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EXECUTIVE SUMMARY

The Project

Following the success of its residential development at New Harbour Village (New Harbour 1; NH1), Gore Developments Limited proposes to develop two new properties (the Whim and Brampton Farms) as extensions to its New Harbour Developments (New Harbour II; NH II) and New Harbour III: NH III).

The New Harbour II development on the Whim property will consist of 1388 two bedroom houses on 111.7 hectares of land with similar amenities to that of NH I.

The New Harbour III development on the Brampton Farms property will follow completion of NH II and will consist of 953 houses on 81 hectares of land also with similar amenities. However NH I and NH II will share a common wastewater treatment plant (WWTP) located at the extreme eastern end of the NH III development. Between the two developments, the public amenities will consist of nature reserves and open spaces, a commercial centre and lands allocated for the construction of basic and primary schools.

TERMS OF REFERENCE

The Terms of Reference for the conduct of an EIA appropriate for the developments have been developed following a combined site visit to both properties by NEPA and other Regulatory Agencies, along with the developers and their professional team. After further consultation between NEPA and the developers, the TORs were approved on June 23, 2009. The essential aspects of the TOR are as follows:

- i. The NH II and NH III EIA is viewed as an addendum to the comprehensive EIA conducted for NH I.
- ii. The NH II and NH III EIA addresses the potential impacts primarily (but not exclusively) related to site specific and cumulative impacts of the developments:
 - a. Hydrology and Drainage
 - b. Water Supply
 - c. Sewage Treatment and Disposal
 - d. Traffic
 - e. Socio-economics
- iii. The EIA process will include a Town Hall Meeting on completion of the Draft Report for feedback from the general public for incorporation into the final report. The final report will then be made available to the public in hard copy and digital form for further written comments.

EXISTING ENVIRONMENT:

(1). Hydrology and Drainage

Both the Whim and Brampton Farms properties have a generally flat topography with a series of earthen gullies traversing from North to South. Immediately to the West of the Whim property, the major drainage is by the Bowers Gully. Coursing through the property is the Whim Gully. Both of these gullies flow down stream through or adjacent to Old Harbour Bay and are responsible for extensive flooding in the town.

On the Brampton Farms property, the major gully course is the Fraser's Gully which, however, has three tributary courses north and east of the development site. These gullies are also prone to flooding although downstream of Brampton Farms, the Fraser's Gully has been improved to reduce flooding in Old Harbour Bay.

(2). Water Supply

The Rodon's Pen Well located on lands just north of the Whim and owned by the developers has the capacity and suitable water quality to provide both NH II and NH III with adequate supply on a sustained basis.

(3). Ecology

The fauna and flora of both the Whim and Brampton Farm sites are typical of ruinate agricultural land, especially after abandonment of sugar cane cultivation. Hence there is no natural forest remaining and no endemic species are known to occur. Included on the Brampton Farms property are also eight abandoned aquaculture ponds.

The most diverse ecology is, however, to be found alongside and in the gully courses. The vegetation is typical of wet lowland environments and the sparse fauna is essentially fresh water and estuarine adapted. However, the local crocodile (*Crocodylus acutus*) occurs in both the Fraser's Gully and the lower Bower's Gully.

(4). Socio Economics

The socio economic environment of the Whim/Brampton area is essentially the same as that described in 2006 for NH I. The major population centres are the towns of Old Harbour to the north and Old Harbour Bay to the south. However, NH I with its newly constructed 845 houses has created its own population centre.

Social infrastructure in the area has not shown significant improvement in recent years, except for the completion of the H2K highway. Social constraints still exist with respect to health care, education and other public services.

Traffic congestion in the town of Old Harbour remains a major problem and is a dis-incentive for business development in the town and for travelling along the A2 main road. Commuters from the New Harbour Village community and others seem to prefer travelling east to Kingston in the mornings along H2K but returning west in the afternoons along the A2 main road.

The NH I development has provided an economic boost to the area with employment of some 500 persons and access to other services. However, this economic impact is perceived by the population as selective and is not being enjoyed by everyone. Nevertheless, the population on a whole views the NH1 development quite favourably and negative impacts such as criminal activity and squatting have not been evident.

POTENTIAL ENVIRONMENTAL IMPACTS:

Construction Phase Impacts

The potential environmental impacts from the construction activities are expected to be the same as for similar developments elsewhere, including the NH I. These include the location and activities at the Batching Plant and at the Petroleum Storage facility. Other impacts could result from the collection and disposal of solid and liquid wastes. Gore Developments Ltd. has demonstrated their ability to prevent and/or mitigate such construction impacts by their performance at NH I.

Operation Phase Impacts:

(i). Hydrology and Drainage

Development of the Whim Site involves the improvement of the Whim and Bower's Gullies to provide suitable drainage on the site, but the proposed plan will also result in significant reduction in flooding in the town of Old Harbour Bay.

The drainage design includes paving of the Whim Gully and its diversion west to the Bower's Gully which will then discharge both flows into the sea west of the town. Hence, most of the drainage from the site will be diverted via the improved Whim drain off the development site and away from the town. The lower part of the Whim site will also be drained by another improved drain to flow east towards Fraser's Gully which itself, will be diverted around the site of the sewage treatment plant before flowing further south and discharging into Dagger's Bay. Fraser's Gully will be physically isolated from the NH III development by the construction of berms between itself and the residential developments.

All the above diversions and improvements will serve to take run off from the development sites to the west (Bower's Gully) and east (Fraser's Gully) and away from Old Harbour Bay. The result therefore should be highly advantageous in reducing flooding in the town.

(ii). Water Supply

The Rodon's Pen Well has been proven to have sufficient capacity and quality to provide potable water to the developments on a sustainable basis. No negative environmental impacts are expected.

(iii). Sewage Treatment and Disposal

Wastewater (sewage and gray water) from both developments will be collected by a system of sewers and pumps and carried to the wastewater treatment plant located to the east of the NH III development. Treatment will be by a biological system consisting of anaerobic ponds and a constructed wetland (reed beds). This system is known to be more stable and reliable than mechanical systems and should consistently meet NEPA effluent standards. Final effluent from the reed beds will flow into the Fraser's Gully but will add less than one percent (1%) to its total flow. The quality of the effluent may actually be better than the present Fraser's Gully water quality. No adverse impacts are anticipated.

(iv). Ecology

No adverse impacts on the ecology of the sites, including the gully courses are envisaged. In Fraser's Gully, the presence of crocodiles should not present a problem although mitigation measures are recommended to prevent their incursion into the WWTP site and the NH III residential areas. In lower Bower's Gully, the presence of crocodiles will not present a threat to the Whim Development (NH II) because of the structure of the Gully and the distance of the development upstream.

(v). Traffic

The impact of traffic into and out of the NH II and NH III developments and the Old Harbour Bay road is likely to be negligible. However, the problem of traffic into and through the town of Old Harbour may only get worse as the population increases and people seek to access more services in the town. A specially commissioned Traffic Impact Assessment study has been completed for the developers by ADeB Consultants and is appended to the main EIA report. In addition, the impact of traffic congestion in the town of Old Harbour has been discussed in the main body of the EIA Report. All the recommendations of these reports are clear, but implementation remains the purview of the Government, specifically the National Works Agency.

(vi). Socio-Economics

As it is for traffic, the impacts on the social infrastructure of the New Harbour II and III areas will be mostly increases for services and the demand for removal of constraints now existing. The provision of land and facilities for recreation, commercial activities and education within the developments will serve to reduce some impacts, but not eliminate them altogether.

MITIGATION MEASURES

The potential impacts identified may be prevented or mitigated by appropriate design of the development, by employing best engineering and environmental practices during construction and operations, and by partnership with Government in improving social infrastructure and amenities.

The appropriate design of the water supply, drainage and wastewater treatment systems has been outlined above and is described in detail in the appended engineering reports. Similarly, the recommendations for traffic improvement have been described in the body of the EIA and in the appended TIA report. There are no major impacts that cannot be mitigated, but the responsibility of the Government, especially in regard to the socio-economic impacts, cannot be discounted.

MONITORING

As with all such developments, careful monitoring of the works during both the construction and operation phases will be critical for good environmental management. The EIA gives guidelines for the development of an appropriate Environmental Monitoring and Management Plan.

CONSIDERATION OF ALTERNATIVES

Consideration of alternatives with respect to land use, the demand for housing solutions, engineering design and socio-economic impacts are discussed in the EIA report. It is concluded that there is no comparable or conflicting proposal for use of the sites and that the engineering design has considered and eliminated less appropriate designs for water supply, drainage and wastewater treatment. Current demand for housing solutions suggests that the proposed development is the most appropriate for the sites. This is in accord with the Potrmore to Clarendon Park Highway 2000 Corridor Development Plan 2004-2025 which has zoned these lands for urban development.

1.0 INTRODUCTION

This document presents the findings of the environmental impact assessment (EIA) for the proposed housing development at New Harbour Village, St. Catherine. The development will involve housing solutions at the Whim and at Brampton Farms, New Harbour Village II and III (NH II and III) respectively, as an expansion of New Harbour Village I that currently exists (Figure 1.0). Environmental Solutions Ltd. (ESL) was contracted by Gore Developments Ltd. (GDL) to carry out the Environmental Impact Assessment, as part of the permitting requirements stipulated by the National Environment and Planning Agency (NEPA) in respect of the proposed development.

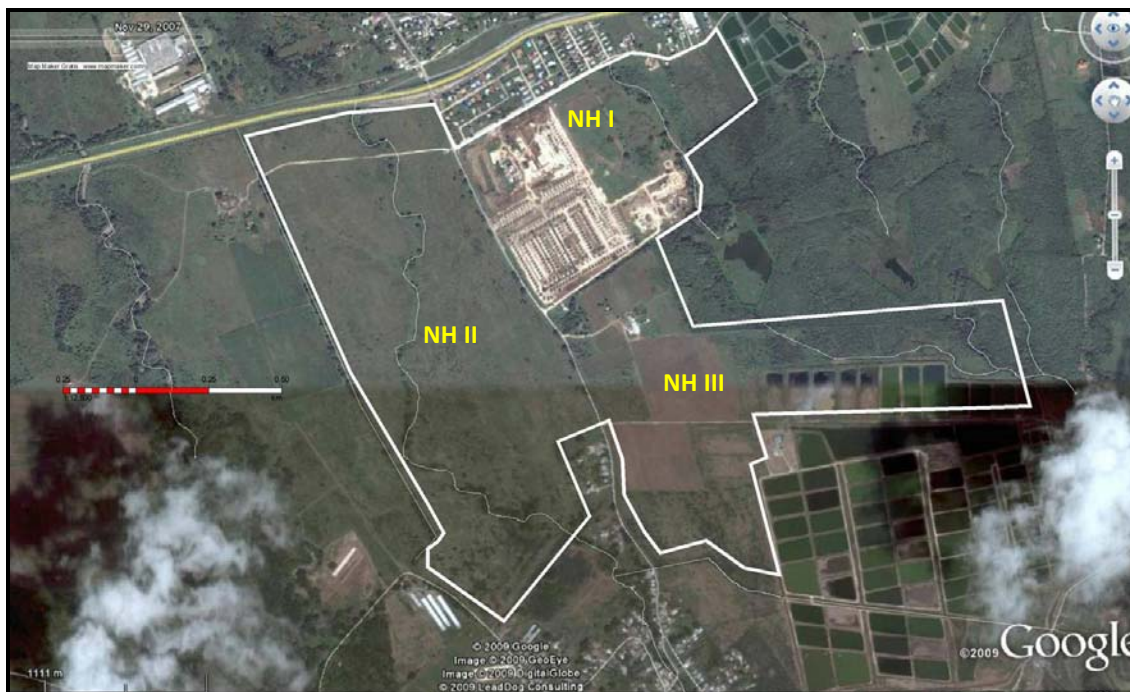


Figure 1.0 The New Harbour Village, St. Catherine.

1.1 Purpose

Gore Developments Ltd initiated dialogue with the Office of the Prime Minister in 2008 in an effort to present the proposal for expansion of the housing solutions in the New Harbour area. The proposed development of NH II and III aims to satisfy the demand for housing in the wider region of Old Harbour within a large community in proximity to Kingston, Spanish Town and May Pen. The project area has also been designated an area for future urbanisation under the Portmore to Clarendon Park – Highway 2000 Corridor Development Plan (Figure 1.1). This document presents the site specific EIA for the Whim and Brampton Farms at New Harbour.

1.2 Description of the Developments

1.2.1 New Harbour II – The Whim

This property is located south of Old Harbour town and north of Old Harbour Bay (Figure 1.2.1a). The Highway 2000 is the northern boundary and entrance to the site is 200 m from the Old Harbour exit ramp of this H2K. The project is directly west of the New Harbour Village currently in final stages of completion by GDL.

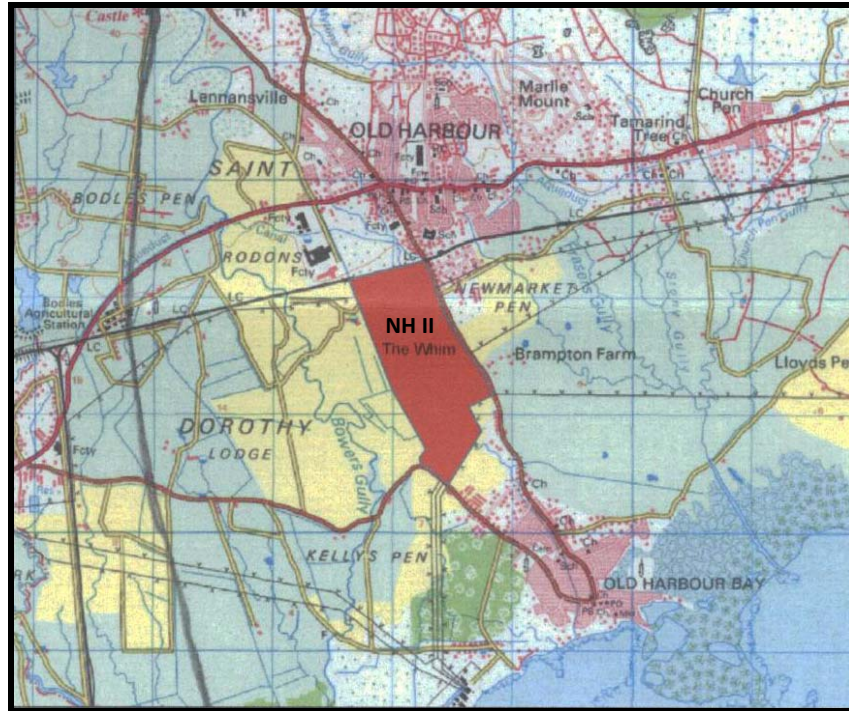


Figure 1.2.1a Location of New Harbour Village Phase II at the Whim, St. Catherine.

The Whim property is 111.7 Ha (276 ac) and the proposed average lot size is a minimum of 375 m² (4000 ft²). The proposed number of houses for this development is approximately 1388 each 74.3m² (800 ft²) of floor area featuring two bedrooms, one bathroom, kitchen and living room space. The proposed development will include land allocation as follows (see Figure 1.2.1b):

Park and other active open spaces:	6.2 ha/15.36 ac
Passive open spaces (JPS):	14.3 ha/35.35 ac
Basic school site:	0.36 ha/0.89 ac (allocated for both NH II and III)
Primary/secondary school:	5.2 ha/12.86 ac (allocated for both NH II and III)
Commercial zone:	3.34 ha/8.27

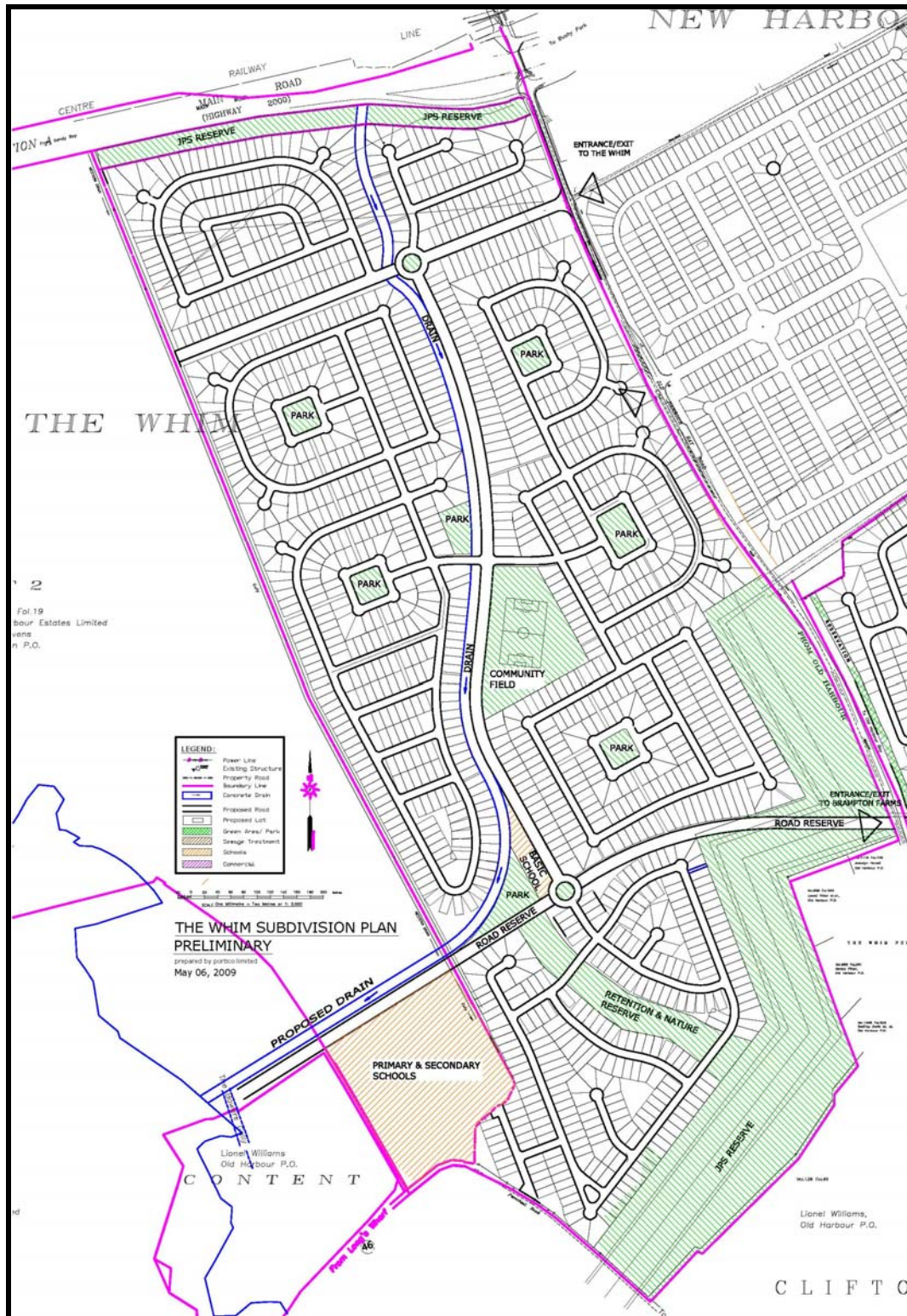


Figure 1.2.1b Site layout of the proposed New Harbour Village Phase II at the Whim.

1.2.2 New Harbour III – Brampton Farms

Phase III of New Harbour Village is proposed to be located at the Brampton Farms south of the New Harbour Village I and east of New Harbour Village II (Figure 1.2.2a). This phase of the development will feature 953 lots each with a minimum land space of 375 m² (4000 ft²). The total property area is approximately 81 Ha (810, 000 m²). Entrance to the property will be located directly opposite the proposed southern road reservation of the Whim (NH II) creating a four way intersection for both phases (Figure 1.2.2b). The full project layout with all three phases is illustrated in Figure 1.2.2c.

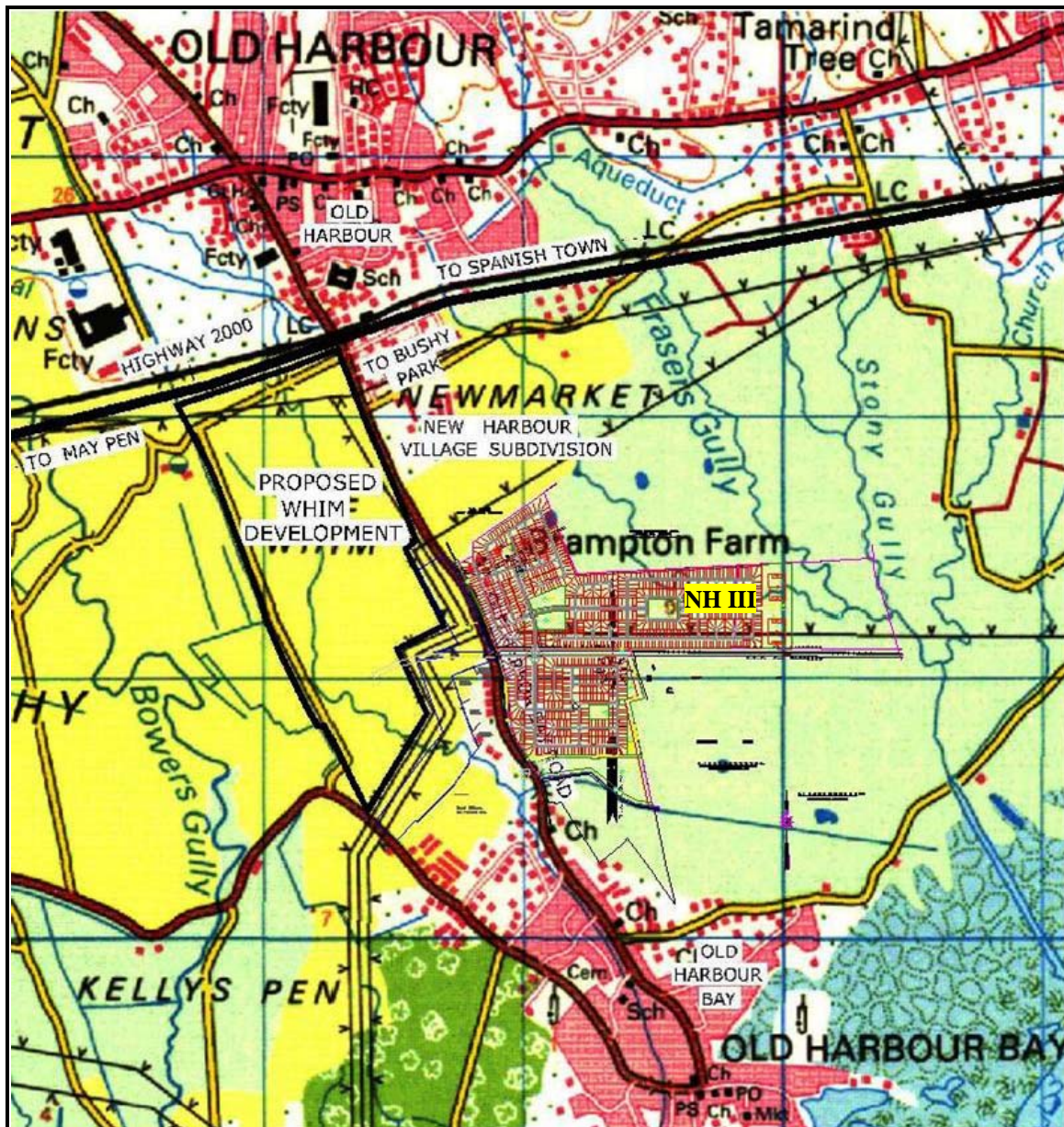


Figure 1.2.2a Location of New Harbour Village Phase III at Brampton Farms, St. Catherine.



1.2.3 Drainage Works

Drainage is the major engineering works which influences the layout of both NH II and NH III. These are described below.

1.2.3.1 New Harbour II (The Whim Property)

It is proposed that the surface drains currently existing on the Whim side of the property will be rerouted to the Bower's Gully (see Figure 1.2.3.1). This will include both the western boundary drain (which will be extended to meet the upgraded mid-property drain) and mid-property/central drain (which will be upgraded and lined with concrete). The only portion of the property drainage that will continue as currently exists is the southern tip of NH II. This continues along the Whim Gully and at the junction with the Old Harbour Main Road will be routed to an existing drainage channel that slopes east toward the lower reach of the Frasers Gully into Dagger's Bay (Figure 1.2.3.1). This will continue to ensure that post-development surface flows are kept out of Old Harbour Bay with the majority of the flow being directed to Bowers Gully and a small proportion to the Fraser's Gully via the new drainage upgrade channel installed by the National Works Agency (NWA).

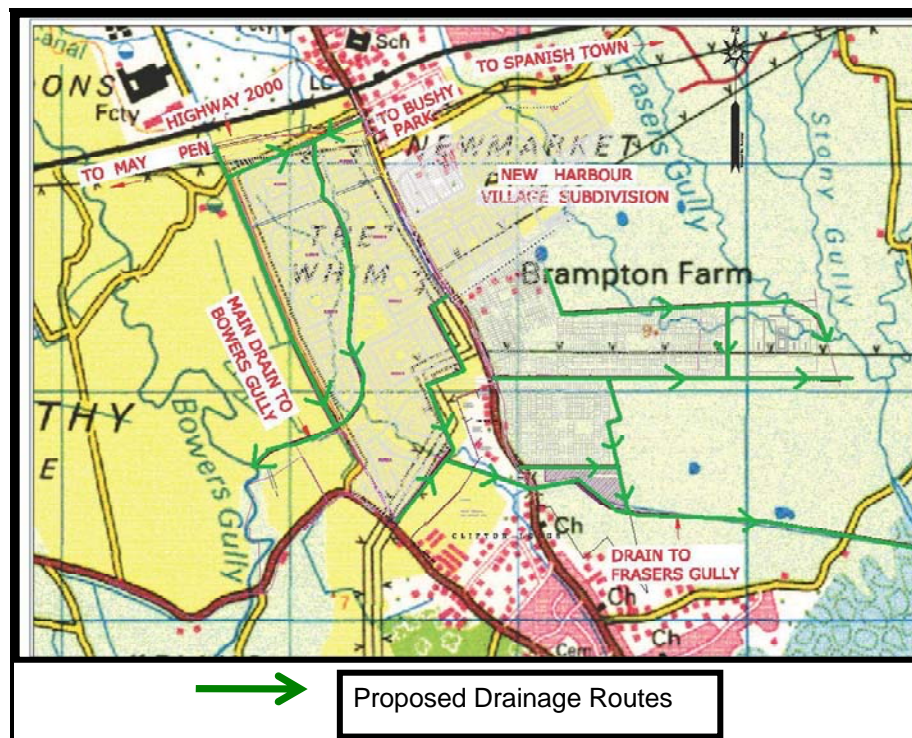


Figure 1.2.3.1 Proposed Drainage Works for the New Harbour II and III Developments.

This new NWA drainage infrastructure development was carried out to alleviate the recurrent flooding problem that exists in Old Harbour Bay during heavy rainfall. The overall development drainage design for NH II will ensure that no additional surface flows are directed towards Old Harbour Bay in keeping with the NWA drainage developments. The central drain within the property will be designed for 1:25yr flows with 25% freeboard as required. Roadways and minor drains will be designed to 1:10yr event.

1.2.3.2 New Harbour III (The Brampton Farms Property)

It is proposed that the unnamed gully (hereafter called the New Harbour I gully) and its confluence with the Fraser's Gully will be relocated north of the property boundary outside of the footprint of the proposed sewage treatment plant (STP) for NH II and III. The relocation will be coupled with the lifting of the land surface of NH III to a 6.5 m above sea level which is presumed to be adequate for the 1:25yr flood stages along the Fraser's Gully. Approximately 33% of NH III (East Brampton Farms, 27 ha) will be routed to the Stony/Fraser Gully confluence. The remaining 77% of NH III and southern portions of NH II (presumably Block A) will be combined and routed along the newly constructed earth drain that discharges to Dagger's Bay via Salinas bordering the shoreline.

Post-development, a substantial portion of the Whim property area will be routed through the created central drain to Bowers Gully, with only a thin sliver alongside the main road. The southern end of the property and the portions of NH III highlighted in Figure 1.2.3.1 will be directed beneath the main road toward Fraser's Gully via an earth drain that separates the shrimp ponds. With these measures, the Old Harbour Town will see a significant reduction in the flows that once were routed through the town from the Whim property. This new earth drain has been evaluated by the design engineers to ensure that the projected flows plus freeboard can be safely accommodated. The installation of appropriate erosion control measures along its length, to ensure no adverse erosion or under mining of the banks of the drain is of critical importance.

2.0 TERMS OF REFERENCE

Following a combined field visit by NEPA and other Regulatory Agencies (Appendix I) with the developers and their proposal team, it was agreed that the Whim/Brampton EIA should be viewed as an Addendum to the New Harbour Village EIA. The EIA study should address the following specific requirements:

Water supply

The source of water supply to both Whim and Brampton Farms developments will have to be identified and examined for capacity, sustainability, water quality and cumulative impacts on relevant ground and surface water resources.

Drainage

An examination of the 1:50,000 metric map covering the project area shows drainage features that directly traverse the proposed sites: (1) the Fraser's Gully (identified in the EIA); (2) a tributary to this gully traversing phase IV of the New Harbour I development; (3) an un-named gully traversing the proposed Whim development site from north to south and; (4) a drainage channel (possibly man-made) that defines the proposed Whim development site's western boundaries.

While these features have similar characteristics due to their underlying substrates, drainage features 2-4 and their upper catchments will have to be characterized in detail, since this was not done in the New Harbour I EIA. Additionally, since a proposed drainage mitigation measure for the newer developments incorporates flows to the Bower's gully, which lies to the west of all drainages listed (and is outside of the development perimeter), this gully's characteristics will also have to be added to the list of drainage features to be examined.

Parameters to be examined for the drainage features will include:

1. Water quality: (DO, salinity, pH, TSS, TDS, BOD, NO₃-N, PO₄-P, metals, Oil and Grease, Sulphates and Chlorides) – pre development
2. Discharges: dry and wet periods – pre-development

The disposal of storm water run-off and any risk of impact on surrounding developments and communities along with potential issues with respect to increased surface run-off and sediment loading will be examined and discussed.

In considering the drainage assessment the report will include, but not be limited to:

- Drainage for the site during construction and operation phases, to include mitigation for sedimentation.
- Drainage control for the gully/gullies traversing the property, to include impacts that the drains will have on the aesthetics, water quality and sedimentation of the developed area.

- Hydrology of the area with special emphasis on the impact of planned and existing development upstream of this proposed development. The hydrological assessment must also consider the offsite drainage downstream (particularly the western section of the town of Old Harbour) of the proposed development and the risk posed for communities within proximity of the drainage systems.

Ecology of the Gully Courses (the sections that traverse the sites as well as down stream portions to the marine discharge points).

Fauna and Flora of the immediate gully environments must be described. Consideration should be given to both the terrestrial and aquatic elements.

Sewage Treatment and Disposal

The Whim and Brampton Farms facilities will utilize a common sewerage system that will be separate from that of New Harbour I. As such an examination of the sewage treatment and disposal systems for the new developments must be undertaken, along with an examination of the proposed recipient environment for the treated effluent (which may be the lower reaches of the Fraser's Gully). The capacity of the proposed system is also to be examined and discussed in the report along with assessment of flooding risk of the proposed STP.

Traffic

With the increased numbers of families that will be focused around the new population centres formed by New Harbour I, Whim and Brampton Farms, new and improved traffic management arrangements will become necessary, particularly as they relate to ingress/egress unto the Highway 2000 and into the town of Old Harbour.

Therefore a traffic impact assessment should be conducted and presented. Specific emphasis will be placed on measures to that will be implemented to address the potential changes in traffic flow.

Socio-economic Setting

In addition to the New Harbour report this study will assess:

1. The changes in economic situation taking into consideration the advent of new housing developments such as New Harbour Village and how they have affected factors such as crime and employment in the area.
2. The impact of the proposed development along with other housing developments that came on stream after the New Harbour Village EIA.
3. The impact of the proposed Whim and Brampton Farms (New Harbour II and III) developments on existing social infrastructure.

Resource Conservation

Statements on water and energy conservation measures/practices for the proposed developments will be presented.

Landscaping

Details on the dimensions of the reservations and the possible relocation of the JPS high voltage lines will be discussed.

Project Alternatives

Alternatives to the proposed project including the no-action alternative should be examined and will include the use history of the overall area in which the site is located and the previous uses of the site itself.

Cumulative Impacts

With three major housing developments ultimately being implemented within proximity to one another, there will likely be cumulative impacts that must be considered. The most likely issues of cumulative interest are:

- Downstream flooding and other impacts on Old Harbour Bay
- Downstream impacts on agriculture, aquaculture and fisheries
- Traffic management
- Solid waste collection and disposal
- Public amenities (health, education, etc.)
- Public perception

These and other additional impacts likely as a result of the new developments should be clearly identified and characterised for both the construction and operation phases as was done for New Harbour Village and the appropriate mitigation measures proposed. Also an outline monitoring plan should be presented.

The environmental assessment should be complementary in all respects to the EIA presented for New Harbour Village but should avoid unnecessary repetition and/or duplication of material already presented in that report.

3.0 THE NEW HARBOUR EIA

3.1 Common Features with New Harbour II and III

As the proposed developments are located adjacent to New Harbour Village Phase I an examination of the New Harbour I EIA was done to determine certain features that are common to both Whim and Brampton Farms. The similarities are as such:

3.1.1 Legislative and Regulatory Considerations

The legislative and regulatory framework governing development in the New Harbour areas is the same as discussed in the EIA of New Harbour Village (Section 3.0). The following were discussed:

- | | |
|--|---|
| 1. NRCA Act (1991) | 11. Natural resources conservation (Portland Bight Protected Area) regulations (1999) |
| 2. Wildlife protection act (1945) | 12. Town and country planning act (1958) |
| 3. Endangered species (protection, conservation and regulation of trade) act (2000) | 13. Land development and utilization act (1966) |
| 4. Natural resources (prescribed areas) (prohibition of categories of enterprise, construction and development) order (1996) | 14. Public health act (1976) |
| 5. Water resources act (1995) | 15. Country fires act (1942) |
| 6. Quarries control act (1983) | 16. National solid waste management act (2001) |
| 7. The pesticide (amendment) act (1996) | 17. Jamaica national heritage trust act |
| 8. Clean air act (1964) | 18. Land acquisition act |
| 9. Noise standard | 19. Registration of titles act |
| 10. Trade effluent and sewage regulations (1996) | 20. Housing act |
| | 21. Office of utilities act (2005) |

3.1.2 Climate

Monthly mean minimum temperatures for the Old Harbour area has been recorded at 16 °C in February and 21 °C in July and mean monthly rainfall is between 41-233 mm. More details on the climatic conditions of the Old Harbour area is examined in Section 5.1.2 of the New Harbour Village EIA of 2006.

3.1.3 Topography

The general slope of the land in this area is towards the south (see Section 5.1.3 of the New Harbour Village EIA, 2006) with northerly elevations up to 21 m along the northern boundary of the Whim and 5 m above sea level at the most south easterly boundary of Brampton Farms.

3.1.4 Geology and Soils

All three sites are located within areas mapped on geological map sheet 10, which outlines the dominant superficial geological feature as being alluvial deposits comprised of coarse gravels, sand and clay originating from the Rio Cobre River. Additionally, the soils map of St. Catherine identifies soil types for all three areas as being the Lodge Clay Loam (High Salinity Phase). Refer to NH I EIA (2006).

3.1.5 Natural Hazards

The NH I EIA (ESL, 2006) (Section 5.1.17) describes the natural hazards that the area is likely to be vulnerable to as floods, hurricanes and earthquakes.

3.1.6 Air Quality

Particulate matter (PM) refers to discrete particles in ambient air that exist either as solid particles, or as liquid droplets. Particulate sources are natural, e.g. pollen; a combination of natural and man-made in variable proportions, e.g. dust in open areas, roadside dust, smoke from vegetation burning; and wholly man-made, e.g. smoking, cooking and barbecuing, vehicle use, industrial activities, etc. Ambient respirable air quality data for the area are below the NEPA standard (Section 5.1.5 of NH I EIA, 2006). As there is no major source of air pollutants in the area it was deemed that air quality would remain generally the same.

3.1.7 Noise

Based on the results of the New Harbour Village EIA the main source of noise is from traffic on the Old Harbour Bay main (Section 5.1.4).

3.1.8 Socio-economic Setting

Socio-economic information is usually obtained for a defined sphere of influence extending outside of the borders of a proposed development. The New Harbour I EIA (2006) (Section 5.3.1) examined and described the socio-economic character of the lands encompassing the Old Harbour to Old Harbour Bay area as defined in Figure 3.1.8 below. This sphere of influence is expanded for Phases II and III of the New Harbour Village but reference should also be made to the New Harbour Village EIA (ESL, 2006). However, an evaluation of traffic, social infrastructure and public sentiment/perception has been conducted for the new development (Section 5.5 of this report).

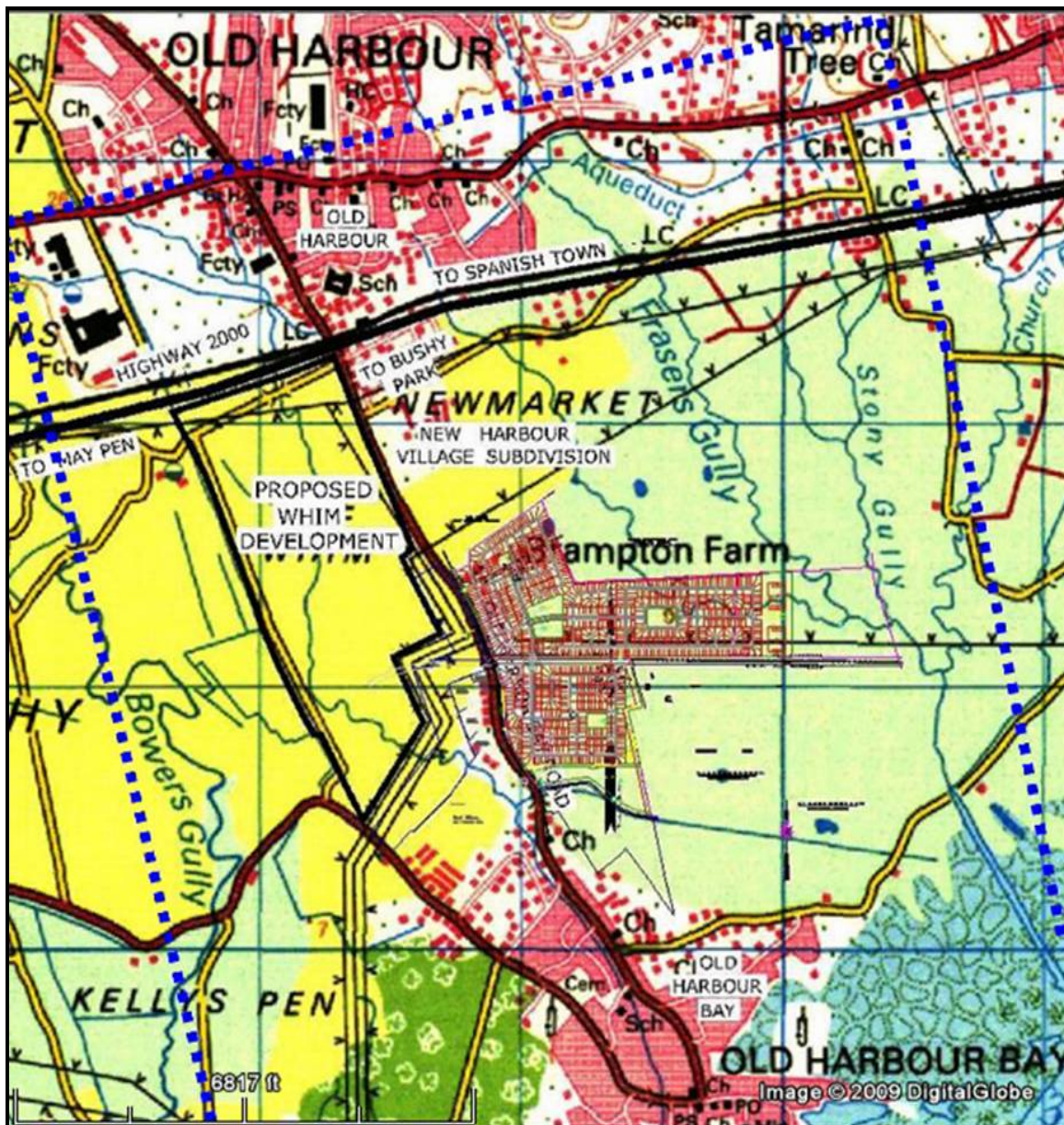


Figure 3.1.8 Sphere of influence of the project area.

4.0 METHODOLOGY AND APPROACH

4.1 General Approach

A multi-disciplinary team of experienced scientists and environmental professionals was assembled to carry out the required resource assessment, generation and analysis of baseline data, determination of potential impacts and recommendation of mitigation measures. The EIA professional team is given in Appendix VIII. An iterative approach among the environmental team members and other project professionals was adopted, and was facilitated by fortnightly or weekly team meetings as required. The EIA team worked very closely with the other project team members including the project manager, engineers and architect.

The team utilized the charette-style approach to data gathering, analysis, and presentation whereby team members conducted the reconnaissance investigations together to determine the critical elements for analysis and the issues to be highlighted for the design and planning process. Team meetings were held to discuss the progress of investigations and analyses and facilitate integration of data toward an understanding of the systems at work in both the natural and built environment. Baseline data for the study area was generated using a combination of:

- Field studies
- Aerial observation
- Analysis of maps, plans, aerial photos
- Review of reports and background documents
- Structured Interviews
- Laboratory analyses

4.2 Physical Environment

The New Harbour I EIA (September 2006) had covered terrestrial issues associated with the New Harbour site. It was determined that the New Harbour I site had topographical, geological, socio-economic, heritage and biological similarities with the New Harbour II and III sites, thus technical descriptions made for New Harbour I would be applicable to the other locations. The major differences between the sites, however, lay in the treatment of drainage and sewage matters and the natural features that would be affected as a consequence of the implementation of drainage and sewage works. In addition, specific attention was placed on describing proposed re-routing for power lines traversing the New Harbour II site.

Physical and water chemistry descriptions for the New Harbour II and III phases of the development were therefore focused around the hydrological conduits influenced by both developments, with guidance for the conducting of such descriptions being outlined in the Terms of Reference for the study (described in Section

2.0). Prior to accessing the study sites, the following aerial imagery were used to establish a general understanding of the lay of the land and historic uses for both the New Harbour II and III sites:

1. Google Earth images of the location dated 2007
2. Aerial imagery of the site commissioned by the Survey Department dated 1992
3. Oblique aerial images of the site taken on June 18, 2009

Hydrological reports prepared for the ratification of drainage on the proposed development site (Appendix III) were used to delimit the actual channel paths through the property. The input obtained from the referenced hydrological reports was of particular relevance, since they outlined the specific drainage interventions that have been proposed to deal with any drainage-related issues that may occur as a consequence of the implementation of the development.

Aerial imagery and hydrological report examinations lead to the creation of a layout of drainage systems within the development footprint. The delimitations of the property drainages provided the following:

- Guidance to field personnel as to the lateral extent of the study area and the best routes to take to access as many areas along the drainage channels being examined.
- Guidance on the development footprint within the drainage areas, thus facilitating impact analysis and mitigation generation.
- Guidance on the deployment of water quality assessment stations

Field investigations were then conducted over the period June 16-18 and 23rd, 2009. Channels examined were as follows (listed from west to east):

1. Bower's Gully from the point of interception with drainage directed from New Harbour II to the sea (17° 55.089'N 077° 06.794W - 17° 53.897'N 077° 07.041W).
2. Whim West Boundary Gully –for extent of property (17° 55.869'N 077° 06.929W -17° 55.073'N 077° 06.597W).
3. Whim Gully –from northern section of property to mouth (17° 55.907'N 077° 06.699W -17° 54.255'N 077° 05.873W).
4. Drain leading from Whim Gully towards mouth of Fraser's Gully (17° 55.048'N 077° 06.135W -17° 54.925'N 077° 05.347W).
5. New Harbour I and Fraser's Gullies from point of entry into New Harbour III property to mouth of Fraser's Gully (17° 55.486'N 077° 05.892W/17° 55.502'N 077° 05.536W 17° 55.398'N 077° 05.372W).

Field surveys for physical and water quality character descriptions of the drainage systems involved walking traverses along the alignment of the gully systems and kayak-aided surveys (where channels were occupied

with water). Additionally, water samples were taken from the channels of the drainage systems for analysis at the locations indicated on Figure 4.2. Note that, of the seven intended sample stations only three had flows at the time of sampling, namely Gore WQ-1, 2 and 3 (Figure 4.2).



Figure 4.2 New Harbour I-III Development Area Showing Intended and Actual Water Quality Sample Stations –June 2009.

Water quality parameters examined for the study parallel those examined for the New Harbour I EIA and are listed below:

- pH
- Salinity/conductivity/temperature
- Dissolved Oxygen
- Nitrate
- Phosphate
- Biochemical Oxygen Demand (BOD5)
- Total and Faecal Coliform
- Total Suspended Solids

Samples were collected in the middle of the channel approximately 0.2 meters below the water surface. All samples were collected in pre-cleaned 2 litre polyethylene sample bottles, with bacterial samples being collected in sterilized 100 ml glass bottles and BOD samples being collected in opaque polyethylene containers.

4.3 Biological Environment

Biological descriptions for the New Harbour II and III phases of the development were focused around the hydrological conduits influenced by both developments, as was done for physical and water quality descriptions, with a similar use of aerial imagery being undertaken to define the relevant study areas. .

Field investigations for biological descriptions were conducted over the period June 16-18, 2009. Channels examined were as follows (listed from west to east):

1. Bower's Gully from the point of interception with drainage directed from New Harbour II to the sea (17° 55.089'N 077° 06.794W- 17° 53.897'N 077° 07.041W).
2. Whim West Boundary Gully –for extent of property (17° 55.869'N 077° 06.929W -17° 55.073'N 077° 06.597W).
3. Whim Gully –from northern section of property to mouth (17° 55.907'N 077° 06.699W -17° 54.255'N 077° 05.873W).
4. Drain leading from Whim Gully towards mouth of Fraser's Gully (17° 55.048'N 077° 06.135W -17° 54.925'N 077° 05.347W).
5. New Harbour I and Fraser's Gullies from point of entry into New Harbour III property to mouth of Fraser's Gully (17° 55.486'N 077° 05.892W/17° 55.502'N 077° 05.536W 17° 55.398'N 077° 05.372W).

Field surveys for biological character descriptions of the drainage systems involved walking traverses along the alignment of the gully systems and kayak-aided surveys (where channels were occupied with water), with the identification of dominant floral and faunal types found within the channel banks being the subject of priority.

4.4 Socio-economic Environment

The approach taken to the socio economic environment was the use of the EIA prepared for Phase I and a revisit of the issues raised then in order to determine the ones that needed to be updated in light of the two year interval. The following have been examined for this EIA:

- Traffic
- Social Infrastructure
- Public Perception
- Employment
- Solid Waste Management
- Energy & Water Consumption
- Heritage

Following a general reconnaissance of the most likely impacted communities as listed below, two field trips were undertaken to capture the data relevant to updating the above. During these field trips about 50 interviews were held using the rapid appraisal approach to capture public perception on the proposed developments within impacted communities, and also specifically targeting key informants. Concurrently studies commissioned by the developers were consulted for corroboration of the field data as well as with team members. Most likely impacted communities visited for observation and interviewing were:

- Old Harbour proper
- Belmont Park
- Bay View Gardens
- New Harbour Village (Phase I)
- Sharper's Pen
- Old Harbour Bay and Main Road

4.5 Prediction of Potential Impacts

In identifying the potential environmental impacts of New Harbour Phases II and III the consultants have carried out an evaluation of Phase I (New Harbour Village) and assessed real impacts against those projected in the Phase I EIA (ESL, 2006). To a large extent the Phase I EIA (ESL, 2006) has held true to the impacts prediction.

Drainage on the development site and downstream has improved, flooding has been averted, the sewage treatment plant is operating efficiently and projected benefits on the socio-economic side are being experienced by the community at large. Construction and other on-site impacts have been successfully mitigated.

Based on this experience, and on consultation with NEPA during and after a combined site visit the major potential impacts from Phases II and III have been identified as:

- Hydrology and drainage
- Water supply
- Sewage treatment
- Traffic
- Socio-economics

The approach to this EIA has therefore been to concentrate largely, but not exclusively, on these aspects of the development.

4.6 Public Consultation and Town Hall Meeting

The approach to public consultation for this EIA has been explained in Section 4.4. As a follow-up to focused interviews, the developers with NEPA's approval agreed to hold a Town Hall meeting upon completion of the Draft EIA report to inform the public on its results and to obtain their feedback. The methodology utilised has been similar to that required for post EIA Public Hearings. The Town Hall Meeting was held on July 9, 2009 at the Old Harbour High School with over 60 persons in attendance.

The purpose was for the feedback received at the Town Hall meeting to be incorporated into the final EIA report which would then be made available to the public in hard and electronic copies for their further written comments or questions. It is anticipated that NEPA will address these to the developers for further consideration and clarification as necessary.

5.0 THE EXISTING ENVIRONMENT

5.1 Site Specific Environmental Features

This section of the EIA examines the features that are specific to the sites at the Whim and Brampton Farms that are to be developed as Phases II and III of the New Harbour Village. Specific physical and biological descriptions for the drainage systems transiting the development site were compiled to compensate for the fact that these descriptions would not have been represented in the New Harbour I EIA. Descriptions for these systems are outlined below. The socio-economic environment has also been revisited in the context of the proposed developments.

5.1.1 Existing Land Use

Both the New Harbour II and III development sites show a development history similar to that experienced by the New Harbour I site, in that they both had been extensively modified and cleared in the past for agricultural pursuits. Figure 5.1.1a, which is a time series representation of the site in 1991 and 2007, shows the New Harbour II (Whim) site in extensive Sugar Cane cultivation in 1991, with the New Harbour III site (Brampton) in orchard agriculture. The 2007 Google image shows both sites being predominantly in a ruinous condition, after agricultural activities had been terminated for several years. The exception in this case is that production is still underway in 5 ponds located at the eastern end of the New Harbour III site.

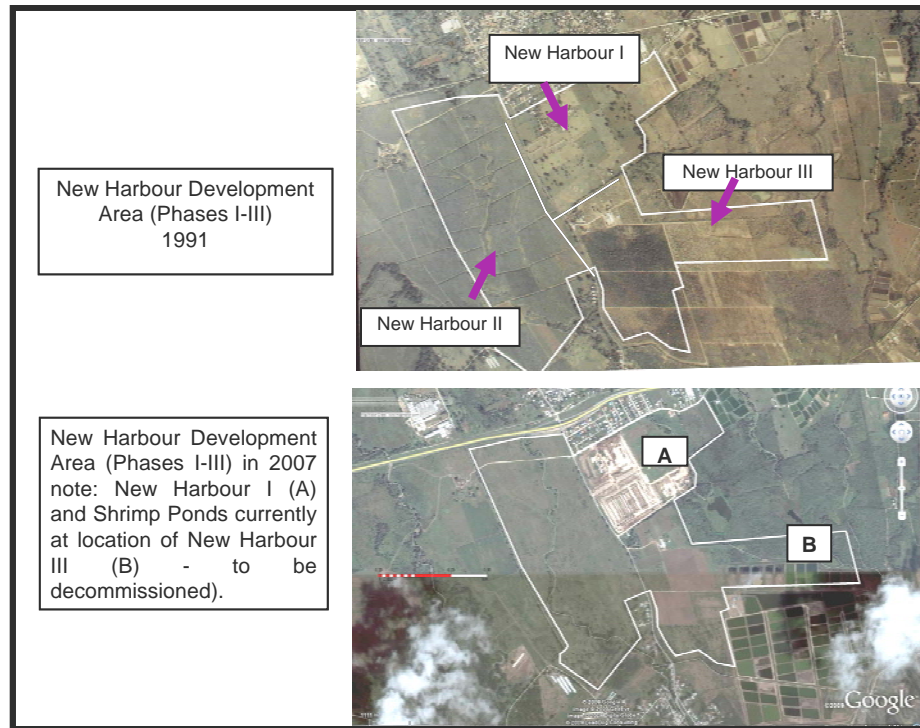


Figure 5.1.1a Time series imagery of the New Harbour development area showing land-use changes over time.

The ponds are a part of a 101 Hectare Shrimp aquaculture facility operated as a joint venture between the Jamaica Agricultural Development Foundation and the University of the West Indies (Figure 5.1.1b). The Facility currently produces approximately 130,000 kg of White Shrimp (*Litopenaeus vannamei*) annually. However, the 5 ponds in question, as well as the entire facility, will be brought out of operation shortly as the entire Jamaica Agriculture Development Foundation's (JADF) Brampton Shrimp farm facility is to be relocated.



Figure 5.1.1b Oblique aerial image of the JADF Shrimp Aquaculture facility adjoining the proposed New Harbour III Development.

Both the New Harbour II and III sites exhibit physical, topographical, geological and biological characteristics in common with that described in the New Harbour I EIA. In summary, the following apply (extracted from section 5 of the New Harbour I EIA):

1. Topography - the New Harbour's I-III sites are of a gently sloping nature towards the southeast, with slopes of 1:91 being typical. The largest elevation changes on the site are approximately 10-14 m
2. Hydrology - all sites are bisected by southerly flowing seasonal drainage systems.
3. Geology/Hydrostratigraphy -All sites are underlain by both Yellow and White limestone groups, with a much younger layer of coarse gravels, sands and clays discharged from the Rio Cobre River having been deposited on top of the Limestone groups.
4. Soils -soil types (as defined on the soils map of St. Catherine) are characterized by the Lodge Clay Loam at all sites.
5. Floral and faunal descriptions – these have been typically controlled by the repeated agricultural disturbances on the site and are, as a consequence, not reflective of virgin environments. The New Harbour I EIA spoke to “adjoining sites” (including the New Harbours II and III sites) as being highly disturbed, precluding any form of natural re-colonization with natural floral species and subsequently reducing faunal diversity. The EIA spoke to pasture lands colonized by both African Star Grass and Guinea Grass, which dominate the landscape with scattered large trees being present, particularly along the alignment of drainage channels traversing the sites. Acacia trees dominated the landscape at the northern end of the New Harbour III site. Faunal representations

were regarded as being low, with a limited number of Bird species being the dominant fauna represented on the site (Appendix VI – New Harbour I, Biological Baseline Data, ESL, 2006).

In addition to the work conducted for the New Harbour I EIA, soil analysis for pesticides was conducted on the New Harbour II site revealed no traces of pesticides or any other chemicals that could pose an issue where the use of the land is concerned (Appendix V).

Land coverage and drainage characteristics, as interpreted from the 2007 Google Earth image of the site and supported by ground truthing, are illustrated on Figures 5.1.1c and d. This interpretation, along with confirmations made from oblique aerial imagery has served to confirm points 1, 2 and 5 outlined above.

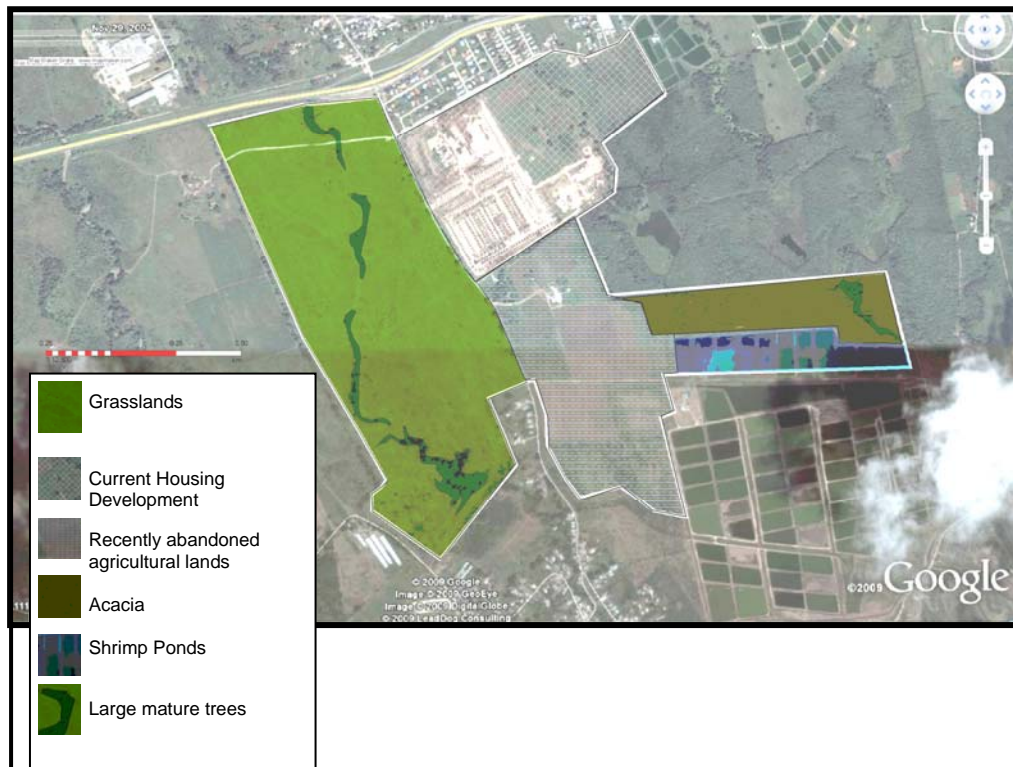


Figure 5.1.1c Land cover characteristics for the New Harbour I-III development sites.

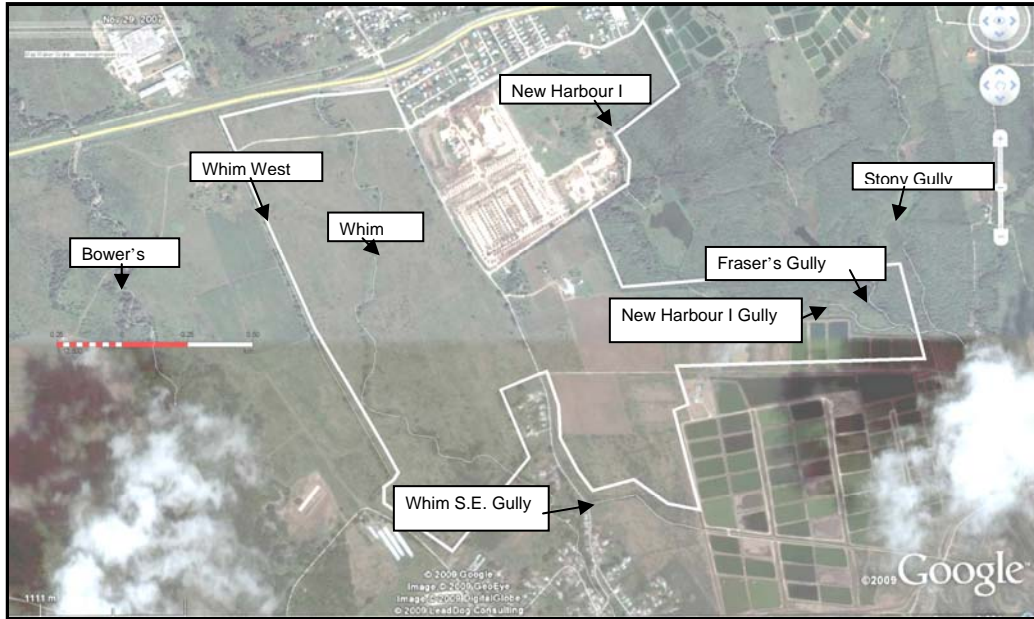


Figure 5.1.1d Overall drainage of the New Harbour I-III development sites.

5.2 Hydrology

Of the seven water courses examined during field investigations for this study, three were examined in detail due to their hydrological significance. These are the Bower's Gully, the Whim Gully and the Fraser's Gully. Diagrammatic representations of the alignments of the channels examined will be outlined under descriptions for Ecological assessments (section 5.3).

5.2.1 The Bower's Gully

The Hydrological study entitled Engineering Hydrology, Drainage Study and Flood Mapping (Feb 2009) prepared by Fluid Systems Engineering Ltd provides the detailed background to the Bower's Gully and is included as Appendix III.

The Bower's Gully currently drains a catchment area that is approximately 4074 Hectares in area. Average cross section dimensions for the Bower's Gully below the New Harbour II drainage intercept are approximately 12 meters wide by 2.5 meters deep. The predicted predevelopment flow along Bower's Gully is estimated to be between 340 – 360 m³/s for the 1:100yr return period (Appendix III).

5.2.2 The Whim Gully

The Hydrological study entitled “GDL WHIM Housing Development Drainage Designs”, (A.F Engineering, 2009) provides the background to the Whim Gully and is included as Appendix III.

Whim Gully currently drains the western section of the Old Harbour town, an area exceeding 100 Hectares. A flows of approximately 23m³/s is projected to flow through this gully during a 1:25 year event. Average cross section dimensions for the Whim Gully are approximately 1.5 meters by 5 meters.

5.2.3 The Fraser's Gully

A hydrological study prepared for Gore Developments Ltd. By Foreman Chung and Sykes (July 4, 2009) provides the background to the Fraser's Gully and is included as Appendix III.

The Fraser's Gully currently drains lands east of the Old Harbour town, with a combined catchment area of 1866.6 Hectares. Two smaller drainage systems, the New Harbour I and the Stoney Gullies also influence the Fraser's Gully within the development site with a combined catchment area of 573 Hectares. For a 1:25 year event, the Fraser's gully has an estimated discharge of 178.7 m³/s while the New Harbour I Gully has an estimated discharge of 50.5 m³/s and the Stoney Gully discharges at 103.9 m³/s.

All three systems flow into three separate micro-dams, constructed in the 1980s for an intended water supply scheme. These micro-dams are on property immediately bordering the New Harbour III site to the north (on lands called Government Brampton). The discharge values for the drains have been calculated for the channels leading seaward from these micro-dams, across the New Harbour III property.

5.3 Water Quality

Water quality data for the three main gullies are presented in Table 5.3 below:

Table 5.3 Water quality data analyses for the project area.

Parameters	Test Method	SAMPLES			NRCA SEWAGE EFFLUENT STANDARDS	NRCA AMBIENT FRESH WATER STANDARDS
		Bower's Gully	Whim South Gully	Fraser's Gully		
pH (Units)	DR	7.68	7.62	7.81	6-9	7.00-8.4
Conductivity (mS/cm)	DR	21.10	2.05	2.61	-	-
Salinity (ppt)	DR	14.0	1.7	2.2	-	-
BOD (mg/L)	H-10099	5.6	4.2	6.8	20	0.80-1.7
TSS (mg/L)	SM-2540D	39.0	7.0	46.0	20	-
Chloride (mg/L)	H-8206	29,720.0	5,200.0	9,100.0	-	5.0-20.0
Sulphate (mg/L)	H-8051	620.0	160.0	180.0	-	3.0-10.0
Nitrate (mg/L)	H-8039 & H-8192	1.3	3.1	1.8	Total Nitrogen 10ppm	0.10-7.5
Phosphate (mg/L)	H-8048	0.02	0.41	2.63	4	0.01-0.8
Oil & Grease (mg/L)	PR/GRV				-	-
Total Coliform (MPN/100ml)	SM9221		≥2400		-	-
Faecal Coliform (MPN/100ml)	SM9221	<3	≥2400	240	1000	-
Copper (µg/L)	F-AAS				-	-
Manganese (µg/L)	F-AAS				-	-
Lead (µg/L)	F-AAS				-	-
Zinc (µg/L)	F-AAS				-	-

KEY H - HACH Water Analysis Handbook, 3rd edition
 SM - Standard Methods for the Examination of Water and Wastewater, 20th edition
 DR - Direct Reading
 F-AAS - Flame Atomic Absorption Spectroscopy

Quality Control – Analytical and Field duplicates, standard reference materials.

All relevant water quality parameters, as covered under both the NRCA Sewage Effluent Standards and the NRCA ambient freshwater standards were well within the respective standards, with the exception of Total and Faecal Coliform values for the Whim Gully - South section. These values are not surprising because the gully banks at, above and below the point of sample taking, were lined with settlements built almost at the bank edge. With absorption pits being the most likely sewage disposal option used within these areas, it is likely that the Whim Gully –south section, may be experiencing sewage seepage from these settlements.

The New Harbour I Gully meets the Fraser's Gully a few meters up-stream of the water sample location at which the previously stated Faecal Coliform values were obtained. The mechanical treatment plant for the New Harbour I development discharges into the New Harbour Gully ahead of its junction with the Fraser's Gully.

In 2006, when the New Harbour I EIA was prepared, Faecal Coliform values greater than 2400 MPN/100 ml were obtained from the New Harbour I Gully near to the current location of the New Harbour I treatment plant. This suggests that there was significant faecal contamination of the New Harbour I Gully prior to the implementation of the New Harbour I development. A value of 240 MPN/100 ml at the junction with the Fraser's Gully, even with contributions from the current treatment plant, suggests that there is a reduction in the Faecal Coliform values by the time the New Harbour I Gully flows meet it.

All three sample locations demonstrated clear evidence of saline influences, indicating that these systems are tidally influenced up to the locations of each station.

5.4 Ecology

5.4.1 Bower's Gully

The length of the Bower's gully channel that was examined in the EIA study has been divided into two sections, based on levels of inundation. The section bound by latitude and longitude coordinates 17° 55.089'N 077° 06.794'W- 17° 54.248'N 077° 06.953'W is characterized by seasonal flows and was predominantly dry at the time of survey, with the exception of a few pools of standing water. Sections existing south of 17° 54.248'N 077° 06.953'W and extending to the sea were tidally inundated, with water depths exceeding 1.5 meters towards the sea. A sediment bar at the mouth of the Bower's Gully effectively reduced channel depths to less than 0.5 meters.

5.4.1.1 Seasonally Dry Channel Area

The banks of this gully were dominated by the species in Table 5.4.1.1 below. This gully is illustrated in Figure 5.4.1.1.

Table 5.4.1.1 Dominant flora and fauna of the seasonally dry channel area of the Bower's Gully.

Flora	Fauna
<ul style="list-style-type: none"> Guango Tree <i>Samanea saman</i> Bastard Cedar Tree <i>Guazuma ulmifolia</i> Duppy Cherry Tree <i>Cordia alba</i> African Star Grass <i>Cynodon nlemfluensis</i> Guinea Grass <i>Panicum maximum</i> Coralita <i>Antigonon leptopus</i> Sedge <i>Cyperus ligularis</i> 	<ul style="list-style-type: none"> Bull Frog <i>Bufo Marinus</i>, in both adult and tadpole forms Mosquito Fish (or Ticki Ticki) <i>Gambusia sp</i> A gastropod, <i>Melanoides tuberculota</i>



Figure 5.4.1.1 Seasonally dry channel area of the Bower's Gully (below New Harbour II Drainage Intercept).

5.4.1.2 Bower's Gully – Tidally Wet Area

The banks and channel of the Bower's Gully were dominated by the species listed in Table 5.4.1.2 and a section of the gully illustrated in Figure 5.4.1.2 below.

Table 5.4.1.2 Dominant flora and fauna of the Bower's Gully – Tidally Wet Area.

Flora	Fauna
<ul style="list-style-type: none"> Acacia, Giant Reed <i>Arundo donax</i> Bamboo, <i>Phyllostachys sp.</i> Black Mangroves <i>Avicennia germinans</i> White Mangroves <i>Laguncularia racemosa</i> Red Mangroves <i>Rhizophora mangal</i> 	<ul style="list-style-type: none"> Snook <i>Centropomus undecimalis</i> Tarpon <i>Megalops atlanticus</i> Mangrove Snapper <i>Lutjanus Griseus</i> Giant Land Crab <i>Cardisoma guanhumi</i> Crocodiles <i>Crocodilus acutus</i>



Figure 5.4.1.2 Permanently inundated channel area of the Bower's Gully (extending towards the sea).

5.4.2 Whim West Boundary Gully

The banks and channel areas of the Whim west boundary gully (Figure 5.4.2) regarded as the western boundary of the New Harbour II property boundary (the whim) was dominated by the species in Table 5.4.2.



Figure 5.4.2 Whim West Boundary Gully.

Table 5.4.2 Dominant flora and fauna of the Whim west boundary gully.

Flora	Fauna
<ul style="list-style-type: none"> Guinea Grass, <i>Panicum maximum</i> African Star Grass, <i>Cynodon nlemfluensis</i> Guango Tree, <i>Samanea saman</i> Duppy Cherry Tree <i>Cordial alba</i> Coralita <i>Antigonon leptopus</i> 	<ul style="list-style-type: none"> No fauna were observed within the channel, which was dry at the time of observation.

5.4.3 Whim Gully

The banks of the Whim Gully were dominated by the species at the various locations as listed in Table 5.4.3.

Table 5.4.3 Dominant flora and fauna of the Whim Gully.

Location	Flora	Fauna
Banks north of position 17° 54.921'N 077° 06.130W (Figure 5.3.3a)	<ul style="list-style-type: none"> Guinea Grass, <i>Panicum maximum</i> African Star Grass, <i>Cynodon nlemfluensis</i> Guango Tree, <i>Samanea saman</i> Coralita <i>Antigonon leptopus</i> 	<ul style="list-style-type: none"> Mosquito Fish (or Ticki Ticki) <i>Gambusia sp.</i> Bull Frog, <i>Bufo marinus</i> African Perch <i>Tilapia mossambica</i>
Banks between 17° 54.921'N 077° 06.130W to position 17° 54.639'N 077° 05.940W (mainly introduced species) (Figure 5.3.3b)	<ul style="list-style-type: none"> Guango Tree <i>Samanea saman</i> Coconut Palm <i>Cocos nucifera</i> Almond Tree <i>Terminalia catappa</i> Mango Tree <i>Mangifera spp</i> June Plum <i>Ambarella spondias</i> Coralita <i>Antigonon leptopus</i> 	<ul style="list-style-type: none"> Mosquito Fish (or Ticki Ticki) <i>Gambusia sp.</i> Bull Frog, <i>Bufo marinus</i> African Perch <i>Tilapia mossambica</i>
South of position 17° 54.639'N 077° 05.940W (see Figure 5.3.3c) and heading towards the sea	<ul style="list-style-type: none"> Acacia Red Mangroves <i>Rhizophora mangal</i> Black Mangroves <i>Avicennia germinans</i> <p>* The mangrove observations suggested tidal exposure at the point of observations.</p>	<ul style="list-style-type: none"> Fiddler Crab <i>Uca sp</i> Blue Crab <i>Callinectes sapidus</i> Needle Fish <i>Strongylura notata</i> Mangrove Snapper <i>Lutjanus griseus</i>

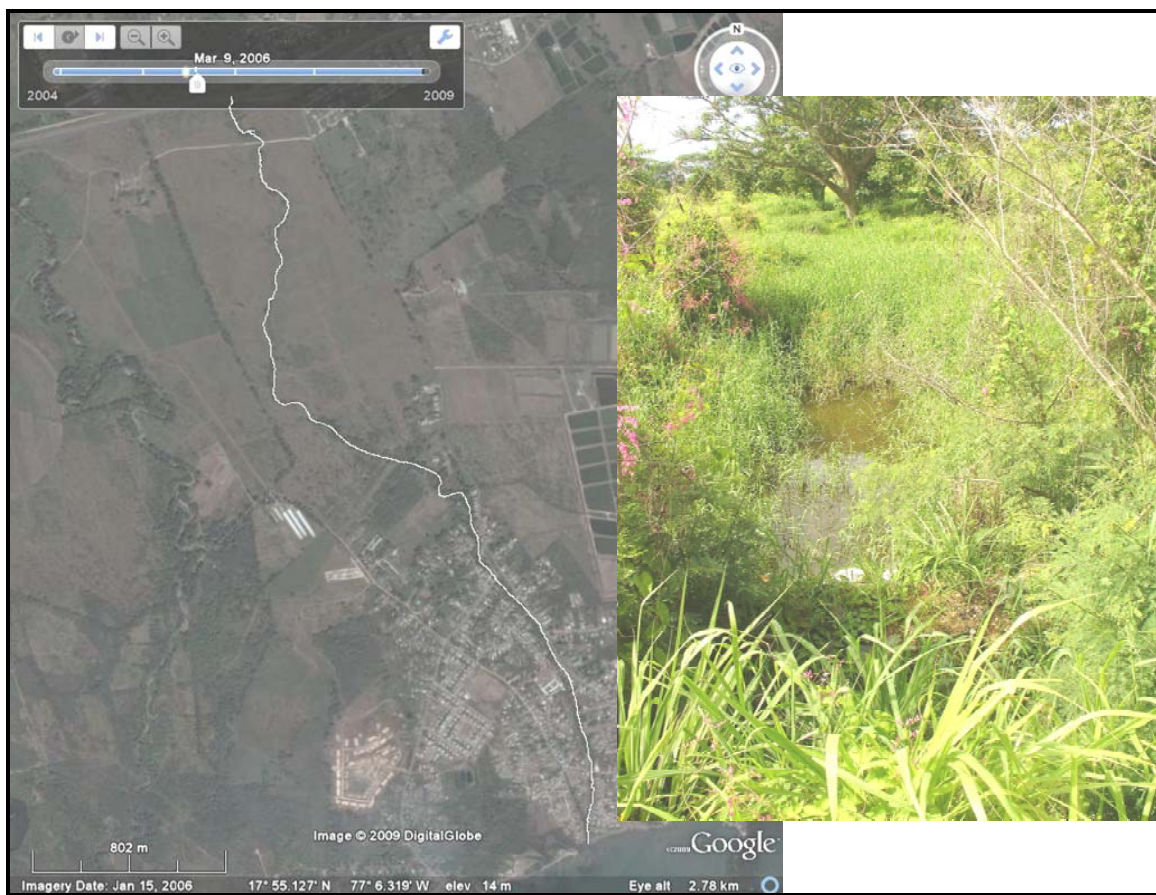


Figure 5.4.3a Whim Gully north of position 17° 54.921'N 077° 06.130W.



Figure 5.4.3b Whim Gully between 17° 54.921 and 077° 06.130W to position 17° 54.639'N 077° 05.940W.

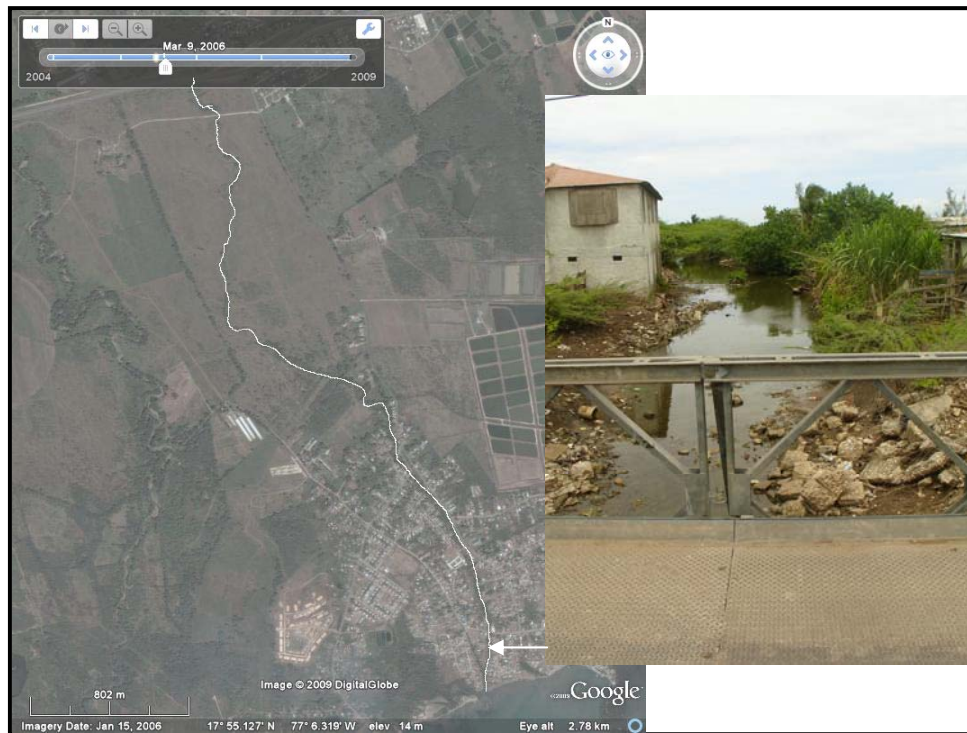


Figure 5.4.3c Whim Gully south of position 17° 54.639'N 077° 05.940W.

5.4.4 Whim S.E. Gully

Flora observed along the banks of this gully included the following:

Flora	Fauna
<ul style="list-style-type: none"> • Acacia • Guinea Grass, <i>Panicum maximum</i> • Coralita <i>Antigonon leptopus</i> 	<ul style="list-style-type: none"> • No fauna were observed within the channel of the gully.

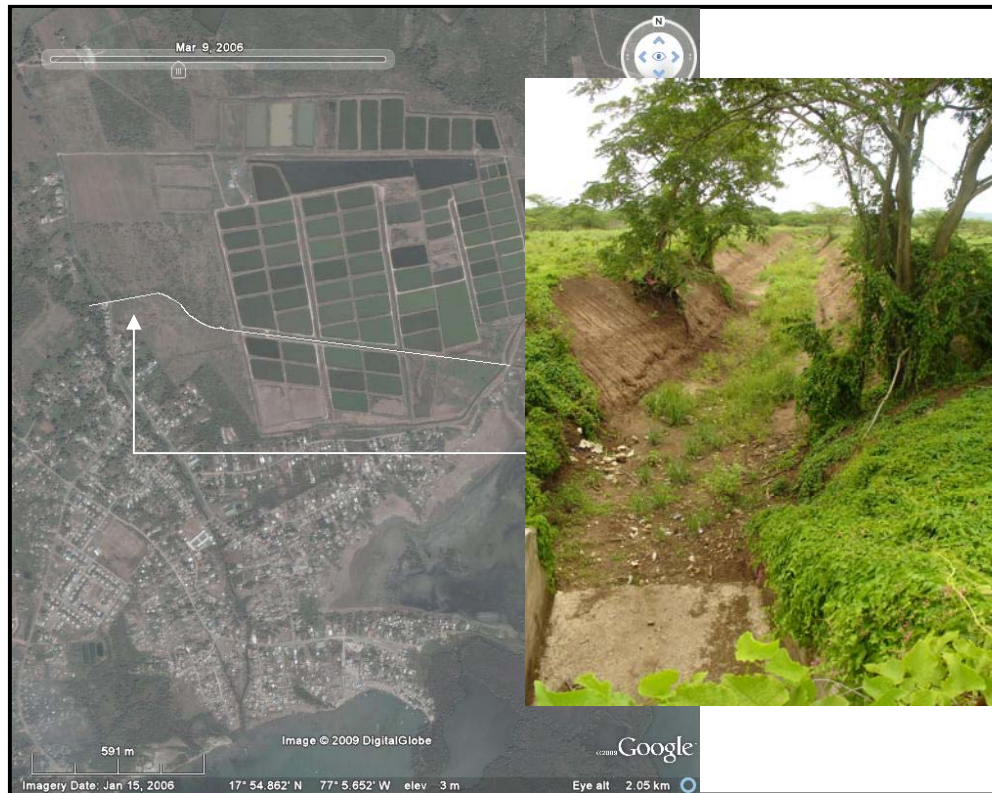


Figure 5.4.4 Whim SE Gully (note recently improved banks)

5.4.5 Fraser's Gully and Tributaries

Sections of the Fraser's Gully designated as the New Harbour I Gully and the Stoney Gully traverse the eastern section of the New Harbour III development area (Figure 5.4.5a, b and c). Crocodiles were observed at sections along this water body (Figure 5.4.5d and e). Table 5.3.5a shows the dominant species identified at the target areas. The gully eventually flows to Daggers Bay (Figure 5.4.5f) into the sea.



Figure 5.4.5a Confluence of the Drainage Systems within the New Harbour III Site (A: New Harbour I Gully; B: Fraser's Gully; and C: Stoney Gully).



Figure 5.4.5b Section of the New Harbour I Gully within the New Harbour III Site



Figure 5.4.5c Section of the Fraser's Gully within the New Harbour III Site



Figure 5.4.5d Image Showing Juvenile Crocodile observed at the Fraser's Gully within the New Harbour III Site.



Figure 5.4.5e Crocodile slaughter in the Fraser's Gully.

Table 5.4.5 Species list of the NH I, Frasers and Stoney Gullies

Locations	Flora	Fauna
New Harbour I Gully (Figure 5.4.5b)	<ul style="list-style-type: none"> Marsh Grass <i>Typha domingensis</i> 	none observed
Fraser's Gully	<ul style="list-style-type: none"> Acacia, Sedge <i>Cyperus ligularis</i>, Guinea Grass <i>Panicum maximum</i> 	<ul style="list-style-type: none"> Crocodile (juveniles –many <22 cm long –see Figure 10D), Land Crab, <i>Cardisoma guanhumi</i>, Blue Crab, <i>Callinectes sapidus</i>, Mangrove Snapper <i>Lutjanus griseus</i>
Stoney Gully	<ul style="list-style-type: none"> Acacia Marsh Grass <i>Typha domingensis</i> Guinea Grass, Sedge <i>Cyperus ligularis</i> 	none observed
Fraser's Gully outside of the New Harbour III development boundary and following its course to the sea.	<ul style="list-style-type: none"> Acacia Sedge <i>Cyperus ligularis</i> Guinea Grass <i>Panicum maximum</i> Marsh Grass <i>Typha domingensis</i> Black Mangrove White Mangrove Red mangrove 	<ul style="list-style-type: none"> Fiddler Crab <i>Uca sp</i> Blue Crab <i>Callinectes sapidus</i> Giant Land Crab Needle Fish <i>Strongylura notata</i> Mangrove Snapper <i>Lutjanus griseus</i> Crocodile (adult – dead with amputated head and tail – see Figure 5.4.5f)

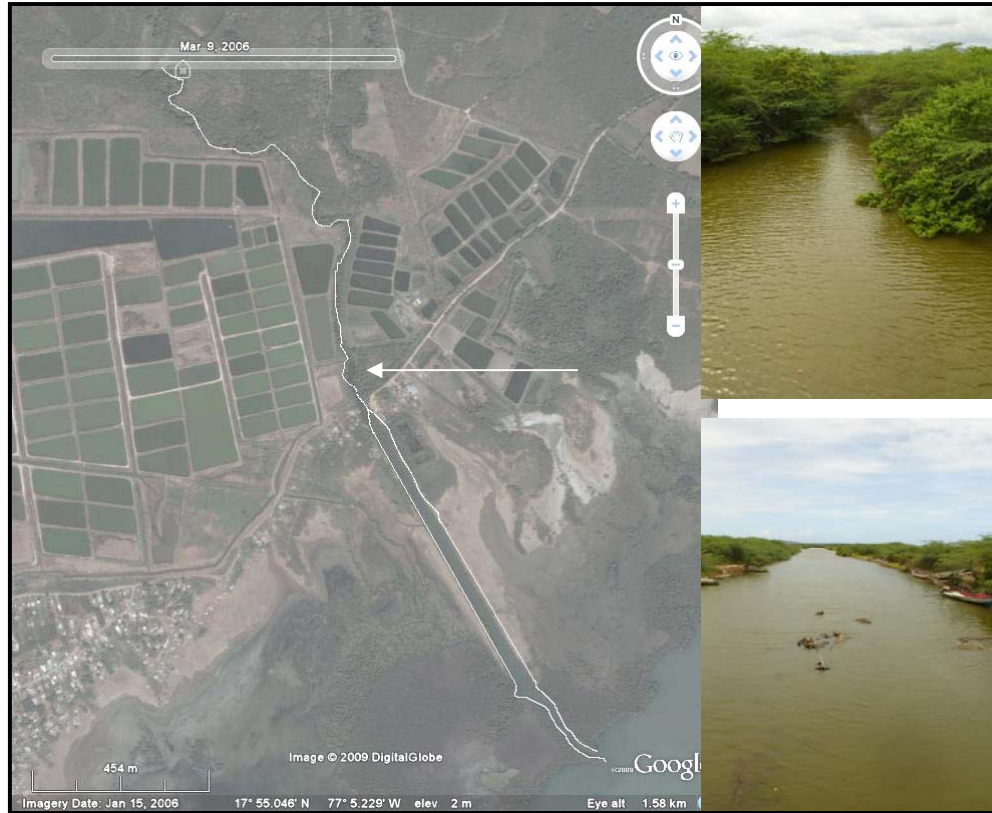


Figure 5.4.5f Fraser's Gully south of the New Harbour III site on its approach to Dagger's Bay.

5.5 Jamaica Public Service (JPSCo.) Power Lines

Three sets of JPSCo power lines transit the New Harbour II site. These are two-139 Kilovolt (KV) power lines, one-69 KV power line and one-40 KV power line. The three lines run from the JPSCo power plant at Old Harbour Bay and transit the New Harbour II site from the south western corner of the property through a 100 meter reservation oriented along the southern boundary of New Harbour II (Figures 5.5a and b).

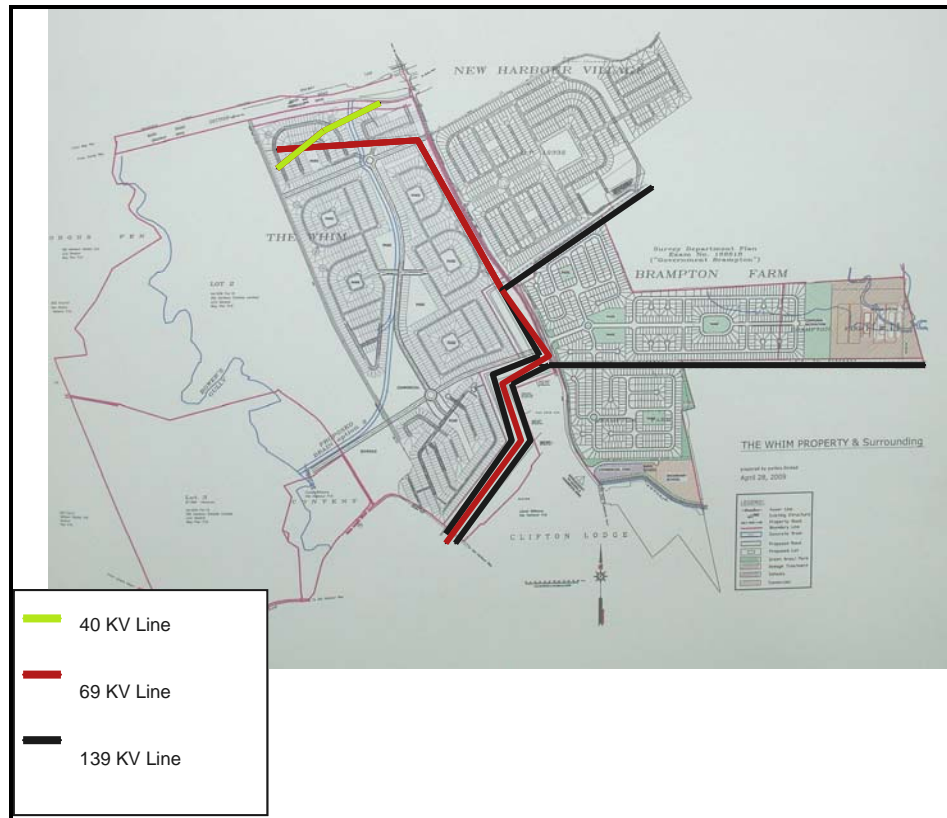


Figure 5.5a Existing layout of power lines transiting the development site.

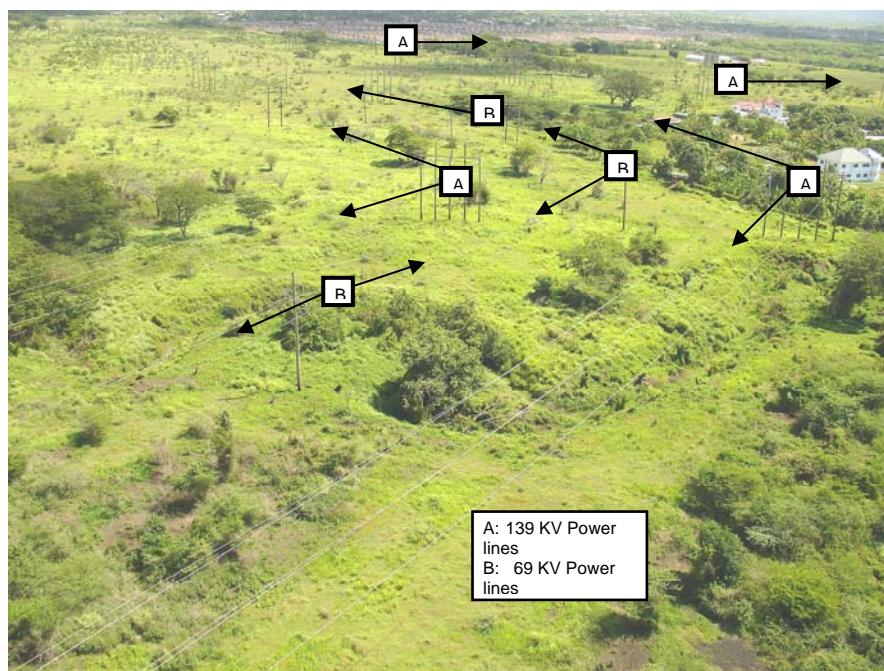


Figure 5.5b Oblique air photo of the existing layout of power lines transiting the Development Site.

At the south eastern section of the New Harbour II property, the 139 KV line runs eastwards over the Old Harbour Bay main road and along a 33 meter reservation existing between New Harbour III and JADF Brampton Shrimp farm facility (Figure 5.5a). The 69 KV line separates from the 138 KV line paths and runs northwards parallel to the Old Harbour Bay main road along a 15 meter wide reservation. At the northern boundary of the New Harbour I development, the 69 KV line turns west and bisects the northern section of the New Harbour II property. The 40 KV power line runs westerly across the northern section of the New Harbour II site, ultimately crossing the 69 KV line.

Proposed re-routes are outlined on Figure 5.5c, with the main re-routes occurring at the northern section of the New Harbour II site.

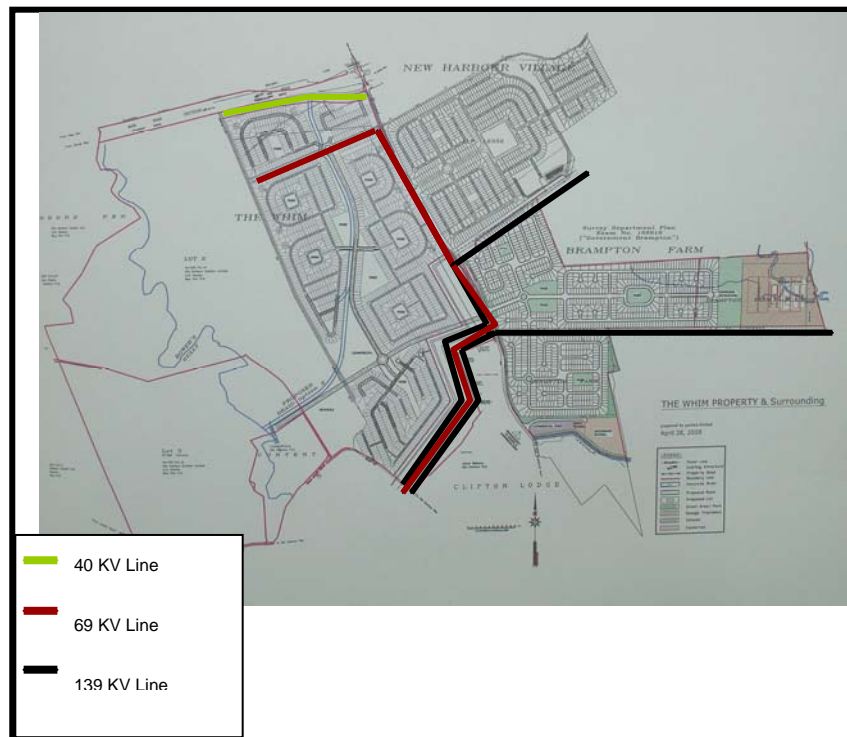


Figure 5.5c Proposed layout of Power lines Transiting the Development Site

The westerly running 69 KV line will be routed over a main internal roadway within the New Harbour II site, while the 40 KV line will be routed along a vegetation buffer to be placed between the northern section of the New Harbour II site and the Highway 2000 corridor. All re-routing will be done at the expense of the developers, to the tune of approximately \$13 million dollars.

5.6 Socio-economic Environment

5.6.1 Traffic

Highway 2000 which is a dual carriageway of two lanes in each direction is designed to international standards permitting speeds of up to 110 KM/H in sections, but reduced to 80 KMH where it bypasses Old Harbour. When complete it is designed to be the main transportation route between Kingston and Mandeville with a spur at Williamsfield to Montego Bay. Currently, while there is an exit off the highway into Old Harbour for westbound traffic and onto the Highway for eastbound traffic, there is no facilitation of traffic leaving Old Harbour westbound. Facilitating this routing by an additional turning lane under the current Highway Bridge is seen as important to handling projected traffic flows from the developments. This is the findings of a report done for the developers (see Appendix VII: *TIA Report Whim/Brampton Farms Development Old Harbour St. Catherine* - ADeb, 2009). As discussed below this is only a partial solution to the overall Old Harbour traffic problem.

The Old Harbour to Old Harbour Bay main road provides the present access to both NH II and III properties (Figure 5.6.1). It is a two lane 24 ft roadway and presently the only link between Old Harbour and Old Harbour Bay. Based on the ADeB report existing peak hour north bound traffic is 286 VPH and south bound is 380 VPH. The Old Harbour traffic police do not regard this volume as heavy or congesting until it comes onto South Street in Old Harbour and contributes to the congestion at the failed intersection at the clock tower (Figure 5.5.1a). The road surface of the Old Harbour Bay road is variable in quality, with the worst stretches lying between the Highway Bridge and New Harbour III (however, the immediate area in from of NH I has been improved).



Figure 5.6.1a Traffic congestion in Old Harbour Town, June 2009.

The traffic report (ADeB, 2009) makes the assumption that 80% of incremental traffic arising from the developments will be Kingston bound and 55% of that traffic will flow along the Old Harbour to Kingston main road. This underscores the importance of this road in connecting Old Harbour westward to May Pen and Mandeville and eastward to Spanish Town and Kingston.

The section between Old Harbour and Gutters is important as it carries commuters from several high density residential clusters east of Old Harbour both into Old Harbour and into Spanish Town and Kingston. In addition, when the Rio Cobre Gorge road is impassable, it provides the route of choice for traffic coming through the Berrydale detour to link to Mandeville via Old Harbour and May Pen.

Like other A2 roads where they border Highway 2000, this road is variable with respect to surface quality and at times challenging with respect to driving conditions. It is also subject to localized flooding during intense weather conditions, closer to Old Harbour end. However, the road has seen recent improvements and it is reported as being reasonably free flowing outside of peak hours.

On the western side of Old Harbour the main road continues past Port Esquivel and the junction with the Salt River road and continues through Sandy Bay to May Pen and Mandeville. Near Old Harbour this road carries traffic routing into Old Harbour and through to Kingston from outlying housing schemes, the largest of which are Longville Park and the Avery schemes. This road also carries all of the traffic from the central and western sides of the Island that avoid using Highway 2000. Figure 5.6.1b shows the road network in and around Old Harbour and Old Harbour Bay.

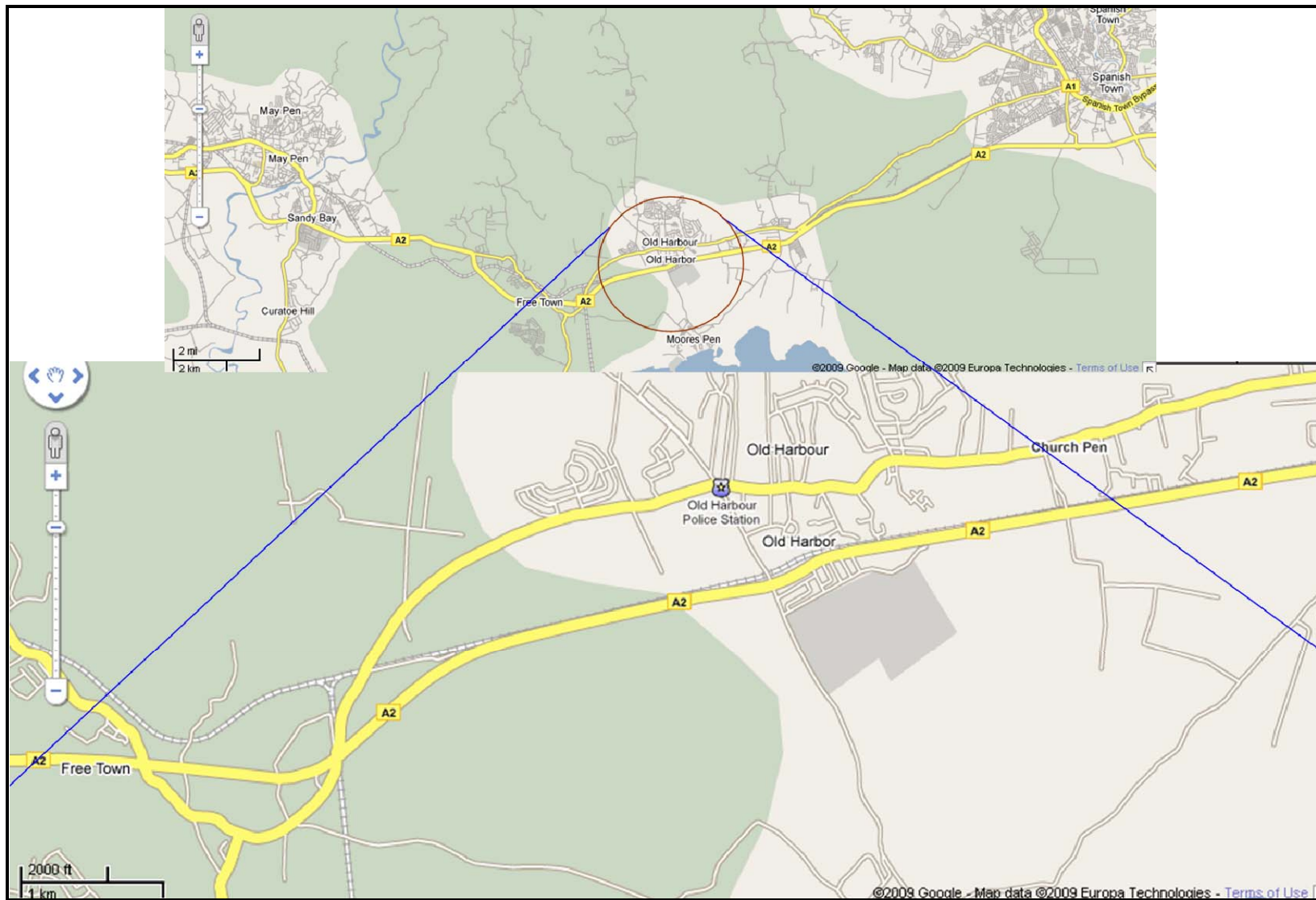


Figure 5.6.1b The road network in and around the project area.

5.6.2 Social Infrastructure

The likely relationship between the planned developments and the existing social infrastructure is discussed against a background of interviews held with service providers prior to and subsequent to Phase I (2006).

5.6.2.1 Health Services

As commented on in the Phase 1 2006 EIA, the nearest hospitals are in May Pen which has since been upgraded to a Type B but with the same number of beds (150) and Spanish Town a Type B which has moved from 275 beds to approximately 340. The anticipated completion of a much upgraded emergency wing will likely make Spanish Town the hospital of choice for emergency cases originating in the Developments. Response time for either of the hospitals for a round trip is about a half an hour. Currently each operates under considerable resource constraints, both of equipment and medical staff. Doctor's offer the opinion that the public health care system has not adjusted itself to the demands generated on it by free medical services.

Some upgrading focus is being placed on the Type 3 Public Health Clinic serving Old Harbour but at the time of the Phase I EIA (2006) major upgrading was predicated on the relocation of the clinic. However it remains in its present location and, in common with most urban clinics, operates with restraints of staff and equipment in relation to demand. A demand that health providers believe has been steadily increasing. Old Harbour Bay still operates with a satellite service (visiting service) on a one visit a month schedule. Discussions with citizen in Phase I suggest that residents generally do not use the local health clinic. Instead, opting to retain their health providers used prior to relocation. If this is typical of what will happen with Phase II and III residents, then the impacts of these housing developments on local health services may not be as dislocating as initially assumed. Space has also been provided by the Developers, in the Whim for a Health Clinic to be established by the Government if it so wishes.

5.6.2.2 Police Stations

The projects fall within Area 5 of the Constabulary Forces, headquartered in Portmore. The Old Harbour Police Station is one of seven Out Stations within the Division. The establishment force for this station was about 40 persons in 2006 and remains the same today. Currently their average strength is reported below this figure as was also the case in 2006. The stations still experience resource stress both in terms of experienced force personnel and transportation. Crime is viewed by officers and civilians as being on the increase but is not yet not seen as a major problem. Phase I, while initially having some security challenges has generally not been an area of demand for policing services. This is partly attributed to the scheme being fenced off and gated with good internal security arrangements in place. Although expanding residential

neighbourhoods will bring additional policing demands, if Phase II and III are managed in a similar way to Phase I then the police will probably not be overly taxed in relation to keeping on top of crime in these areas.

5.6.2.3 Fire Services

Interviews with the officers at the new fire brigade station on South Street (Figure 5.6.2.3), revealed that some improvement has been effected to the complement of officers subsequent to their relocation. Considerable improvement has been made to personal comfort and over-night facilities. However, the station still operates only one unit which has to re-water off location, as the need arises.



Figure 5.6.2.3 The Old Harbour Fire Brigade.

Unreliable water supply in a significant percentage of the fires responded to was cited as a major challenge of the Brigade in the 2006 EIA and is still the case in 2009. This is partly because a majority of hydrants serving the Old Harbour area are out of service. In fact Phase I fire hydrants are a main source of watering their unit. Similarly unreliable water pressure is still an important hindrance to effective service.

5.6.2.4 Educational Facilities

Old Harbour High school remains the only high school located in Old Harbour and in this part of St. Catherine. It receives students (2,500) from five main feeder schools in the parish. It therefore comes under tremendous pressure for absorbing the annual demand for GSAT placement. Since the Ministry of Education places students by location within limited choices, any new residential developments in the school's catchment area add to this annual challenge.

With respect to students already in the secondary system, most parents in the Phase I scheme appear to be keeping their children in the schools they attended prior to relocation. The pre-secondary situation remains far from clear except that persons interviewed suggest that facilities targeting these needs are inadequate in relation to space, facilities and staffing. As more residential settlements emerge in the greater Old Harbour area the current inadequacy of school places, at all levels, and must be addressed aggressively. Some 12 acres of land (see area in orange circle in Figure 5.6.2.4) has been set aside by the developers on the Whim (NH II), for the Government to access and construct a secondary and primary school if it so wishes.

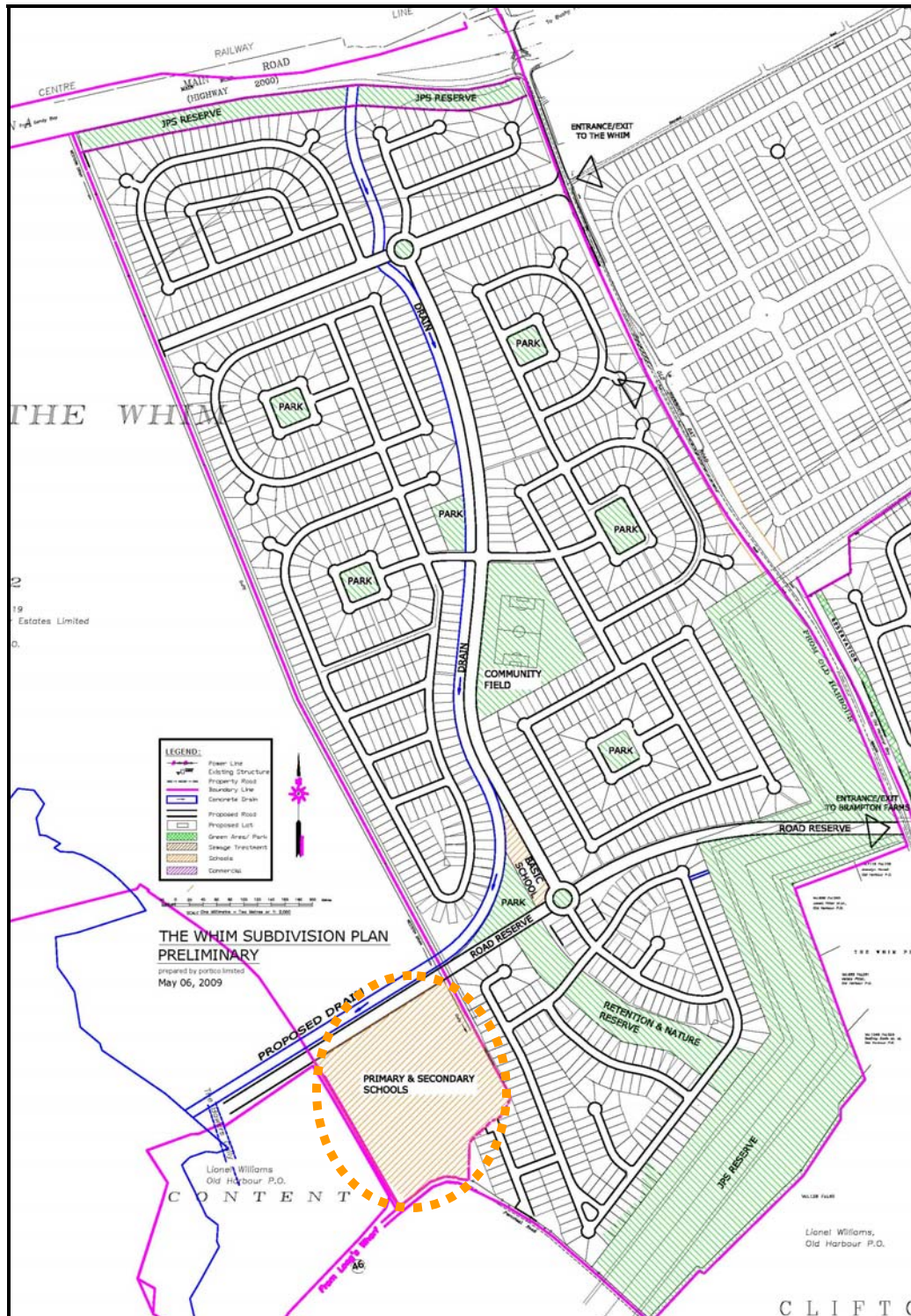


Figure 5.6.2.4 Reserved land for the establishment of primary and secondary level schools on the south west boundary of NH II.

5.6.3 Public Perception

In the EIA undertaken for Phase I some 300 persons were canvassed throughout several communities to address their attitude towards that pending development. However, for Phases II and III a smaller sampling of just over 50 opinions on the proposed project was targeted (Table 5.6.3). The objective was to use the significant completion of Phase I to investigate how the development influenced how those sampled viewed the new proposed developments.

The information confirmed by those interviewed is that Phase I is viewed very favourably as a positive contribution to housing solutions for the area and this can be assumed to have influenced the receptivity among all respondents, to the proposed developments. For Phase I there was a core of concerns related to: imported criminality; noise and anti social behaviour; the steady deterioration of residential standards; waste management fears; and induced flooding. Particularly sensitive were the closer lying communities of Bay View Gardens, Belmont Park and Sharpers Lane. None of these concerns were realized with Phase I and they were not felt to be an important concern for Phases II and III.

Several of those interviewed suspended final judgment on the impact of Phase I on flooding in the area, on the grounds that the scheme had not yet been tested by heavy flood rains. There was also concern, mainly in Old Harbour Bay, that improvements experienced with flooding consequent to ongoing efforts to address this issue, should not be undermined by the developments.

Table 5.6.3 Interviews held, using the rapid appraisal approach for capturing community perceptions in the Old Harbour area.

Interviewees	Old Harbour	Old Harbour Bay	Totals
Community Residents	17	10	27
Business Operators	17	4	21
Other stakeholders or Informants	5	1	6
Total	39	15	54

The consultants conclude that there is strong community approval for Phases II and III, and that the main reasons for this lie in the fact that there are expectations that some employment and income benefits will be generated and because New Harbour Village I is viewed in a very positive light.

5.6.4 Employment

Construction of Phase II is expected to create about 500 jobs. The later Phase III is not expected to generate further new employment since it will be timed to utilize the same workers. Typical of residential developments, the post-construction phase of additions and modifications will also create employment opportunities for the pool of construction skills that exists in the Old Harbour area.

In the EIA undertaken for Phase I, Old Harbour was characterized as an urban centre growing rapidly with settlements over the past two decades, but, during which its economic vibrancy had considerably waned. Based not only on anecdotal reports but objectively verifiable by observation, this shrinking economic base has been brought about by the demise of once important labour intensive economic infrastructure. Loss of productive assets have occurred in: livestock (dairying); crop production (tobacco); heavy & light manufacturing (electricity, garments, animal feeds pulp and paper products); road & housing construction (H2k & Gore's Phase I); and more recently bauxite (Windalco).

Currently the only new initiative, ethanol plant, which is capital intensive and animal feeds production, fish farming, packaging, power generation and some housing construction are the main stabilizing production factors. The creation of 500 jobs, even temporarily is therefore important. In addition haulage contracts and other construction site services contracted for can be expected to assist the local economy over the five to six year construction period of NH II and NH III.

5.6.5 Solid Waste Management

The solid waste management requirements of both phases of the development require prompt and efficient removal of construction phase vegetative matter and construction related waste and later domestic waste to an approved disposal site.

In the case of Old Harbour the approved disposal site is Riverton City and the service provider for domestic waste is the Metropolitan Parks and Markets (MPM). Contract haulage firms will be used for the construction waste as was the case with Phase I. Garbage collection in Old Harbour, and in particular large residential developments, seems better scheduled and therefore more reliable than in outlying communities. Citizens in Phase I report that waste collection is regular and fairly efficient. The service is regarded by informants as generally sufficient for the orderly and timely removal of garbage. Phases II and III schemes can be expected to generate in the order of 21.5 metric tonnes of waste daily based on national household waste generation assumptions.

5.6.6 Energy and Water Consumption

5.6.6.1 Energy

Jamaica Public Service Co Ltd is being approached to approve the electricity supply plan for the developments. As in New Harbour Village Phase I, and other GDL developments, solar water heaters are provided as built in features in all residential units.

5.6.6.2 Water Supply

The projects may be extracting 100% of their water requirements from the Rodon's Pen well. The daily requirement of water from this source is calculated to be 3,325 cubic meters and a license has been obtained to extract up to 4,360 cubic meters per day. The Water Resources Authority has approved abstraction from the source (Appendix IV).

The National Water Commission (NWC) has also given a commitment to provide water for their system for NH III if required. A water treatment facility will be installed to ensure the integrity of the project's domestic water supply needs. Water storage will be provided for both developments, by a tank designed to hold 1,845 cu meters (or 500,000 US Gals).

The Rio Cobre basin is the main source of supply for the parish of St. Catherine supplemented in some areas by The Rio Minho. The Rio Cobre basin's resources and production profile through 2015 – 2025 is illustrated in Table 5.6.6.2.

Table 5.6.6.2 Resource and production profile of the Water Management Unit serving the Rio Cobre basin
10⁶m³/year.

Water Management Units	Demand		Surplus (Deficit)	
	2015	2025	2015	2025
Rio Cobre	389	430	95	53

The data reflect that the Rio Cobre Basin will be put under further stress over time. The 10 year period from 2015 to 2025 shows a reduction in surplus supply of about 44%. The implication for the developers is that serious consideration must be given to introducing total water management systems into Phases II and III from this planning stage. This is given more urgency when national planners, in looking forward, have identified that the competition for scarce water resources to support large scale economic land use, either agricultural, manufacturing or housing development, will ultimately play a determining role in the future.

economic profile of this area (*Highway 200 Corridor Development Plan – Portmore to Clarendon Park –PIOJ 2005*). It should be noted that GDL homes are provided with modern water conservation systems for wash room and other domestic uses. Hence water consumption per capita is generally less than the national average.

5.6.7 Heritage Considerations

The developments lie in an area whose settlement dates back in the records to the Spanish and early British period. They both lie on a historically important trade, communication and security route between Old Harbour Bay, Old Harbour and the interior. The Whim property is found on early maps of the area. Sugarcane, tobacco, cattle and other livestock rearing were well established and documented activities.

The likelihood that the Spanish occupied former Taino settled sites (also reported on by Columbus) which would have already been cleared and favourably endowed with fresh water, also flags that such Taino sites may have been on the development sites. More recently Jamaica National Heritage Trust has taken a keen interest in foundations recently recovered (2006) and believed to be the Whim/Kelly Great House. This points to the need for due diligence to be exercised and in this regard it is proposed that the Jamaica National Heritage Trust (JNHT) be asked to undertake a watching brief at the time of site clearance and excavation.

5.7 Sewage Treatment Works

The New Harbour Phases II and III developments will be serviced by one sewage treatment plant to be located at the extreme eastern end of the New Harbour Phase III development (see location on Figure 5.7a). The treatment system will provide tertiary level treatment of the wastewater generated by the residential developments at the Whim, Brampton Farms, and commercial development area, as well as that of the proposed primary and secondary schools to be built in the future. The collection system from the developments will direct the sewage flow to a terminal lift station, which will then pump the sewage into the head-works of the treatment plant (WWTP) (Appendix II).

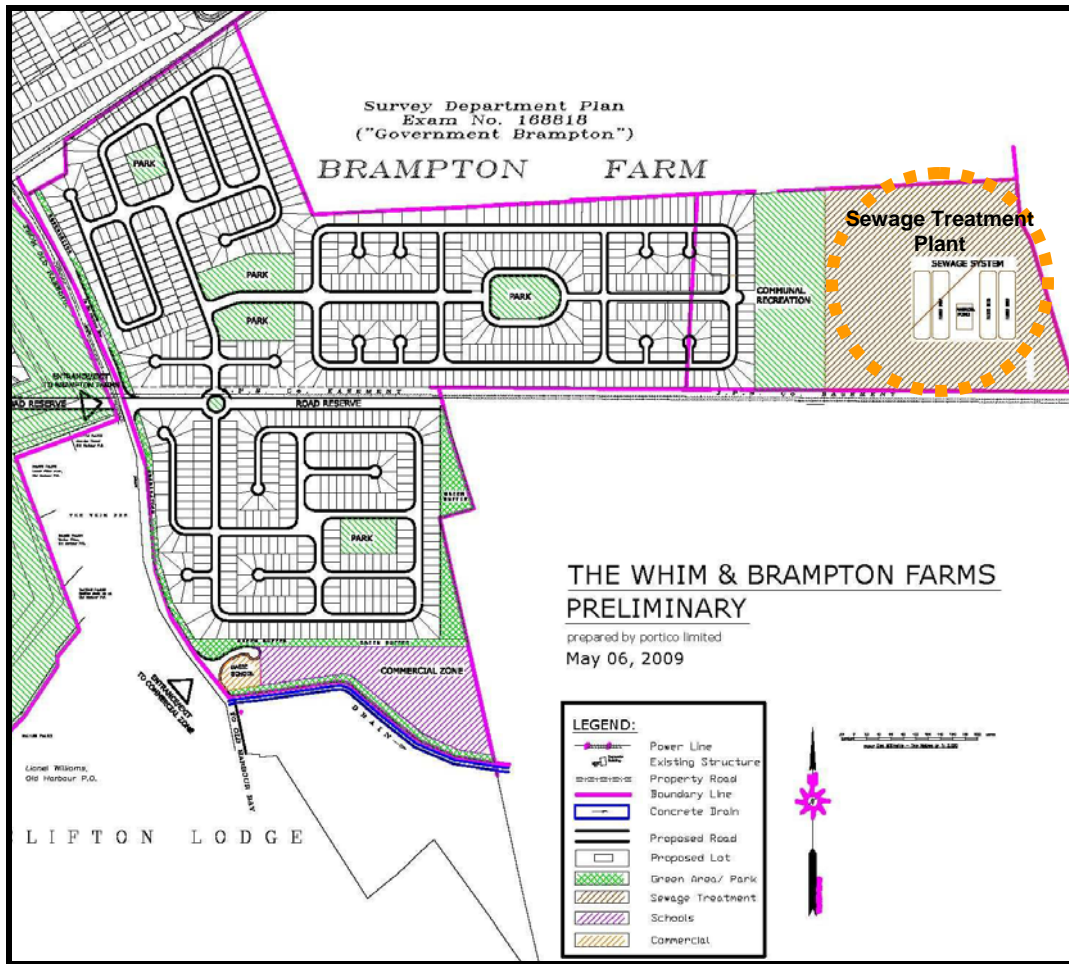


Figure 5.7a Location of the proposed Sewage Treatment Plant at New Harbour III.

The WWTP will be located within a 13 Hectare area and will be set back from any residential buildings by a 35 meter open space on all sides and, in addition, with two football fields between the reserve and the nearest houses.

To construct the system with its reserves, approximately 500 meters of the Fraser's Gully with two of its tributary streams will be diverted some 200 meters north and east of its present course to flow around the WWTP site. The gully will be retained as an earth drain and suitable berms will be constructed to prevent overflows south of the gullies.

The proposed WWTP is a biological system, which includes anaerobic ponds, reed beds and a chlorination chamber (Figure 5.7b). Final effluent disposal will be to the Fraser's Gully. The proposed capacity will be 2771 cubic meters of sewage per day, based on 1.17 of the expected sewage load. The basic criteria used

in the design is that influent to the treatment plant is typical of medium strength domestic sewage. The treatment effluent will meet NEPA 2004 standards for effluent discharge. The anaerobic ponds will remove the majority of the total suspended solids and faecal coliform, while the constructed wetland will remove most of the remaining BOD and nutrients to achieve the NEPA standards.

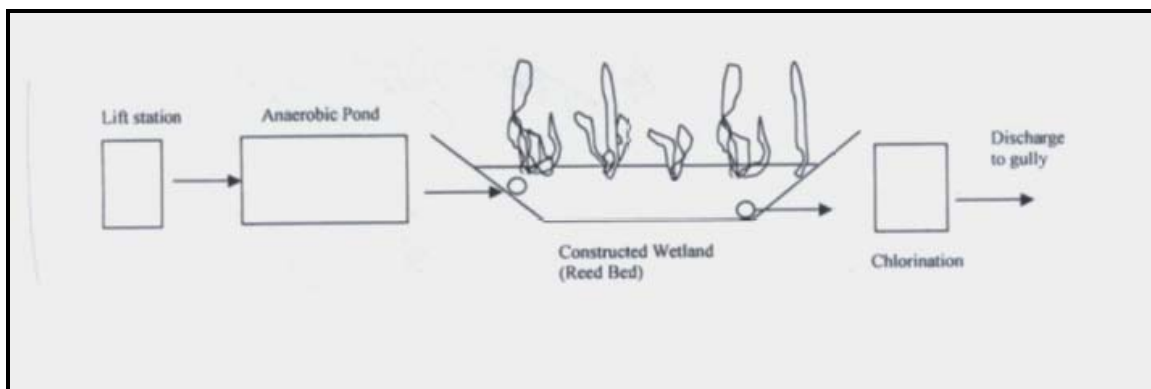


Figure 5.7b The biological waste water treatment system proposed to be employed in the sewage treatment plant at NH III.

A constructed wetland is an engineered system designed and constructed to utilize wetland vegetation to assist in treating wastewater in a more controlled environment than occurs in natural wetlands. The type of wetland chosen for this site is subsurface flow in which the partially treated wastewater flows through a porous media, such as gravels or aggregates in which wetland plants are rooted. This system is most appropriate for treating primary wastewater because there is no direct contact between the water column and the atmosphere. There is, therefore no opportunity for vermin to breed and the system is safer from a public health perspective. The WWTP system is also easily maintained with low energy requirements. Design details for the proposed WWTP can be found in Appendix II, which contains the Engineering Report and the Operations and Maintenance Manual for the system.

5.8 Batching Plant Works

Concrete for the proposed New Harbour II and III development will be produced at a facility that will be temporarily located at the vicinity of the proposed sewage treatment works on the eastern end of the New Harbour III property.

Concrete is composed essentially of water, cement, sand and coarse aggregate and will be produced at the facility, which will store, convey, measure and discharge the components of concrete into trucks for transport to the job site. Specifically, sand, aggregate, cement and water will be gravity fed from a weight

hopper into mixer trucks. The concrete is then mixed in the truck on the way to the site, where the concrete is to be poured.

All raw materials to be used at the batching plant will be transported to the plant by truck, where they will be transferred to storage bins. Cement will be transferred by an Auger tube while sand and aggregates will be loaded by way of a front-end loader. From the storage bins, concrete components will be fed to weigh hoppers by way of conveyers.

The process to be used at the plant is dry process, meaning that no washing of aggregate will be done on-site. Any water remaining within mixer trucks used for mixing and transporting concrete will be discharged into concrete settling tanks, from which settled water will be taken for re-use in the next concrete mix. Solids left within the settling tank will be re-mixed into subsequent cement batches.

5.9 Diesel Storage

A section of the Batching Plant facility will be used to store and supply diesel fuel for concrete mixer trucks which will service the batching plant and other diesel-fuelled mechanical equipment on-site. The location of the Above-ground Storage Tank (AST) will be to the eastern section of the New Harbour III site, within the proposed Batching Plant.

The proposed storage tank will contain diesel fuel which will be supplied and installed by a registered Petroleum marketing company. The infrastructural design includes a plan for a containment bund wall, elevations and details for an 11,356 litre (3000 gallon) storage tank. The tank will have a steel casing and will be located as an Above-ground Storage Tank (A.S.T.). The bund wall will be 1 meter from ground level and the tank will be sited on a 15cm thick well compacted marl and 15cm thick C/C slab to support a pressure of 3000 psi. Only one tank will be erected.

6.0 POTENTIAL IMPACTS

6.1 Construction Phase Impacts

6.1.1 General Impacts

The New Harbour I EIA identified construction-related impacts, which have been deemed to be similar to those expected for the New Harbour II and III developments. These impacts are summarized below:

6.1.1.1 Soil Erosion and Sediment Loading

During the construction phase, the clearing of vegetation on large tracts of land can result in exposure of top soil. During heavy rainfall events the soil can be washed into drainage channels. This is seen as a short term impact. Slope stability is not expected to be a risk at this site - as the land is flat.

Loose stockpiles of earth materials can be washed into gullies during heavy rainfall events. During the construction phase stormwater run-off can carry large sediment loads which increase turbidity in the coastal waters. This would be a short-term, irreversible impact if not mitigated. During construction, oil and grease and hazardous material should be managed in properly designated areas, and disposed of appropriately off-site. These are minor short term, reversible impacts.

6.1.1.2 Noise

Noise nuisance related to construction may affect communities within a radius of 160 m from the emitting source. In particular the existing housing schemes at Belmont Park, Bay View Gardens and the current New Harbour I development may be affected. The 160 m zone is based on the physical property of sound whose energy is inversely proportional to the square of the distance. At a distance of approximately 160 m

and starting from a noise level of 95 dB the sound level would have been reduced to 68dB. The recommended WHO standard is 70 dB for daylight hours.

6.1.1.3 Air Quality

During the construction phase air quality is expected to decline as a result of an increase in levels of fugitive dust from cleared land, stockpiled earth materials, dusty roads and gaseous emissions from vehicular

exhaust. Respirable particulates are a public health hazard and may otherwise create considerable nuisances to the public.

Fugitive dust levels will likely increase during construction activities, particularly excavation, transportation and storage of fines as well as aggregates, resulting in an increase in PM10 levels in the short term. These impacts are reversible and minor.

6.1.1.4 Groundwater Quality

The integrity of the groundwater quality must be maintained in order to ensure the long term yield of water suitable for potable supply. The WRA has indicated that lands once used for agriculture may suffer from termite infestation and the application of pesticides is sometimes considered by developers.

6.1.1.5 Solid and Liquid Waste Generation

Wastes generated on construction sites will originate from the following:

- Used product containers (cement bags, tile boxes, paint containers etc).
- Used construction materials (cut rebar, lumber, broken blocks, tiles, wasted poured cement, spilled aggregates etc)
- Cut vegetation and trees
- Unusable excavated materials
- Kitchen wastes (uncooked and cooked food items, peelings, food containers etc)
- Used oil and spilled fuel

The improper control, collection and disposal of these wastes will result in solid waste disposal impacts, both onsite if not properly collected and offsite, if not properly disposed of.

6.1.1.6 Sewage Generation

Construction sites have numbers of persons working on-site, all of whom will at some point in time, want to utilize bathroom facilities. If adequate numbers of such facilities are not available on site, then workers will resort to less satisfactory and unsanitary means of relieving themselves. Additionally, if the facilities present

onsite are not adequate for the treatment of human wastes, then contamination of the environment could occur from discharges from these facilities.

6.1.1.7 Handling & Storage of Hazardous Material

Worker health and safety, as well as the environment can be impacted by the improper storage and handling of hazardous materials, such as fuels, lubricants etc.

6.1.1.8 The Batching Plant

With the batching plant operation being a dry operation, there are no issues envisaged where sediment-laden water discharges are concerned. However, dust discharges emanating from the offloading and on-loading of cement and aggregates are seen as a potential negative issue that will have to be mitigated against.

6.1.1.9 Petroleum Transplant and Storage

The potential exists for spillages of fuel during the following occasions:

- 6.1 During transport to the storage facility
- 6.2 During vehicle re-fuelling operations
- 6.3 As a consequence of faults in the storage mechanism

The risks associated with spillages at the storage facility are magnified by the fact that the facility will be located near to the Fraser's Gully –a water body that lies within close proximity to the sea.

6.1.1.10 Solid Waste Disposal

Wastes generated on construction sites will originate from the following:

- Used product containers (cement bags, tile boxes, paint containers etc).

- Used construction materials (cut rebar, lumber, broken blocks, tiles, wasted poured cement, spilled aggregates etc)
- Cut vegetation and trees
- Unusable excavated materials
- Kitchen wastes (uncooked and cooked food items, peelings, food containers etc)
- Used oil and spilled fuel

The improper control, collection and disposal of these wastes will result in solid waste disposal impacts, both onsite if not properly collected and offsite, if not properly disposed of.

6.1.2 Drainage Works – Physical and Ecological Impacts

6.1.2.1 Drainage inputs to Bower's Gully

No physical modifications are proposed for the Bower's Gully channel both above and below the proposed point of intercept with the Whim West and Whim Gullies, thus there will be no physical impact to the configuration of the Gully, and no anticipated ecological impacts.

6.1.2.2 Drainage in West Whim

No modifications of this channel are proposed, thus its status will remain the same as per pre-development.

6.1.2.3 Drainage in Whim

Above Bower's take-off

Modifications have been proposed to the channel configuration, with the channel north of the Bower's gully intercept to be concrete lined. This will necessitate the removal of trees and other vegetation as well as the loss of some faunal habitats from the area, which would present a significant flora-presence impact. However, the fauna of the gully are already sparse and un-interesting; as such no significant impact is expected.

Below Bower's take-off

No modifications of the physical alignment of the Whim gully is proposed for sections below the Bower's Gully take-off, therefore no impact issues are contemplated.

6.1.2.4 Whim SE Gully

This gully will remain in its existing state, therefore there is no physical impact issue envisaged.

6.1.2.5 Fraser's Gully and Tributaries

Approximately 502 meters of the Fraser's Gully channel, 916 meters of the New Harbour I gully and approximately 150 meters of the Stoney Gully lie within the boundary of the New Harbour III site. Development proposal involves re-routing these gully courses so that they run on the northern border of the New Harbour III site. Impact on the New Harbour I gully will involve the removal of 916 meters of channel occupied with Marsh Grass. The re-routing of the Fraser's Gully will remove approximately 502m of present crocodile and fish habitat, but will create a new potential habitat of similar size and character.

6.1.2.6 Coastal Resources

No impacts on coastal resources are envisaged.

6.2 Operation Phase Impacts

6.2.1 Hydrology, Drainage and Downstream Flooding

6.2.1.1 Drainage inputs to Bower's Gully

A 3 % increase in peak flows is expected during rainfall events due to the proposed inclusion of storm flows from the Whim West and Whim Gullies. The Engineering Hydrology, Drainage Study and Flood Mapping report (Feb 2009 – see Appendix III) regards this as an insignificant contribution. Floral and faunal communities within the Bower's Gully are currently acclimatized to periodical inundation – thus with no

significant change in drainage contributions anticipated from the New Harbour II development, there should be no change in the adaptive process.

No change is expected where down-stream flood plain flooding is concerned. The Engineering Hydrology, Drainage Study and Flood Mapping report (Feb 2009 –see Appendix III) has indicated that communities downstream of the New Harbour II drainage intercept, specifically Burkes field and Terminal, will continue to experience the current level of flooding that would occur during heavy rainfall periods. However, the report recommends a simple and practical solution to this problem, which should be the purview of the Government. Implementation of the solution will not only prevent flooding of residential areas but also of some agricultural lands and aquaculture ponds.

6.2.1.2 Drainage in Whim

Above Bower's take-off

Modifications have been proposed to the channel configuration, with the channel north of the Bower's gully intercept to be concrete lined. This will necessitate the removal of trees from the area, which would present a significant tree-presence impact.

Below Bower's take-off

Drainages from the southern sections of New Harbour II will be routed towards the discharge routed through the current Brampton Shrimp Farm area. Thus, a significant amount of flow will be routed away from the lower Whim Gully, which runs parallel to the Old Harbour Bay main road towards the sea. Thus, a significant amount of flow, which would have contributed to the flooding of the Old Harbour Bay area, will be removed. This is seen as a positive impact.

6.2.1.3 Whim SE Gully

A report entitled Potential Hydrological Impacts – New Harbour II and III Proposed Housing Sub-Division St. Catherine (Richardson, 2009 – see Appendix III) has outlined that the current discharge from this gully currently contributes to flooding near to the terminal end of its route, where it discharges into Fraser's Gully near to a Salina above Dagger's Bay. Drainage culverts crossing a roadway at this point have been deemed to be inadequate to accommodate current discharges from this gully, which also transports pond

discharge from the JADF Shrimp farm facility. This choke point has been recognised by the NWA who propose to enlarge the culverts under the roadway as it will further significantly reduce the flooding potential.

Current discharges from the Whim SE Gully during a 1:25 year event are estimated at 44 m³/s. With the drainage designs proposed for the New Harbour II and III developments, drainage discharge is expected to be reduced to 31 m³/s. This is a 30% reduction in overall flows and is seen as a positive impact.

6.2.1.4 Fraser's Gully and Tributaries

Hydrological calculations obtained for the New Harbour, Frasers and Stoney Gullies suggest that during heavy rainfall periods, microdams located up-stream of the New Harbour III site (within what is known as Government Brampton Lands) provide some amount of flood attenuation and will provide capacity for flood mitigation during a 1:25 year rainfall event. Flood events beyond a 1:25 year event will, however, result in the overtopping of the micro-dams and with flooding occurring within the land spaces between the dams and over the confluences of the Fraser's Gully and its tributaries to the tune of over 1 meter above ground level. This flood period typically lasts for not more than three hours.

The developers propose to re-route sections of the New Harbour, Fraser's and Stoney Gullies as a means of providing flood-prevention protection for the proposed sewage treatment plant to be located at the eastern section of the New Harbour III development. A part of the flood prevention mitigation effort will involve the creation of a berm along the northern border of the eastern section of the New Harbour III site. Such a construction will effectively reduce the area of land over which flooding and drainage discharge would normally occur during heavy rainfall events, leading to a potential for a northward progression of flooding within the Government Brampton lands.

It is anticipated, however, that the proposed drainage re-routing and sizing will allow for adequate interception and conveyance of flood waters in excess of a 1:25 year event.

6.2.2 Water Supply

While adequate water resources exist for both proposed developments, reduced ground water resources coupled with slower surface water run off, underpins the evidence that south coast water basins are becoming increasingly stressed. These housing developments will exist into 2025 and beyond, coinciding with the time that projected impacts of climate change will begin to seriously impact water resources along the south coast. A highly rational policy on distribution will have to be implemented to inform extraction permitting going forward.

6.2.3 Sewage Treatment and Disposal

The major earthworks required for the diversion of Fraser's Gully around the designated WWTP site should improve its flow characteristics and reduce chances of flooding on the site. This will be further enhanced by the construction of earth berms between the gullies and the proposed housing and treatment plant.

Abandoned aquaculture ponds (5) within the WWTP site will be filled to eventually eliminate surface depressions before the anaerobic ponds and reed beds are constructed. This will alter the existing landscape but without loss of any currently beneficial features. When the WWTP system is completed, its landscape with flat topography and planted vegetation should be a visual improvement on what now exists.

The sewage plant itself should not create any negative aesthetic impacts if appropriately maintained. Biological systems are known to be more robust and stable than mechanical systems and, hence, any decline in performance is more predictable and takes place more slowly.

Furthermore, they are less prone to invasion by vermin and nuisance species. The type of plant, and its setback from residences, should ensure no significant aesthetic impacts on the human population. Similarly, safety issues should not be a problem, although normal precautionary measures must be put in place.

The effluent from the anaerobic ponds to the reed beds will be routed by sub-surface drains; hence there should be no exposure of foul odours to the atmosphere. Uptake of nutrients by the reed beds and oxidation of the primary effluent by the root system of the reed beds should ensure that the final effluent to the Fraser's Gully safely and routinely achieves the required NEPA standards.

Fraser's Gully is known to flow throughout the year (see Hydrology Report) and is capable of receiving all the effluent from the WWTP without flooding (the effluent will be less than 1% of the total flow). Thus hydrologically, there will be no significant impact.

Sewage sludge will be drawn from the anaerobic ponds once every one to two months. This sludge will be anaerobically treated and may be dried in suitable beds on-site or in another approved facility without significant environmental impact.

6.2.4 Ecology of the Gully Courses and Flood Plains

6.2.4.1 Drainage Inputs to Bower's Gully

No down-stream modifications of the channel proposed above or below the point of intercept with the Whim west and Whim gullies. Thus no physical impacts on flora or fauna will occur

Some 3 % increase in peak flows during rainfall events is anticipated with the inclusion of drainage from the New Harbour II site. Floral and faunal communities living within the Bower's Gully are already acclimatized to periodical inundation – thus with no significant change in drainage contributions from the Whim, there should be no change in the adaptive process.

6.2.4.2 Drainage in West Whim

No modifications of channel is intended, therefore its Floral and Faunal status will remain the same as per pre-development.

6.2.4.3 Drainage in Whim

Above Bower's take-off:

Modifications are proposed to the channel configuration with concrete being used as a liner for the new drain alignment. This will remove major trees from the area, which would present a significant tree-presence impact. However, this is an impact that can be compensated for in landscaping to ensure that a no-net loss concept is maintained.

Below Bower's take-off:

Drainages from the southern sections of New Harbour II will be routed towards the discharge routed through the current Brampton Farm Shrimp Farm area. Thus, a significant amount of flow will be routed away from the Whim gully, which runs parallel to the Old Harbour Bay main road towards the sea. This will result in a significant reduction of flow into the Old Harbour Bay area, thus reducing the potential for flooding in this area during heavy rainfall periods. This is seen as a significant positive impact.

No modifications of the physical alignment of the gully below the New Harbour II development is contemplated – no impacts envisaged

6.2.4.4 Whim SE Gully

This gully will remain in its existing state – no impacts envisaged

6.2.4.5 Fraser's Gully and Tributaries

Approximately 502 meters of the Fraser's Gully channel, 916 meters of the New Harbour I gully and approximately 150 meters of the Stoney Gully lie within the boundary of the New Harbour III site. Development proposal involves re-routing of both gully areas so that they run on the northern border of the New Harbour III site. Impact on the New Harbour I gully will involve the removal of 916 meters of channel occupied with Marsh Grass. The re-routing of the Fraser's Gully will remove approximately 502 m of present crocodile and fish habitat but will create a new potential habitat of similar size and character.

6.2.5 Coastal Ecology

No impacts on coastal ecology are envisaged.

6.2.6 JPS Powerline Relocation

No impacts are envisaged. The power lines will be maintained within internationally established setbacks to ensure safe distances are maintained between the lines and inhabited areas.

6.2.7 Socio-economics

6.2.7.1 Traffic

The description of the main road network for traffic entering and leaving Old Harbour as discussed in Section 3.1.8, is central to an appreciation of the traffic challenge posed by Phase I and potentially for Phase II and thereafter Phase III. A single vehicle operating household wishing to use the highway to Kingston both ways daily, would currently, on a 5 day week basis (270 working days per year) spend J\$135,000 annually on toll charges. If the household operated two vehicles the figure would exceed a quarter million dollars annually. Just over four out of 10 single vehicle households in this socio economic bracket would be willing to pay this as suggested by the traffic study (ADeB, 2009).

Also from the standpoint of traffic movements, the projected daily vehicle trips are 8,400 for NH II, 6,180 for NH III. Applying the same determinants for New Harbour Village Phase I will be 5,070 for a total of 19,650 or just under 20,000. With 95% of traffic assumed to be either May Pen bound or Kingston bound this means that the issue of access to the Old Harbour Bay main road other than through Old Harbour itself is central to finding solutions for the chronic congestion currently experienced in Old Harbour.

6.2.7.2 Social Infrastructure

Health

There is likely to be increasing strain on already stressed public health services in Old Harbour since access to public health clinics is limited to those with residential status.

Education

The only secondary school in Old Harbour already reports an almost insurmountable challenge to accommodate annual enrolment demand. This is therefore likely to be compounded with the influx of students arising from settlement within Phases II and III.

6.2.7.3 Public Perception

Crime: In the minds of some community members, construction activity induces criminal activity. The phasing of both developments to be successive rather than concurrent will extend any such potential. However the potential for this has not been evidenced in NH I.

Squatting: No empirical evidence can be offered that would confirm an increase in squatting consequent on development of New Harbour Village I, but experience informs that job seeking workers are attracted to construction sites. The proposed combined developments are large and therefore would be attractive to job seekers from a very wide catchment area.

Worker Housing: The assumption of the community is that construction labour can access and leave the project area by public transport, and that housing in the immediate area is not a pressing need. Furthermore worker housing which is usually a critical factor for construction projects has not been evidenced for New Harbour Phase I.

6.2.7.4 Employment

Economic Effect: Even if not usefully measurable, the employment income generation for 500 workers over the entire construction period (five to six years) will have a positive impact on the Old Harbour economy. This is only one aspect of the construction process where benefits will be generated for the area. Haulage contracting, security, mechanical workers, hardware establishments and land surveying skills will need to be part of the project team.

Incomes Effect: Incomes from direct employment will support indirect employment such as in food vending, accommodation and transport and personal services to name the most likely.

While the introduction of several thousand residents into a hitherto 'greenfield' will introduce social infrastructure challenges, an overriding social benefit of these developments will be the general improvement to firstly housing stock and the attendant sanitary and health improvements that come with planned developments. With its impact on family life and health, the benefits of adequate housing cannot be overstated. In its absence the overall proportionate share of sub-standard housing increases and an entrenched impetus towards unsustainability.

6.2.7.5 Solid Waste Management

It is estimated that 6.7 metric tonnes of solid waste is generated by the currently existing New Harbour I development per day. The development of New Harbour Phases II and III will add an additional 21 metric tonnes of solid waste per day for disposal. Metropolitan Parks and Markets (MPM), which according to residents of NH I currently provide an acceptable service, will be presumed to provide an equally acceptable service to more than 2000 more homes. This will require a significant increase in equipment and personnel by MPM. Disposal of solid waste will be at the Riverton City disposal site.

6.2.7.6 Energy and Water Consumption

Water

While an adequate water resource exists for both developments, reduced ground water resources coupled with slower surface water run off, underpins the evidence that south coast water basins are becoming increasingly stressed. These housing developments will be around into 20/25 and longer, around the time that Climate Change will begin to seriously impact on water resources along the south coast. A highly rational policy on distribution will have to inform extraction permitting going forward.

6.2.8 Heritage

Potential heritage material, even though currently unidentified, could be at considerable risk unless a watching brief is held by JNHT.

7.0 MITIGATION MEASURES

7.1 Mitigations - Construction Phase Impacts

7.1.2 General Impacts Mitigations

7.1.1.1 Soil Erosion and Sediment Loading

Since the lands on which the New Harbour II and III sites are to be built are predominantly flatlands, there should be no foreseeable issues related to run-off induced sedimentation. However, the placement of emphasis on the minimization of vegetation removal or the minimization of the time over which the property remains exposed to the elements should ensure that run-off-induced sedimentation and soil erosion is kept to a minimum. Additionally, the placement of sediment curtains at vulnerable locations, such as areas in close proximity to gully courses, will provide an additional level of protection against these impacts. Finally, any stockpiles of sediment or soil that are created on the construction site should be covered and bermed so as to prevent the washing away of these materials during rainfall periods.

7.1.1.2 Noise

Construction noise mitigations will have to focus on ensuring that these noises are contained within the borders of the construction site. To achieve this, the following mitigations are proposed:

- Where applicable, the use of the lowest noise-emitting equipment appropriate for the given task should be opted for, since this will result in less noise generated on-site.
- Time limits should be considered to limit the periods during which construction noises can be generated. The following times are proposed: - Mondays to Fridays 0800hrs to 1800hrs. Saturdays 0800hrs to 1300hrs. Sundays and Holidays – no noisy activities are to be permitted.
- Physical noise barriers should be considered for the property, particularly the northeastern and southern sections of the New Harbour II development and the Northern section of the New Harbour III development so as to reduce potential noise impacts on residences and housing developments adjoining the construction areas at these locations.
- A combination of the following physical barriers could prove to be successful in reducing construction noises leaving the site:
 1. Walls
 2. Portable barriers
 3. Vegetation barriers
 4. Earth berms

7.1.1.3 Air Quality

Mitigations for air quality impacts are listed as follows:

- Phasing of vegetation clearance to coincide with phasing of construction activities so that the exposure of bare ground is kept to a minimum.
- Watering of un-vegetated areas and stripped road surfaces along which construction vehicles and trucks travel should control dust emissions by up to 70%. For exposed areas, apply dust suppression (whether water or dust suppression products) in a sufficient quantity and frequency to maintain a stabilized surface; any areas which cannot be stabilized, as evidenced by wind driven dust, must have an application of water at least twice per day to at least 80 percent of the unstabilized area.
- A watering truck should be maintained on site for watering road surfaces as needed to minimize fugitive dust emissions. For exposed roadways, water all roads used for any vehicular traffic at least once per every two hours of active operations; OR water all roads used for any vehicular traffic once daily and restrict vehicle speed to 15 mph. Over-saturated conditions, which would cause outgoing trucks to track mud onto public streets, should be avoided. Watering would not be necessary on days when rainfall exceeds 2.5 mm.
- Stock piling of earth materials for construction should be carried out within temporarily constructed enclosures to limit fugitive dust. Vehicles transporting earth materials should be covered en route. Stockpiles of fines should be covered on windy days.
- Wind breaks should be employed both around the perimeter of the property and at locations that could pose a problem for dust generation, such as stockpiles or vehicle access ways.
- Mixing equipment should be sealed properly and vibrating equipment should be equipped with dust removing devices.
- No hauling or earth-moving activities should be conducted during strong wind events exceeding 40 kilometers per hour. Additionally, watering of all exposed surfaces or stockpiles should be conducted at least 3 times per day during these periods.
- A monitoring program for dust is recommended to assess the effectiveness of control measures in meeting ambient air quality standards. The cost for monitoring particulates on a monthly basis would be included in the overall cost of the monitoring program. All measures outlined should ensure compliance with NEPA Ambient Air Quality Standards (150 µg/m³ over a 24 hour period)
- Dust masks should be provided for workers.

7.1.1.4 Groundwater Quality

Any fumigation of land areas for the purpose of controlling pest infestations prior to construction must consider the possibility of pesticide leaching into the ground water. The manufacturer's specifications for

applications must be strictly adhered to in order to ensure that excess application of pesticides does not occur. Additionally, the application of such pesticides immediately before or after heavy rainfall periods should be avoided.

7.1.1.5 Solid and Liquid Waste Generation

The following mitigations are recommended:

- Construction management operatives should be required to prepare a waste reduction implementation and sensitization plan to encourage construction practices that will lead to less waste being produced. Such a plan will have cost saving benefits, in that wasted materials will be a direct cost to the development.
- Construction waste size reduction equipment (e.g., grinders, shredders and crushers) should be considered as mandatory items of equipment for the construction site. These items will be important as a means of reducing the bulkiness of both construction and domestic waste materials generated on-site.
- Sorting and containerization of construction and domestic wastes on-site will facilitate the efficient transport of these materials off-site.
- Site management should ensure that solid waste containers, skips or other receptacle areas are located at points that are easily accessible by workers for their use and by those persons responsible for the transportation of the materials off-site.
- The National Solid Waste Management Authority must be consulted for permission to dispose of construction wastes at facilities that will be authorized by them.
- Servicing of heavy equipment (with the exception of re-fuelling) should be conducted off-site at locations specifically prepared for these activities. Refueling facilities must meet the specific conditions for fuel storage and dispensing that would be mandated by NEPA, particularly to mitigate against spillages.
- Sediment-bearing wastewater particularly that generated at batching plants should be recycled within the system to promote zero discharges to the environment.
- It is also recommended that the National Solid Waste Management Authority be consulted to advice on its best practices for solid waste management, so that a best practices inspection guide can be developed.

7.1.1.6 Sewage Generation

Sewage mitigations will have to focus on ensuring that construction workers have adequate access to toilet and bathroom facilities that meet both numerical standards (to prevent workers from using the bushes) and treatment standards. Considerations could be given to the employment of chemical toilets for sewage treatment, along with personal washing areas tied into an approved disposal mechanism, such as a tile field.

A separation between sewage and grey water streams should be maintained to reduce the volume of sewage effluent generated. The developers should ensure that the providers of the chemical toilets have adequate mechanisms to collect, treat, and dispose of the chemical agents within the portable toilets.

7.1.1.7 Handling & Storage of Hazardous Material

The developers will have to ensure that its operators are thoroughly briefed on safe actions that will have to be adhered to when operating around or handling hazardous materials. Additionally, appropriate containerization and labeling of these potentially hazardous materials will be required so that persons will have immediate knowledge of the following:

- The characteristics of the materials being stored
- The potential health hazards
- Emergency response requirements

Further, the developers will have to ensure that operators who will be required to handle these materials have the requisite protective equipment to do so safely.

7.1.1.8 The Batching Plant

Mitigations for the Batching Plant will mirror those outlined for air quality impacts (general) in most areas. These are listed as follows:

- The use of pre-washed aggregates will greatly reduce the release of airborne particulates during the offloading of such aggregates.
- A watering truck should be maintained on site for watering road surfaces as needed to minimize fugitive dust emissions. For exposed roadways, water all roads used for any vehicular traffic at least once per every two hours of active operations; OR water all roads used for any vehicular traffic once daily and restrict vehicle speed to 15 mph. Over-saturated conditions, which would cause outgoing trucks to track mud onto public streets, should be avoided. Watering would not be necessary on days when rainfall exceeds 2.5 mm.

- If open stockpiles of batching plant materials are a requirement, these should be semi-enclosed to prevent wind mobilization and recessed to prevent transportation by rainfall.
- Vehicles transporting aggregate materials should be covered en route. Stockpiles of fines should be covered on windy days.
- A monitoring program for dust is recommended to assess the effectiveness of control measures in meeting ambient air quality standards. The cost for monitoring particulates on a monthly basis would be included in the overall cost of the monitoring program. All measures outlined should ensure compliance with NEPA Ambient Air Quality Standards (150 µg/m³ over a 24 hour period)

7.1.1.9 Petroleum Transplant and Storage

The Petroleum storage facility will require a permit from NEPA and will have to meet its standards for leak detection and leak retention. In addition to these conditionalities, the following will apply:

- The tank will have a steel casing and will be located as an AST. This will facilitate visual inspections for leaks
- The tank will be surrounded by a bund wall, which will be 1 meter from ground level and the tank will be sited on a 15cm thick well compacted marl and 15cm thick C/C slab to support a pressure of 3000 psi. The capacity of the containment bund is sized to accommodate more than the volume of the fuel that is stored within the tank, and to restrict fuel contamination. Thus, if there is a spill, it will not only be contained within the bund wall, but will also maintain a quality allowing it to be recovered and re-used.
- The leak detection system for the diesel storage tank will include daily visual tank and bund inspections and stock reconciliation. Fuel gauges will be read daily to track stock levels and ensure losses are negligible.

7.1.2 Drainage

7.1.2.1 Bower's Gully

The Engineering Hydrology, Drainage Study and Flood Mapping report (Feb 2009 – see Appendix III) has made recommendations to be adopted by the Government to alleviate current flooding impacts occurring near the mouth of the Bower's Gully. These include:

- Construction of a dyke parallel to the Bower's Gully 600 meters to the east of "Bundung Bridge"

- Removal of the old Tilapia ponds towards the seaward end of the Bower's Gully

These recommendations have been shared with the NWA.

7.1.2.2 Whim SE Gully

With the expected reduction in flows in this gully during a 1:25 year event, it is anticipated that the incidences of flooding near to the terminal point of this drain will be significantly reduced. Additionally, it is understood that the National Works Agency is currently seeking to resolve the drainage restrictions that currently exist at the point of flooding.

7.1.2.3 Fraser's Gully and Tributaries

Drainage re-routing and sizing will ensure that flood waters generated by rainfall events in excess of a 1:25 year event are adequately conveyed off-site, ensuring that there will be no flooding in excess of what would normally be experienced at the Government Brampton lands under current conditions.

7.1.3 Ecology

7.1.3.1 Drainage in Whim – North of the Bower's Gully intercept

Modifications to the Whim Gully will necessitate the removal of major trees from the area, which would present a significant tree-presence impact. Compensation for this loss will have to be allowed for in landscaping to ensure that no-net loss of trees from the site is maintained.

7.1.3.2 Fraser's Gully and Tributaries

Proposed drainage re-routes should therefore be constructed to maintain water flow to the lower section of the Fraser's Gully, with a gradual in-filling of the existing channels to ensure that fauna residing within the channels have time to migrate to and colonize the new channels. Natural vegetation re-colonization will occur along the new channels over time.

7.1.4 Heritage

To protect potential heritage material loss during land clearance and excavation, a watching brief during this period, by JNHT or a qualified architect should be part of the permitting requirement.

7.2 Operation Impacts

7.2.1 Traffic

Proposed solutions focus on enabling two way accesses to the Highway by creating an additional turning lane and creating two instead of one highway ramp onto the Highway at the current intersection. Also being considered is the desirability of access points further along the highway in both directions, thereby reducing an otherwise complicated access at the present Highway Bridge. Realistically neither solution addresses the main assumption that the Highway will not be used as the favoured route towards either Kingston or May Pen. The Old Harbour traffic police are therefore skeptical of any solution that does not bypass Old Harbour Main Street entirely by enabling the Highway to be crossed to access the Old Harbour to Kingston main road. This they feel can best be achieved by using the Sharper's bridge to make the link. It is likely that GOJ concessions to Highway 2000 may discourage this as an option.

A consideration yet to be fully factored is the impact of proper public transport centres to relocate parking now congesting the Old Harbour clock tower intersection and along Main Street. The traffic department at the Old Harbour police station report that no concrete proposals have been seen by them to date. They fear that if the planned parks are not properly sized and designed so that all can be accommodated, they will not be used by operators who would feel disadvantaged should overflow parking in the square continue to take place.

Ultimately it is the recommendation of this EIA that the most effective medium term approach will be a combination of all three approaches:

1. Facilitate access by traffic moving along the Old Harbour Bay main road, to enter the Highway at the bridge.
2. Provide motorists from both existing and planned developments along the Old Harbour Bay main road, whose destination is eastbound, with means to cross the highway east of Old Harbour town as an alternative to passing through the town.
3. Provide adequate public transport parking away from the clock tower and not interfacing directly with Main Street at the clock tower.

7.2.2 Sewage Treatment System

To mitigate any adverse impacts from the sewage treatment and disposal system its location and design have been carefully chosen.

The location of the system with its reserves, setbacks and landscaping will minimize any aesthetic impacts of a visual, odour or nuisance species nature.

The design of the plant (anaerobic ponds and reed beds) will ensure a stable, conservative form of treatment that should consistently meet NEPA standards. The key to this is in its proper design, operation and maintenance. Appendix II outlines the requirements in further detail.

Monitoring of the plant and its effluent is also critical for early detection of any malfunction or decline in performance. This is also set out in Appendix II.

The hydrology of the Fraser's Gully into which the effluent will be discharged is fairly stable except in times of very heavy rains. The construction and maintenance of earthen berms in the area of the WWTP will prevent flooding while not restricting effluent discharge.

The ecology of Fraser's Gully (water quality, flora and fauna) should not be adversely impacted by the effluent discharges. However, precaution will be taken by fencing the WWTP site to ensure no invasion of Crocodiles that frequent the gully. Signs should be posted in the vicinity to remind the operators and the public that the Crocodile is a protected species.

8.0 CUMULATIVE IMPACTS

Most of the significant site specific environmental impacts identified for New Harbour II and III have a bearing also on cumulative impacts since they relate essentially to developing residential communities that will bring increasing demands on the physical and socio-economic structures needed to support them. Also, since the known Government policies and plans suggest that the Old Harbour area will become an ever increasing population growth center (with or without the GDL projects), these demands on the environment will have to be addressed sooner or later. The immediate impact of the New Harbour developments is that it will accelerate these demands within a time frame of five to six years as NH II and NH III are constructed and occupied.

The particular cumulative impacts resulting from residential development and increase in population in the area may be considered under:

- i. Prolonged construction activities
- ii. Increase in employment and in-migration
- iii. The need for improved regional drainage and reduction in flooding
- iv. Relief in traffic congestion
- v. Increasing demands for social infrastructure and services
- vi. Improvement and maintenance of solid waste management
- vii. Contribution to the economy

8.1 Construction Activities

The Old Harbour area has seen a considerable increase in construction activities in recent years, including NH I construction from 2006 to present, as well as other developments. These activities will increase over the next 5-6 years as NH II and NH III are constructed. While this will be good for the economy of the area, these activities will bring an increasing amount of inconveniences (eg. noise and dust), traffic congestion, road wear and possibly intermittent pollution incidents.

Some of these impacts, while they may be mitigated, are almost inevitable. The people of the Old Harbour area must be prepared for this through public information and dialogue at all stages, and the developers and their contractors must deal with these problems with care and sensitivity.

8.2 Employment and In-Migration

The GDL development projects and others will result in increased employment and in-migration of workers (temporary) and new residents (permanent) in the area. These activities will require some social

adjustments and may even result in human conflicts. While there has been no evidence of these happening during the NH I phase, their possibility cannot be discounted. The developers as well as the social services must be vigilant of any problems arising and be prepared to cooperatively mitigate them as soon as they are detected.

8.3 Regional Drainage and Flooding

The problems of flooding in lower Bower's gully, lower Whim's gully and lower Fraser's gully have existed for a very long time with considerable impacts on the town of Old Harbour Bay and its surrounds. Alleviation of the flooding problems has been a concern of the National Works Agency (NWA) for some time and some drain improvement and other construction works have been initiated to resolve the problems.

The proposed improved drainage works for the Whim and Brampton Farms developments provide a great opportunity for a new regional approach to the problems of flooding in the area as the developers and the NWA agree to and initiate improved drainage designs. The projected impacts are all positive, both for NH I and NH II and for the town of Old Harbour Bay.

8.4 Traffic Congestion

Much has already been said about the need to ease traffic congestion in Old Harbour, with or without the GDL developments. While these developments will certainly not improve the situation in the short term, the opportunity exists for an accelerated assault on the problem and the GDL developments may be just the stimulus needed to initiate this.

As it is for the regional drainage and flooding problems, the traffic solutions must be approached on a regional basis. The National Works Agency must take the lead in this, but they will need to be supported by other Government Agencies as well as the private sector.

The Old Harbour area, as a regional population growth centre, and as a vital transportation link between east and west urgently requires these solutions.

8.5 Social Infrastructure and Services

The case has already been made for improvement in social infrastructure and services within the Old Harbour area. The cumulative impacts of the GDL and similar developments are obvious and, like the traffic issue, must be dealt with on a regional basis. It must be recognized by all concerned, both public and private sectors, that Old Harbour and the neighbouring towns or settlements will never be the same again. Improved and more modern social services are inevitable. Education and health care have been highlighted because they are the most urgent, but they are not the only ones; the police and fire brigade (water supply) follow close behind. The Government has no choice but to upgrade the entire town of Old Harbour befitting its status as a growing regional population centre.

8.6 Solid Waste Management

The demands for increased solid waste management capabilities in the Old Harbour area will be inevitable. For the New Harbour developments alone, the volume of solid waste will increase more than 300% from the present.

NH II and NH III present the perfect opportunity to practice waste management reduction and waste sorting and recycling strategies to alleviate the problems of solid waste management.

8.7 Economy

It is projected that NH II and NH III will require a capital injection of about J\$10 billion into the local and national economy. This is a very substantial figure which can do much to boost the national economy and stimulate recovery and growth in the Old Harbour area. The cumulative economic impact should be extremely positive.

9.0 CONSIDERATION OF ALTERNATIVES

The methodology employed by GDL in its current and previous developments has been to utilize the services of environmental professionals from the early stages of their projects' conceptualization process. Hence environmental considerations are taken into account in a development's design before a final application is made for approval. In the case of the New Harbour Phases II and III, the experience gained from NH Phase I has been an invaluable guide to its design. Alternatives to the proposed project that have been considered include:

(i). Land Use

The Whim and Brampton Farms properties, being adjacent to New Harbour Village I are prime consideration for the development of the two new New Harbour development phases. The success of Phase I from a socio-economic as well as engineering and environmental perspective make these properties ideally suited for similar developments. Both properties at present are in ruinate agriculture and there has also been no consideration by the Government or private enterprise to reintroduce agriculture on these lands. In addition, the remaining and adjacent fish and shrimp ponds which adjoin the Brampton Farms property are also slated for early relocation. Hence no land use conflicts exist for these lands. Furthermore, it is instructive to note that the Portmore to Clarendon Park Highway 2000 Corridor Development Plan 2004-2025 has identified these lands for urban development (as mentioned in Section 1.1).

(ii). Housing Solutions

Gore Developments Ltd, the developers, have determined, based on their experience of Phase I and further investigation, that the required housing solutions in the Kingston Metropolitan Area (KMA) / St. Catherine / Clarendon Region exceed that of the proposed developments and that for the proposed developments a ready market exists for all their houses. Furthermore, the infrastructure required for these solutions is best developed in adjacent projects. The size of the developments therefore seems appropriate to GDL for the intended market.

(iii). Site and Regional Drainage

The developers have extensively studied the need for suitable drainage solutions for all three project phases and the plan designed takes this into consideration. The solutions proposed are also considered the best to improve drainage and flood control features downstream, particularly in the flood prone Old Harbour Bay.

Leaving the drainage features as presently exist, especially the Bower's Gully would consign Old Harbour Bay to frequent and perpetual flooding.

(iv). Water Supply

The availability of Rodon's Pen Well with its ample water supply for Phases II and III has been acknowledged by the WRA. Hence no alternative has been considered. Furthermore, the NWC has indicated that water from their system may be made available for NH III if required. No further water supply sources have been considered.

(v). Sewage Treatment

Various methods for sewage treatment have been considered, both mechanical and biological. The biological system that is proposed is considered the best alternative from the treatment, energy conservation and aesthetic points of view.

(vi). Socio-economics

The demand for housing, the need for employment and the economic benefits that flow from residential development all suggest that the proposed development on the Whim and Brampton Farm lands is highly desirable. The incorporation of ample open spaces, a commercial centre and lands available for schools adds to the socio-economic attraction of the development. No other comparable or conflicting development has been proposed for the Whim and Brampton Farm lands or for any other lands in the vicinity.

Conclusion

All the above suggest that the proposed residential development by GDL in New Harbour Phases II and III is the best use for both properties. No conflicting or other use of these lands has been proposed. Also, to leave them in an undeveloped state would be to perpetuate the existing poor drainage and flooding conditions, particularly in Old Harbour Bay.

10.0 MONITORING PROGRAMME

If a permit is granted for the proposed development, and before site preparation and construction activities begin, a monitoring programme should be prepared for submission to NEPA, for their approval. The aim of the Monitoring Plan is to ensure the following:

- compliance with relevant legislation
- implementation of the mitigation measures provided
- conformance with any General or Specific Conditions as outlined in the
- permit
- Long-term minimization of negative environmental impacts.

The Monitoring Plan should include the following components:

- Inspection protocol
- Parameters to be monitored, which should include
 1. Ambient air quality
 2. Water quality
 3. Perimeter noise
- Construction monitoring
 1. Worker health and safety
 2. Disposal of solid waste
 3. Disposal of hazardous material
 4. Disposal of liquid waste
 5. Draining and rehabilitation of sewage pond
 6. Caves, voids, sinkholes
- Materials handling and storage
- Covering of haulage vehicles
- Transportation of construction materials
- Deployment of flaggers and signposting
- Storage of fines and earth materials

The duration of the monitoring programme should be for the entire construction period, with monthly reporting.

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