, Georgia USA.

Project management for civil engineering works, environmental monitoring, hydrological design, reverse osmosis, renewable energy, waste, and wetland projects. Construction site inspections, prepare final reports, and expert witness in defense of environmental matters. Independent environmental laboratory data review for clients. International project works for land development, water & natural resources management, climate change | disaster risk reduction & mitigation mechanisms, and the scaling of resilient water-energy technologies. Ocean Thermal Energy Conversion (OTEC) research | development.

- *American Institute of Hydrology [AIH] – Member*
- *American Society of Civil Engineers [ASCE] / Environmental & Water Resources Institute [EWRI] – Member*
- *Greenhouse Gas Management Institute [GHGMI] Inventory Courses (2022)*
- *Ocean Thermal Energy Association [OTEA] – Member (2020 – Present)*
- *United Nations [UN] Department of Safety and Security [BSAFE] Certification (2021 - Present)*
- *UN Food & Agricultural Organization [FAO] Forest & Water Nexus – Intro (21Nov2021)*
- *UN Development Programme [UNDP] / UN Environment Programme [UNEP] Consultancies (2021 -Present)*
- *UNESCO-IHP, EcoHydrology Working Group for Latin America & Caribbean – Head (2021 - Present)*
- *UNESCO-IHP Latin America & Caribbean (LAC) – Consultant (2020 – Present)*
- *World Meteorological Organization [WMO] – Hydrological Advisor for the Bahamas (2004 – Present)*

7/99 – Present **WATER RESOURCES CONSULTANT | SR. HYDROLOGIST [Groundwater Management | WaSH].**

{2021/2022 Pre- **Water & Sewerage Corp. [W&SC] – Water Resources Management Unit [WRMU]. Nassau, The Bahamas.**

Retire Leave} Water & Environmental Manager with responsibility for the assessment & monitoring of the groundwater resources, thru the Engineering & Planning Department of WSC. Provide guidance on the development / management of the groundwater resources & coastal zone. Involved in matters concerning groundwater abstraction, reverse osmosis processes, wastewater effluent disposal, and Water Sanitation & Hygiene [WaSH]. In accordance with a key international environmental convention, served as Chairman of the National Wetlands Committee [Ramsar Convention] to implement the countries goals/policy regarding wetlands. Additional international duties for water | hydrology | environment are:

- *Global Water Partnership – Caribbean [GWP-C], Bahamas Water Resources Representative (2000 – 2021)*
- *International Water Association [IWA] Specialist Group – Caribbean Representative (2013 – Present)*
- *Ramsar Convention on Wetlands – Caribbean Representative (2003 – 2008), Vice-Chairman of Standing Committee (2005– 2008), & Member of the Management Working Group (2009 – 2012)*
- *UNESCO-IHP, Hydrological Representative for the Bahamas / Caribbean (Aug 2007 – Present)*
- *Water Resources Government Representative to the Organization of American States [OAS] (2002 – Present), & Inter-American Water Resources Network [IWRN] Board Member (2009 - 2012)*

4/99 – 7/99 **CONTRACT CIVIL | ENVIRONMENTAL ENGINEER. George V. Cox & Co. Nassau, NP, The Bahamas.**

Family Island Infrastructure Study - Great Exuma, Little Exuma | Exuma Cays, & Cat Island, The Bahamas.

Collection of data for the physical condition of government facilities. Project site data integrated into a Global Information Systems (GIS) Project. Facilities consist of Docks, Airports, Buildings, Bridges, Roads, and Utilities. Hazardous substances and potential environmental impacts also identified.

6/98 – 3/99 **PROJECT ENGINEER | CONSTRUCTION MANAGER. Willmer Engineering, Inc. Atlanta, Georgia, USA.**

Project management of landfill closure, asphalt testing at airports, and asbestos surveys | abatement monitoring. Construction Quality Control | Assurance (CQC | CQA) services for the testing & inspection of fill density | compaction, asphalt & concrete pavements, building footings, and structures. Conduct construction site inspections, and prepare final CQA Certification Reports for landfill projects.

9/97 – 6/98

CONTRACT CIVIL | DESIGN ENGINEER. EMCN Environmental Services. Duluth,

Georgia, USA.

Designs of solid waste landfills & transfer facilities, site development, and hydrological analysis. Environmental Phase I & II Surveys, Corrective Action Plan (CAP) analysis, site closure, and remediation for Environmental Projects. CQA, site inspections, and CQC for landfill projects.

8/96 – 9/97

CIVIL ENGINEER | TECHNICAL SPECIALIST. GZA GeoEnvironmental, Inc. Gwinnett,

Georgia, USA.

Solid waste landfill | transfer facility design, site development, drainage studies, & environmental site assessments. Engineering | hydrological design calculations using AutoCAD, and EaglePoint Software.

12/93 – 7/96

ENVIRONMENTAL ANALYST. Analytical Services Inc. [ASI]. Norcross, Georgia,

USA.

Extraction methodologies | organic analysis for analytical methods following the US Environmental Protection Agency (EPA) Solid Waste Regulations (SW-846). Performed the review and report of clientele results for sample extracts following EPA-8270, 625, 525 methods | regulatory guidelines, including all required QA/QC Protocols for US Army Corp Of Engineers Project Sites. [ASI - Norcross, GA Environmental | Lab is presently PACE Analytical]

PUBLICATIONS | RESEARCH:

Frontiers | Frontiers in Water Publication, Community Case Study, Intervention and solutions for water supply on small islands: The case of New Providence, The Bahamas (Welch | Bowleg, 2022), DOI: [10.3389/frwa.2022.983167](https://doi.org/10.3389/frwa.2022.983167)

Climate Change, Water Resources, & Renewable Energy in The Bahamas, 2022, DOI: [10.13140/RG.2.2.22283.98084](https://doi.org/10.13140/RG.2.2.22283.98084)

Water-Energy Nexus: Case Study on Climate Change and Water Resources, in The Bahamas. {Use of the reverse geothermal conditions, towards adaptation measures - OTEC | SDC/SWAC | SWRO} – September 2017 | December 2020 | Ongoing Research Activities (Bowleg, 2017, DOI: [10.13140/RG.2.2.28981.91369](https://doi.org/10.13140/RG.2.2.28981.91369))

Water Resources - Challenges for Groundwater Management & Climate Change in the Caribbean | Commonwealth of The Bahamas, North Andros and Grand Bahama Storm Surge Data (UNESCO International Science School - Havana Cuba, Bowleg, 2018, DOI: [10.13140/RG.2.2.22690.45765](https://doi.org/10.13140/RG.2.2.22690.45765))

UNESCO Ecohydrology, Ecosystem Change & Management Response on Tropical Island Systems: Case Study of Great Exuma linking Land Use Change, Coastal Wetlands and Marine Fisheries (Exuma Bahamas, Sealey | Bowleg, 2015)

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Ethylbenzene, & O-Xylene using Calgon Filtrasorb-400 Granular Activated Carbon (Howard University School of Engineering, Washington DC, 1993)

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MASHAV – SHEFAYIM, ISRAEL – CINADCO | Water Resources Management | Certificate – International Course [2000]

HOWARD UNV. | Mobil Oil Removal of Gasoline Contaminants in Groundwater | Senior-Graduate Research [1993]

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