www.baird.com

Baird

oceans
engineering
lakes
design
rivers
science
watersheds
construction

Proposed Cruise Berthing Facility, Grand Cayman

Environmental and Engineering Consultancy Services
Preliminary Scoping of Possible Mitigation Measures - Draft

September 14, 2015
12214.203

Innovation, Excellence & Service

Proposed Cruise Berthing Facility, Grand Cayman

Environmental and Engineering Consultancy Services

Preliminary Scoping of Possible Mitigation Measures - Draft

Prepared for

Ministry of District Administration Tourism & Transport and The Port Authority of the Cayman Islands

Prepared by

Baird

W.F. Baird & Associates Coastal Engineers Ltd.

SMITH WARNER INTERNATIONAL

TEM network | TECHNOLOGICAL & ENVIRONMENTAL MANAGEMENT NETWORK LIMITED

Smith Warner International Ltd. and TEM Network Ltd.

For further information please contact
Dave Anglin at (613) 731-8900

12214.101

EXECUTIVE SUMMARY

Overview

This report presents the results of a preliminary scoping level study to estimate the potential costs of various mitigation measures identified in the Environmental Statement (ES) that could be implemented to mitigate adverse impacts associated with the constuction and operation of the proposed Cruise Berthing Facility (CBF) in George Town Harbour (GTH). It is understood that the Cayman Islands Government (CIG) will use this information, along with the results of the Environmental Impact Assessment (EIA) and the Outline Business Case (OBC), as input to the decision making process for the project.

While specific mitigation measures have been identifed in the ES, and potential costs are presented herein, it is important to note that systematic quantification of the "value" of the mitigation measures (in terms of environmental, social or economic benefits) are not presently available. At this time, the benefits have been defined in a qualitative manner using the Rapid Impact Assessment Matrix (RIAM) method, as presented in the ES. Also, it is noted that certain mitigation efforts may address overlapping concerns; for example, the various measures available to mitigate the effects of sediment re-suspection by cruise ship traffic (overdredging, vacuum dredging of fines and seabed protection) may have overlapping benefits that diminish with increasing cost.

The final decision to proceed with the project must be based on a holistic review/assessment that considers many issues, including environmental and socio-economic impacts. With respect to the various mitigation measures that could be implemented to address adverse impacts, the general magnitude of their costs needs to be considered, along with the uncertainty in the total project cost estimate at this time (CI$156M, including a CI$33M contingency). The process of advancing the project design (including the collection of more detailed information on subsurface conditions, and understanding the market place for means and methods of construction) will be utilized to develop an integrated mitigation strategy that considers the probability of success, benefits and costs of the various mitigation measures. This can only be done as the project proceeds into the design development phase. At this time, the potential costs of possible mitigation measures, as presented herein, must be considered in the context of the overall project, including costs and impacts, both positive and negative.

Considering the above, it is important to understand that the potential costs of the various mitgation measures, as they are understood at this time, is only half of the equation (i.e. the benefits are missing). A qualitative understanding of cost/benefit ratios that defines the highest and best use of mitigation dollars will occur during the design development phase. The objective must be to create a project design and construction scheme that integrates the mitigation of potential impacts within the practical economic constraints on the project. This will be accomplished through continuing interaction with key stakeholders, and design refinement/optimization based on detailed knowledge that can only be developed as the project concepts are advanced, and an economically viable total project cost is established.

It is also important to note that the scope of the study presented in this report was limited by the time available to complete the study (ten days). Where the scope/cost of particular mitigation measures could not be readily quanitified, a range in costs is provided, along with a summary of key input assumptions and limitations inherent in the estimates.

Summary of Key Issues for Possible Mitigation

Based on the results of the EIA study, as well as the results of the public consultation process, the primary areas of concern related to the development of the proposed are as follows:

- Potential environmental impacts of project construction and operations on the marine habitat in George Town Harbour, in particular water quality, coral health and marine life;
- Potential socio-economic impacts of the project on the tender operator (CMS) and various dive and water sports businesses operating in George Town Harbour.

Summary of Possible Mitigation Measures and Costs

Various mitigation measures are available to reduce potential adverse impacts associated with the project, as noted in the Environmental Statement. Many of these mitigation measures are incorporated into the estimated project cost (CI$156M, including a CI$33M contingency) as previously presented to the CIG. However, a number of other mitigation measures could be implemented at additional cost. The most important and significant of these possible mitigation measures are summarized below:

- ***Coral Relocation Program***: The current project cost estimate includes CI$9M for a coral relocation program. The table below summarizes the estimated scope, cost and duration of alternative coral relocation efforts, including "soft costs" associated with the planning and design of the coral relocation plan, monitoring during its implementation and a five year post-construction monitoring program. It is noted that this information has been developed without the benefit of discussion with the DoE; consultation with the DoE is required to define the specific goals and objectives of the coral relocation program.

	No. of Hard Corals > 10 cm (and % of total)	Artificial Substrate (boulders)	Live Rock Relocation (and % of total)	Estimated Duration (months)	Estimated Cost (CI$M)
Level 1	19,600 (~ 15%)	6,000 m^2	1,600 m^3 (~ 3%)	10-12 mths	$8-10M
Level 2	39,200 (~ 30%)	12,000 m^2	3,200 m^3 (~ 6%)	20-24 mths	$15-18M
Level 3	58,800 (~ 45%)	18,000 m^2	4,800 m^3 (~ 9%)	30-36 mths	$20-25M

- ***Relocation of Balbao:*** The estimated cost to relocate the wreck of the *Balboa* to another site within George Town Harbour is in the order of CI$0.8-1.5M.

- ***Constraints on Dredging Method and Schedule:*** The project cost estimate includes an allowance for various measures that are typically used to limit the generation of suspended sediment and associated turbidity plumes during dredging, including silt curtains, real-time monitoring and adaptive management of dredging operations (i.e."Best Management Practices"). The tender documents could define specific constraints on the dredging method and schedule in order to reduce impacts on the marine environment. However, such constraints might reduce competition for the project during the tender phase, and could result in higher costs. In particular, the requirement to use a mechancial dredge and complete the dredging, reclamation and disposal works within the preferred three month window (May-July) could result in the need to demobilize/remobilize the dredge, or have it sit idle for nine months. This could result in a cost increase in the order of CI$3-4M.

- ***Seabed Protection in Berthing Area***: Ship propellor and thruster generated flows associated with berthing and de-berthing manouvers will result in sediment re-suspension, turbidity plumes and sedimentation on coral reefs adjacent to the facility. It is anticipated that the severity of this issue will decrease with time, as regular cruise ship traffic to and from the facility will progressively dissipate the fines from the berthing area. If necessary, seabed protection could be placed in critical zones within the berthing area to reduce the risk of sediment re-suspension. The estimated cost to construct a 300 ft wide seabed protection system is in the order of CI$6-12M. Less expensive mitigation measures are also available, but may not provide the same level protection against sediment re-suspension.

- ***Environmental Monitoring During Construction***: A significant environmental monitoring effort will be required during construction. The current project cost estimate includes an allowance for comprehensive monitoring of water quality, turbidity, sedimentation and coral health during construction. Other environmental monitoring efforts could also be considered, including the following:

    - Air quality monitoring: estimated cost ~ CI$200K/year;
    - Noise and vibration monitoring: estimated cost ~ $75K/year.

- ***Mitigation of Socio-Economic Impacts***: The EIA study estimated the annual loss in income for the tender operator (CMS) and various dive and water sports operators in George Town Harbour at CI$14.5M per year. The approach, scope and cost to mitigate for these impacts can not be estimated without input from the CIG.

The information presented above summarizes the estimated scope and cost of the most significant mitigation measures that may warrant consideration by the CIG should they decide to proceed with the project. Various other mitigation measures are also presented in the attached report.

Summary and Path Ahead

The information provided herein provides a preliminary estimate of the costs associated with various mitigation measures that could be implemented to mitigate adverse environmental and socio-economic impacts associated with the development of the proposed cruise berthing facility. Although the Environmental Statement presents a qualitative evaluation of the of benefits of the various mitigation measures (using the Rapid Impact Assessment Matrix method), the actual "value" of the various mitigation measures (in terms of environmental, social or economic benefits) can not be readily quantified at this time.

The final decision to proceed with the project must be based on a holistic review/assessment by the CIG that considers many issues, including environmental and socio-economic impacts. With respect to the various mitigation measures that could be implemented to address adverse impacts, the general magnitude of their costs needs to be considered, along with the uncertainty in the total project cost estimate at this time (CI$156M, including a CI$33M contingency).

Should the CIG decide to proceed with the project, a key objective of the design development phase will be to create a project design and construction scheme that integrates the mitigation of potential impacts within the practical economic constraints on the project.

TABLE OF CONTENTS

APPENDICES - CORAL AND WRECK RELOCATION PROGRAMS

1.0 INTRODUCTION

The Environmental Statement for the proposed Cruise Berthing Facility in George Town Harbour identified a number of possible mitigation measures that could be implemented to reduce or eliminate adverse environmental and socio-economic impacts associated with the construction and operation of the proposed facility. This report presents the results of a preliminary scoping study to estimate the anticipated costs of the various mitigation measures. It is understood that the Cayman Islands Government will use this information, along with the result of the Environmental Impact Assessment and the Outline Business Case, as input to the decision making process for the project.

The scope of the study presented in this report was limited by the time available to complete the study (ten days). Hence, there is some uncertainty in the results of the study. Where the scope/cost of particular mitigation measures could not be readily quanitified, a range in costs is provided, along with a summary of key input assumptions and limitations inherent in the estimates.

Regarding the benefits of the various mitigation measures, a qualitative evaluation has been developed using the Rapid Impact Assessment Method, RIAM, as presented in the Environmental Statement. However, the actual "value" of the various mitigation measures (in terms of environmental, social or economic benefits) can not be readily quantified at this time. As such, it is not possible to systematically rank or prioritize the various mitigation measures presented herein based on a measure such as cost/benefit ratio.

The final decision to proceed with the project must be based on a holistic review/assessment by the CIG that considers many issues, including environmental and socio-economic impacts. With respect to the various mitigation measures that could be implemented to address adverse impacts, the general magnitude of their costs needs to be considered, along with the uncertainty in the total project cost estimate at this time (CI$156M, including a CI$33M contingency).

Should the CIG decide to proceed with the project, a key objective of the design development phase will be to create a project design and construction scheme that integrates the mitigation of potential impacts within the practical economic constraints on the project considering the probability of success, benefits and costs of the various mitigation measures.

2.0 OVERVIEW OF POSSIBLE MITIGATION MEASURES

The Environmental Statement (ES) presents possible mitigation measures that could be implemented to reduce adverse impacts related to the construction and operation of the project for each of the various environmental and socio-economic subjects considered in the Environmental Impact Assessment (EIA). Table 2.1 provides an overall summary of the possible mitigation measures identified in the ES, organized by EIA subject.

Table 2.1 – Overall Summary of Possible Mitigation Measures

ES Chapter	Subject	Possible Mitigation Measure	Comments
8	Natural Hazards	Contractor planning & preparation	Included in project cost estimate
		Disaster management plan (with links to hurricane & tsunami warning systems)	Estimate cost of equipment, installation and training requirements
		Additional engineering studies and final design	Included in Phase II study estimate
		Overdredging	Estimate cost for each additional 0.5 ft depth in dredging
		Maintenance dredging	Assess dredging equipment and disposal options/costs
		Scour protection around land reclamation area	Included in project cost estimate
		Subsurface investigations	Included in Phase II study estimate
		Ground improvements/longer piles (to mitigate liquefaction)	Estimate additional cost of measures to address liquifaction
		Tsunami study/risk assessment	Define scope/estimate cost of tsunami study
		Climate change	Included in Phase II study and project cost estimates
9	Geology & Soils	Subsurface investigations	Included in Phase II study estimate
10	Waves & Sediment Transport	Overdredging	Estimate cost for each additional 0.5 ft depth in dredging
		Maintenance dredging	Assess dredging equipment and disposal options/costs
11	Hydrodynamics & Dredge Plumes	Specify mechanical dredging (BMD)	Reduced flexibility for bidders/reduced competion/increased cost?
		Specify dredging window (May-July)	Reduced flexibility for bidders/reduced competion/increased cost?
		Turbidity barriers (EMP)	Estimate cost to deploy turbidity barriers throughout dredging
		Best management practices (EMP)	Included in project cost estimate
		Real-time monitoring and adaptive management (EMP)	Included in project cost estimate
		Overdredging	Estimate cost for each additional 0.5 ft depth in dredging
		Vacuum dredge fines after main dredging	Assess dredging equipment and disposal options/costs
		Seabed protection within berthing area	Estimate cost of mattress protection system
		Operational controls (approach speed, power application at berth, etc)	CIG/PACI to implement
12	Sediment & Water Quality	Enforcement of IMO & MARPOL regulations	CIG/PACI to enforce
		Reduced use of phosphates	CIG to implement
13	Storm Water	Site grading and drainage plan	Included in Phase II study and project cost estimates
14	Air Quality & GHG	Best management practices (EMP)	Included in CAPEX estimate
		Monitoring during construction (EMP)	Define scope/cost of AQ monitoring
		AQ modeling to define impacts on landside receptors	Define scope/cost of AQ modeling
		Improved industry practices (low sulphur fuel, scrubbers, LNG ships, etc.)	Dependent on co-operation of cruise industry
		Provide shore power to cruise ships	Unlikely to be practical (see response to public comments)
15	Noise & Vibration	No blasting allowed	Risk to contractor/increased cost?
		Working hours and equipment/methods (pile driving)	Included in project cost estimate
		Community liason program	Define scope/cost of program
		Baseline and construction monitoring - buildings within 500 ft (EMP)	Define scope/cost of monitoring
		Baseline and construction monitoring - noise and vibration (EMP)	Define scope/cost of monitoring
16	Marine Ecology	Coral relocation program	Preliminary scoping level assessment (no field work)
		Specify mechanical dredging (BMD)	Reduced flexibility for bidders/reduced competion/increased cost?
		Specify dredging window (May-July)	Reduced flexibility for bidders/reduced competion/increased cost?
		Turbidity barriers (EMP)	Estimate cost to deploy turbidity barriers throughout dredging
		Best management practices (EMP)	Included in project cost estimate
		Real-time monitoring and adaptive management (EMP)	Included in project cost estimate
		Vacuum dredge fines after main dredging	Assess dredging equipment and disposal options/costs
		Seabed protection within berthing area	Estimate cost of mattress protection system
		Operational controls (approach speed, power application at berth, etc)	CIG/PACI to implement
17	Cultural Heritage	Relocate Balboa	Scoping level assessment (including structural assessment, but not mapping)
18	Vehicle & Pedestrian Traffic	Landside master plan	Included in Phase II estimate
		Improvements along Harbour Drive (as per MMM study)	CIG/Ministry of Planning (part of landside masterplan)
		George Town Revitalization Plan	CIG/Ministry of Planning (incorporate in landside masterplan)
		NRA road network improvements	CIG/NRA (incorporate in landside masterplan)
		Marine based tour staging area (sheltered basin?)	Estimate cost of breakwater, perimeter walls and dockage
19	Cruise & Cargo	Landside infrastructure improvements	CIG/Ministry of Planning (part of landside masterplan)
		Marine based tour staging area (sheltered basin?)	Estimate cost of breakwater, perimeter walls and dockage
		People movers	CIG/PACI
		Landside master plan	Included in Phase II study estimate
		Additional resources to support cruise (& cargo) operations	CIG/PACI
		New rubber tired cranes to replace crawler cranes	CIG/PACI
		Carrying capacity study - landside infrastructure	Define scope/cost of carrying capacity study
		Carrying capacity study - other tourist attractions	Define scope/cost of carrying capacity study
		Alternatives to CMS for tender operation	CIG/PACI
20	Socio-Economic & Business District	Loss of income/livelihood mitigation program	Define scope/estimate cost of program
		Stakeholder consultation/grievance mechanism	Define scope/estimate cost of program

Notes: Items in blue strikethrough are covered earlier in the table (i.e. they are relevant to multiple subjects in the ES)
Items in red cannot be readily estimated, as they are dependent upon market factors at the time of bidding

As noted in Table 2.1, some of the mitigation measures address more than one subject. The individual mitigation measures that are addressed in this document are highlighted in bold text in Table 2.1.

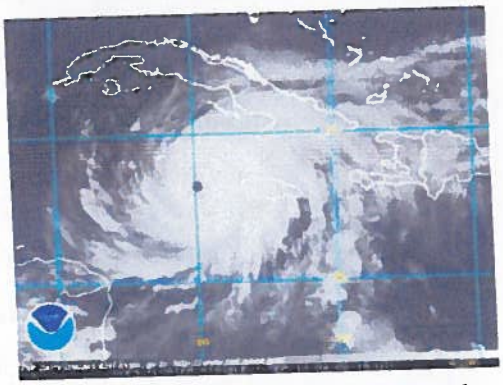
The following sections provide an overview of the possible mitigation measures, including the following information:

- Primary objective/intent of mitigation measure;
- Overview of approach/scope of mitigation measure;
- Estimated cost (or range in cost) to implement mitigation measure;
- Key assumptions and uncertainties.

3.0 MITIGATION MEASURES FOR NATURAL HAZARDS

3.1 Natural Hazard Response Plan

Objective: The proposed CBF will be exposed a number of natural hazards, including hurricanes, earthquakes and tsunamis, that have the potential to cause severe damage to the facility, as well as other infrastructure on the island, possibly resulting in an extended period of time when the facility is non-functional (i.e. during repair/reconstruction efforts). The loss of cruise ship traffic over an extended period of time would have significant impacts on the economy of the Cayman Islands.



Hurricane Ivan at the Caymans Islands [Source: US NOAA]

Appropriate design and construction is the primary method to minimize the risk of damage during extreme events. In addition, a Natural Hazard Management Plan could be developed to establish appropriate responses to hurricanes and tsunamis, as discussed below.

Description: There are two fundamental steps to the development of a Natural Hazard Response Plan:

- Identification and early detection of the hazard;
- Development of a Natural Hazard Response Manual.

A hurricane warning system can be established by means of access to public source information (such as NOAA's National Hurricane Center web site - http://www.nhc.noaa.gov/). Simlarly, a tsunami warning can be established by means of access to public source information (such as NOAA's Pacific Tsunami Warning Center - http://ptwc.weather.gov/?region=3). Ready links to these sites and information should be established within the PACI and CIG offices. Alternatively, a dedicated, customized link to this information could be developed.

Following on from the warning system development, the second step is to work with the PACI to define the required preparation and reactions to the natural hazards, and to document these steps in a procedural manual. This manual should address both the construction and operational phases of the CBF. The Natural Hazard Response Manual is a document that PACI staff will consult in the event either a hurricane or tsunami hazard event has been identified.

A hurricane preparation and response manual generally involves a multi-step procedure depending on the warning time to hurricane strike. With current technology and forecast systems, there is usually a period of several days leading up to the hurricane where the island has time to prepare. The preparation response occurs in stages, as the likelihood of the hurricane strike increases; as such, there is time to react to changing storm track or intensity.

Typically, a tsunami will have a much lower warning period than a hurricane. The event causing the tsunami typically happens with little to no warning and, once generated, the tsunami waves travel very rapidly. In this case, the critical item is to have a warning system that gives as much time as possible for the public to react. A multi-step procedure manual would also be developed for tsunamis, albeit with a much more rapid implementation time. In addition, given the low lying elevation of the portlands and George Town, a "vertical evacuation structure" may be required to provide a safe haven during a tsunami.

Estimated Cost: The development of a Natural Hazard Response Plan is expected to cost in the order of CI$60-75K (excluding the cost of participation by PACI and CIG representatives) and would take about six weeks to complete.

The cost of a tsunami vertical evacuation structure can not be estimated without further study; specifically, the cost of such a structure would be dependent upon the location, size and structural design concept for the structure.

3.2 Overdredging

Objective: Sedimentation of the dredged berthing area could occur during a severe storm or hurricane, resulting in reduced water depths within the berthing area and the possibility of access constraints for larger (deeper draft) vessels. Model simulations undertaken for the EIA suggest that the sedimentation will be relatively small and localized, perhaps 5,000 to 20,000 cy and 3-5 ft in thick in localized areas.

Overdredging of the berthing areas could be undertaken to provide a "sediment trap", thereby providing a "buffer" (i.e. storage capacity) for sedimentation during storm events and delaying the requirement for maintenance dredging.

Description: Overdredging would consist of dredging the berthing area, or specific sections of it, deeper than that required for navigation by the design vessels. Preliminary estimates of the volumes associated with overdredge depths (ODD) of 0.5, 1 and 2 ft were completed for a 200 ft wide zone along the East limits of the berthing area (where sedimentation is most likely to occur) and for the full berthing area, as summarized in Table 3.1.

Estimated Cost: The estimated cost of overdredging for the scenarios described above is summarized in Table 3.1. The cost is based on the additional dredging volume for each scenario multiplied by the unit cost of dredging. A unit cost of CI$15/cy has been assumed, as per the unit cost used in developing the construction cost estimate for the project. This unit cost assumes open water disposal in deep water approximately 1.25 miles west of the project site.

Table 3.1 – Estimated Overdredging Volumes and Costs

Overdredge Area	Estimated Overdredging Volume (cy) / Cost (CI$)		
	ODD = 0.5 ft	ODD = 1.0 ft	ODD = 2.0 ft
200 ft Wide Zone (31,500 sy)	5,250 cy / $0.08M	10,500 cy / $0.16M	21,000 cy / $0.32M
Full Footprint (103,200 sy)	17,200 cy /$0.26M	34,400 cy / $0.52M	68,800 cy /$1.04M

Overdredging, if adopted as a mitigation measure, would be incorporated into the project design and tender documents, and would be completed as part of the dredging and land reclamation works for the project.

3.3 Maintenance Dredging

Objective: As noted above, sedimentation of the dredged berthing area could occur during a severe storm or hurricane, resulting in reduced water depths within the berthing area and the possibility of access constraints for larger (deeper draft) vessels. Model simulations undertaken for the EIA suggest that the sedimentation will be relatively small and localized, perhaps 5,000 to 20,000 cy and 3-5 ft in thick in localized areas.

Should such sedimentation occur, maintenance dredging could be undertaken to restore the design dredge depths within the berthing area.

Description: Considering the small sedimentation volumes expected and the loose nature of the materials, it is anticipated that maintenance dredging would be undertaken with a small hydraulic or mechanical dredge. For example, a long reach excavator could be fitted with a pump or bucket and deployed on a barge to complete the dredging works. The dredged material (loose sand) could be disposed of offshore; alternatively, it could be dewatered and stockpiled for use as beach fill (if suitable) or general fill. The dredge zones would be delineated by a pre-dredging bathymetric survey, with a post-dredging survey undertaken to confirm that the design depths have been achieved (and to determine the dredged volume).

Estimated Cost: The estimated cost of maintenance dredging following a significant storm event is expected to be in the order of CI$0.5-1.0M, depending on the spatial extent and volume of sedimentation and the method of disposal (onshore or offshore). These costs assume that the work would be undertaken by a contractor who has to mobilize from the United States (Florida or Gulf coasts). Lower costs may be possible if the work can be completed by a local contractor.

3.4 Mitigation Measures for Liquefaction of Fill Materials

Objective: Grand Cayman is located in a seismically active zone, and a significant earthquake could cause liquifaction of fill materials within the land reclamation area (existing port area, as well as new expansion). Specific design measures are required to mitigate the risk of significant damage to marine structures (in particular, the bulkhead walls around the perimeter of the land reclamation area) and landside development (such as buildings, pavement and utilities).

Description: The concept design of the bulkhead walls around the perimeter of the new land reclamation was developed to withstand the effects of a extreme events, including hurricanes, earthquakes and liquifaction of fill materials. In addition, the cost estimate for the project includes an allowance for compaction and basic ground improvements.

However, there are two specific areas of concern with respect to the risk of damage by hurricanes, earthquakes and liquefaction, as summarized below:

- The ability of the existing bulkhead walls to withstand such extreme events is not known. Pending the results of a detailed structural evaluation, it is possible that rehabilitation/upgrade of the existing bulkhead walls on the north and south sides of the port, and/or ground improvements within the existing port area, will be required to mitigate the risk of damage by extreme events.
- The design and construction of landside development (i.e. new buildings, pavement and utilities) to be implemented as part of a separate/subsequent uplands development package must consider the risk of damage by hurricanes and earthquakes.

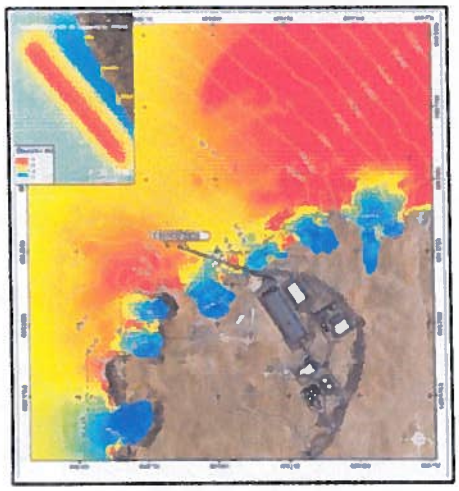
Estimated Cost: The estimated costs associated with the areas of concern noted above are summarized below:

1. The estimated cost to complete a detailed structural assessment/evaluation of the existing bulkhead walls would be in the order of [to be determined]. Should the results indicate that signfiicant rehabilitation/upgrade is required, the construction cost may be in the order of CI$10-15K/ft, resulting the following costs for specific sections:
   - RW terminal dockwall - length ~ 435 ft, cost ~ CI$4.4 to 6.5M;
   - South cargo dockwall - length ~ 410 ft, cost ~ CI$4.1 to 6.2M;
   - North terminal dock wall - length ~ 235 ft, cost ~ CI$2.4 to 3.5M.
2. Landside infrastructure – the cost of landside development can not be estimated at this time, as the nature and scope of the landside development has not been developed. The tender documents for the marine works will specify that the dredged fill materials be placed in such a manner that the value of the reclaimed land area for future use be maximized given the nature of the materials being dredged and the means and methods elected by the Contractor, including consideration of short and long term settlement of the fill, differential settlement and entrapment of fine material. It is not required that the

Contractor make the area suitable for final use. The finished site conditions will ultimately be subject to the nature of the material dredged, which is not the responsibility of the Contractor. The CIG will advise consultants and contractors involved in future landside development that structure specific foundation design analyses will be required, and that localized ground improvements and/or deep foundations may be required.

3.5 Tsunami Risk Assessment Study

Objective: A tsunami is a series of long period ocean waves generated by an underwater disturbance such as a landslide, earthquake or volcano. Although tsunamis in this region have a low likelihood of occurrence, a tsunami could result severe overtopping and flooding of the CBF and adjacent land areas, with the potential for severe damage to landside infrastructure and loss of life. Another risk with a tsunami is that if a ship is at berth when the tsunami wave strikes, there is significant potential for the ship to break free of its moorings and possibly strike another vessel or run aground. A tsunami study would provide an estimate of the frequency of occurrence and magnitude of possible tsunami events, and an assessment of the consequences resulting from such events.



Numerical Modeling of Tsunami Wave Inundation

Description: The Caribbean is a geologically active region, with earthquakes and volcanoe eruptions being relatively common occurrences. Generally, tsunamis have been acknowledged as having a relatively low risk of occurrence in the Caribbean; however, the potential for a destructive event does exist, particularly in the northern and eastern Caribbean. In this region, there are four potential sources of tsunamis: (1) volcanoes; (2) landslides; (3) earthquakes; and (4) tele-tsunamis (events generated at significant distance from the project site).

A tsunami study would involve the following steps:

- Review and analyses of historical and geological data related to the potential sources identified above.
- Estimation of the characteristics and ranges of return periods associated with the various tsunami-generation events, focussing on events critical to the project site.
- Numerical model simulations of tsunami wave generation at the source using the earthquake, landslide or volcano characteristics defined above.
- Hydrodynamic modeling of the propagation and inundation associated with each event.
- Numerical modeling of tsunami wave interaction with moored ships.

- Development of tsunami hazard maps using a GIS framework, detailing the level of flood inundation as well as the peak velocities associated with the overland flow.
- Interpretation of the modelling results to assess the potential impacts on project infrastructure and moored vessels.

Estimated Cost: The tsunami study is expected to cost in the order of CI$60-90K, and would take about 8 to 10 weeks to complete. The final deliverable will be a report detailing the modeling results, and GIS maps detailing the spatial extent of impacts, including contour mapping of overland flow depths and velocities.

Depending on the results of the study, the CIG may wish to consider the construction of a tsunami vertical evacuation structure to provide a safe haven during a tsunami event. The cost of a tsunami vertical evacuation structure can not be estimated without further study; specifically, the cost of such a structure would be dependent upon the location, size and structural design concept for the structure.

4.0 MITIGATION MEASURES FOR TURBIDITY AND SEDIMENTATION

4.1 Constraints on Dredging Means, Methods and Schedule

Objective: As noted in the EIA, specific constraints could be put on the dredging method and schedule in order to reduce turbidity and sedimentation generated by dredging, land reclamation and disposal works and the associated adverse impacts on the surrounding environment. Note that the use of turbidity barriers is discussed separately in Section 4.2.

Description: The following constraints could be considered:

1. *No blasting*: Considering the available information on subsurface conditions (in particular unconfined compressive strengths of less than 3,600 psi), blasting is unlikely to be required for this project. Hence, this constraint is considered to be reasonable and should be specified in the tender documents.
2. *No hydraulic dredging*: Based on discussions with several dredging contractors, mechanical dredging is considered to be preferable from an environmental perspective, and also more practical for this project. That being said, excluding the option of hydraulic dredging reduces flexibility for bidders, may reduce the number of bidders and could result in increased bid prices.
3. *No overflow*: This constraint means that the barges transporting dredged materials from the project site to the onshore reclamation area or offshore disposal site can not overflow, thereby eliminating spillage and associated turbidity and sedimetation. This constraint reduces the barge capacity and the efficiency/speed of the overall operation. This constraint was considered in developing the cost estimate for the project, and should be specified in the tender documents.
4. *Dredging in May - July only*: This three month "window" is considered the best time to complete the dredging, land reclamation and disposal works, as it avoids coral spawning seasons, periods of elevated sea temperatures (when corals are at risk of bleaching) and the peak tourist/cruise season. However, depending on when the project is awarded, and the means, methods and construction sequence adopted by the Contractor, this constraint could have a significant impact on the cost of the project, as it could result in the requirement to complete dredging in two stages.

Estimated Cost: The first and third constraints listed above were considered in developing the cost estimate for the project; hence, there is no additional cost associated with specifying these constraints. Regarding the second constraint, it is not possible to estimate the cost of excluding the option of hydraulic dredging, as this will be dependent on market factors at the time of bidding. Regarding the fourth constraint, the potential cost of limiting dredging, land reclamation and disposal works to a three month period (May - July), particularly if a mechanical dredge is used, could be in the order of CI$3-4M, as it could result in the requirement for the dredge to site idle for nine months, or to demobilize/remobilize. Again, this will be dependent on market factors at the time of bidding.

4.2 Turbidity Barriers

Objective: Turbidity barriers, also referred to as silt curtains, may be used to limit the dispersion of suspended sediment generated by dredging and marine construction works.

Description: The performance of turbidity barriers is dependent upon many factors, including the nature of the materials being dredged, the dredging method, the design of the barrier and prevailing metocean conditions (in particular, waves and currents). A number of technical papers and reports have been published that discuss the effectiveness of silt screens for dredging projects, including MALSF (2010), Ogilvie et al (2012) and Radermacher et al (2013).

The use of turbidity barriers for this project could include different configurations, including the following:

1. Extended barrier around the project footprint (fixed/ standing or floating/hanging);
2. Localized barriers around specific work areas, such as the active dredging zone and the overflow/discharge from the land recalmation area.

The use of an extended turbidity barrier around the project footprint is expected to be problematic, costly and potentially ineffective given the open coast exposure and high level of vessel traffic at the project site. In particular, prevailing waves and currents will impose significant hydrodynamic loads on the barrier, requiring a substantial "support system" (piles or floating pontoons) to anchor it. In addition, substantial effort will be required to maintain the barrier, and to accommodate frequent vessel traffic to/from the port.

The use of localized turbidity barriers around active work areas is expected to be a more effective approach for this project. For example, a mechanical dredge could be equipped with a frame and curtain system whereby the dredging is done within a contained area.

Estimated Cost: The cost estimate for the project includes an allowance for various measures that are typically used on dredging projects to control/limit the generation of suspended sediment and associated turbidity plumes, including turbidity barriers, real-time monitoring and adaptive management of dredging operations (i.e. "Best Management Practices"). A significant increase in cost (likely tens of millions of dollars) would be associated with specifying/requiring more stringent constraints, such as those utilized for dredging contaminated sediments.

The Tender Documents (in particular, the Environmental Management Plan) will specify allowable thresholds for turbidity and sedimentation at critical locations (i.e. sensitive receptors, such as coral reefs) adjacent to the project site. The Tender Documents will not specify the "means and methods" by which to meet the specified thresholds, but will require tenderers to present the equipment and methology that they propose to complete the dredging and meet the specified thresholds. The proposed "means and methods" will be an important part of the tender review process.

4.3 Vacuum Dredging of Fines after Main Dredging

Objective: Ship propellor and thruster generated flows associated with berthing and de-berthing manouvers will result in sediment re-suspension, turbidity plumes and sedimentation on coral reefs adjacent to the facility over the operational life of the facility. It is anticipated that the severity of this issue will decrease with time, as regular cruise ship traffic to and from the facility will mobilize and dissipate the fines from the berthing area.

If necessary, this issue can be mitigated, to some degree, by vacuum dredging fines from the berthing area after the main dredging program has been completed.

Description: It is anticipated that the vacuum dredging of fines would be undertaken using a long reach excavator fitted with a pump and deployed on a barge. The dredged material (loose sand) could be disposed of offshore; alternatively, it could be dewatered and stockpiled for use as beach fill (if suitable) or general fill. The dredge zones would be delineated by a pre-dredging bathymetric survey, with a post-dredging survey undertaken to confirm that the design depths have been achieved (and to determine the dredged volume).

Estimated Cost: The estimated cost of vacuum dredging following the main dredging program expected to be in the order of CI$0.5-1.0M.

4.4 Seabed Protection within Berthing Area

Objective: Ship propellor and thruster generated flows associated with berthing and de-berthing manouvers will result in sediment re-suspension, turbidity plumes and sedimentation on coral reefs adjacent to the facility over the operational life of the facility. It is anticipated that the severity of this issue will decrease with time, as regular cruise ship traffic to and from the facility will mobilize and dissipate the fines from the berthing area.

If necessary, this issue can be mitigated by installing seabed protection in critical zones within the berthing area. In addition, the issue can be further mitigated through the use of specific operational measures, as described in the ES.

Description: The seabed protection would consist of the fabrication and installation of a mattress system in critical areas within the dredged berth pockets where propellor and thruster

generated flows are greatest. Several different mattress concepts are available and could be considered for this project.

Estimated Cost: The estimated cost to provide seabed protection throughout the first 300 ft of all four berths is estimated to be in the order of CI$6-12M. The range in cost is related to uncertainties regarding the specific details of the mattress design and likely costs for its manufacture and installation.

Installation of Pre-Fabricated Seabed Protection System

5.0 MITIGATION MEASURES FOR AIR QUALITY

5.1 AQ Dispersion Modeling to Assess Impacts on Landside Receptors

Objective: As noted in the Environmental Statement, the cruise berthing facility will result in increased emissions, in particular due increased cruise ship traffic, larger ships and berthing closer to shore. However, the impacts of increased emissions on onshore receptors will be naturally mitigated, to some degree, by the prevailing easterly (offshore) trade winds. If necessary, air quality dispersion modeling could be undertaken to quantify the impacts on specific onshore receptors.

Description: Air quality dispersion modeling would be undertaken using various models (CALMET, CALPUFF, CALPOST) to estimate emissions at various onshore locations for key pollutants (NO_2, SO_2, PM_{10}, CO_2). The modeling will utilize available information on marine sources (cruise ships, cargo ships, harbour craft), as well as vehicular traffic, air traffic and local stationary sources (such as power plant). It is assumed that the CIG will provide suitable contacts to source such information.

Estimated Cost: The estimated cost of the air quality dispersion modeling is in the order of CI$50-75K. This does not include any additional field work or monitoring.

5.2 AQ Monitoring during Construction

Objective: Air quality monitoring could be undertaken during construction in order to determine concentrations of key pollutants at various locations around George Town.

Description: The air quality monitoring program would include the deployment and operation of an air quality monitoring instrument (real-time sensor with remote access) at a selected location. The scope of work would include the purchase, calibration, installation and operation of the sensor (including consumables), data downloading/reduction/analysis and regular reporting.

Estimated Cost: The estimated cost of the air quality monitoring program would be in the order of CI$200K/year. This includes measurements at a single location.

6.0 MITIGATION MEASURES FOR NOISE AND VIBRATION

6.1 Pre-Construction Structural Assessment of Selected Buildings

Objective: There is a potential for damage to buildings in close proximity to the projejct site due to vibrations associated with construction operations, in particular, pile driving and heavy truck traffic. A pre-construction structural assessment could be undertaken on selected buildings to assess existing conditions, specifically to identify any signs of structural damage and/or settlement. The results of this study would provide the baseline information necessary to review/assess claims for damage that might arise during project construction.

Description: The pre-construction structural assessment would include the following tasks for each building of interest:

- Review structural plans and details;
- Identify presence of critical structures and structures without redundancies;
- Review loading conditions, including deviations from intended use and signs of overloading;
- Identify any addition and alteration works;
- Identify any signs of structural damage, deterioation or settlement;
- Provide summary report summarizing study results, including detailed information on any signs of strutural damage, deterioration or settlement.

Estimated Cost: The estimated cost to undertake a pre-construction structural assessment of nine buildings is in the order of $CI7.5-10K.

6.2 Noise and Vibration Monitoring

Objective: Noise and vibration monitoring could be undertaken during construction in order to determine noise and vibration levels at selected locations of interest.

Description: The noise monitoring program would include the deployment and operation of a series of noise monitoring instruments (real-time sensors with remote access) at specific locations of interest, for example at the fence line of the project site towards the closest sensitive receptor. The vibration monitoring program would include the deployment and operation of vibration data loggers installed on selected buildings in close proximity to the project site. The scope of work would include the purchase, calibration, installation and operation of the sensors (including consumables), data downloading/reduction/analysis and regular reporting.

Estimated Cost: The estimated cost of the noise and vibration monitoring program would be in the order of CI$75K/year. This includes noise measurements at one location and vibration measurements on three buildings (one location each).

7.0 MITIGATION MEASURES FOR MARINE ECOLOGY

7.1 Coral Relocation Program

Objective: The overall objective of the coral relocation program is to mitigate damage to coral resources, coral reef habitat and biodiversity located within the project footprint by translocating as much of the live coral material and supporting natural substrate ("live rock") that would otherwise be destroyed by project construction. The specific goals and objectives of the coral relocation program require discussion with the DoE. In particular, the Terms of Reference for the coral translocation program must be developed by, or in collaboration with, the DoE. The DoE was not consulted during the preparation of this report.

Description: The overall approach to the planning, design and implementation of the coral relocation program includes the following key tasks:

- CIG to define budget/funding avialable for coral relocation program;
- Define goals and objectives for coral relocation program (DoE input critical – refer to Appendix A);
- Complete field work to identify/map/prioritize components for relocation, and to identify/scope recipient site(s);
- Develop detailed coral relocation plan and prepare Terms of Reference/Tender Documents;
- Solicit/review tenders and award contract;
- Complete coral relocation work (coral harvesting, transport and re-attachment);
- Undertake post-construction monitoring.

The results of benthic habitat surveys undertaken by TEMN (2014) and CSA (2015) have been used to assess the possible scope of the coral relocation program (i.e. number and size of colonies to be harvested, substrate augmentation at recipient site, etc.), the possible means and methods for coral relocation, and the anticipated costs and duration of completed the work. Specifically, the following supporting analyses were undertaken:

- Assessment of methodology, unit costs and durations for coral relocation and substrate augmentation (Appendix B);
- Volumetric estimate of reef spurs (Appendix C);
- Define scope of work for planning, design and monitoring (Appendix D).

These analyses led to the development of estimated costs and durations for a range in possible coral relocation efforts, as summarized below.

Estimated Cost: The current project cost estimate includes CI$9M for a coral translocation program. The following table summarizes the estimated scope, cost and duration of alternative coral relocation efforts. These costs include allowance for "soft costs" associated with the planning and design of the coral relocation plan ($CI60-85K), monitoring during its implementation (CI$300-380K) and a five year post-construction monitoring program (CI$150-190K).

	No. of Hard Corals > 10 cm (and % of total)	Artificial Substrate (boulders)	Live Rock Relocation (and % of total)	Estimated Duration (months)	Estimated Cost (CI$M)
Level 1	19,600 (~ 15%)	6,000 m^2	1,600 m^3 (~ 3%)	10-12 mths	$8-10M
Level 2	39,200 (~ 30%)	12,000 m^2	3,200 m^3 (~ 6%)	20-24 mths	$15-18M
Level 3	58,800 (~ 45%)	18,000 m^2	4,800 m^3 (~ 9%)	30-36 mths	$20-25M

Based on the information presented above, it is anticipated that cost and schedule will limit the scope of the coral relocation effort possible for this project. Should the CIG decide to proceed with the project, it is recommended that the planning and design effort for the coral relocation program begin immediately, as this activity will be on the critical path for project implementation. The first steps in this process include the CIG establishing a budget for the coral relocation program, and consulting with the DoE to define the specific goals and objectives of the program such that a Terms of Reference can be prepared.

7.2 Other Mitigation Measures

Various other mitigation measures are possible to reduce the impacts of project constuction and operation on the marine environment. These are described in Chapter 4 – Mitigation Measures for Turbidity and Sedimentation.

8.0 MITIGATION MEASURES FOR CULTURAL HERITAGE

8.1 Relocate *Balboa*

Objective: The wreck of the *Balboa* is an important cultural heritage site, and also a popular site for night dives. As the wreck is located within the footprint of the proposed project, it will be lost unless it is relocated. In addition to protecting it as a cultural heritage asset, relocation of the *Balbao* to a new site that is accessible during the day will increase its value as a dive site.

Description: A dive inspection and preliminary structural assessment of the wreck of the *Balboa* was completed by an ABS Class marine surveyor (John MacKenzie of West Indian Marine Group). As previously reported, the wreck consists of a scattered field of debris encrusted with a significant amount of hard and soft corals. The preliminary structural assessment concludes that relocation of the wreck is feasible, and that relocation to a new site within George Town Harbour will likely be less expensive than removal and disposal ashore. Appendix E provides a detailed discussion of the existing condition of the *Balboa*, as well as the general methodology proposed to relocate it.

Estimated Cost: The estimated cost to relocate the wreck of the Balboa to a new site within George Town Harbour is in the order of CI$0.8-1.5M. This estimate assumes that the relocation site is within 1 mile; the range in costs reflects uncertainty regarding the scope of the relocation effort (i.e. partial or full). The scope of the relocation effort requires discussion with key stakeholders, including the CIG, Cayman Islands National Museum, PACI and CITA.

9.0 MITIGATION MEASURES FOR VEHICULAR AND PEDESTRIAN TRAFFIC

9.1 Marine Based Tour Staging Area

Objective: A marine based tour staging area would allow cruise passengers to embark on various water-based excursions (glass bottom boat, submarine, snorkelling, diving, fishing) directly from the CBF, thereby reducing pedestrian and vehicular traffic along Harbour Drive.

Description: A breakwater could be constructed on the north side of the CBF in order to provide a sheltered small craft harbour basin. Figure 9.1 presents a concept layout for such a facility.

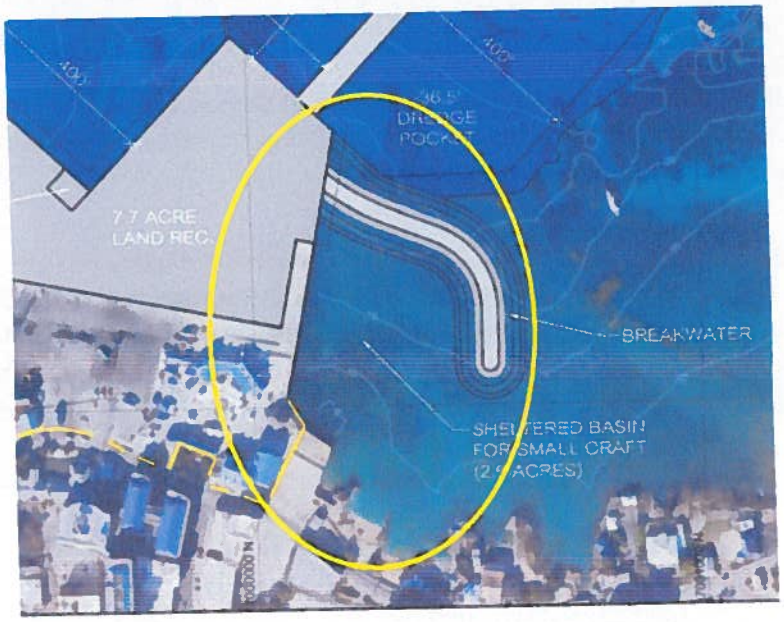


Figure 9.1 – Concept Layout for Marine Based Tour Staging Area

There are a number of potential users of such a facility, including the following:

- Water sports excursion operators (diving, snorkeling, fishing);
- Tender operator (CMS);
- Pilot boats, tugs and other service vessels owned/operated by local commercial marine businesses (Bodden Shipping, West Indian Marine);
- Visiting yachts (and possibly mega-yachts);
- Visiting commercial vessels (USCG, scientific research vessels, etc.).

Mooring/berthing fees associated with the use of such a facility represent a potential revenue stream for the CIG. It is anticipated that such a facility would also provide additional spinoff benefits to the local economy.

Estimated Cost: The estimated cost of the marine based staging area described above is expected to be in the order of CI$12-15M. The majority of this cost (~85%) is the breakwater, which is required to shelter to the facility from Nor'Westers. Other costs include the dockage system, utilities and navigation aids.

9.2 Landside Master Plan

Careful planning and design of landside development associated with the CBF will be important to manage pedestrian and vehicular traffic (cruise and cargo) associated with the new facility. A landside master plan study should be undertaken to address these and numerous other considerations associated with the development of the project. The objectives, scope and estimated cost of the landside master plan are discussed in Chapter 10.

9.3 Other Mitigation Measures

As noted in the ES, increased vehicular traffic is expected regardless of whether the proposed CBF is constructed. Various infrastructure improvements proposed as part of the George Town Revitalization Plan and the NRA's Priority for Road Network Improvements will both play a significant role in mitigating issues associated with the anticipated increase in vehicular traffic. In addition, it is recommended that the Ministry of Planning and the NRA incorporate and promote sustainable modes of transit, such as walking, cycling, car sharing and increased use of public transport, as part of these plans.

Should the CIG decide to proceed with the CBF, it is essential that a coordinated approach be adopated for the planning, design and construction of these infrastructure projects (i.e. CBF, GTRP and road network improvements). This will require extensive and ongoing communiciation and coordination amongst numerous CIG entities, consultants and contractors.

10.0 MITIGATION MEASURES FOR CRUISE AND CARGO OPERATIONS

10.1 Landside Master Plan

Objective: A basic site plan for the land reclamation area was developed as part of the EIA study, including general separation of cruise and cargo operations, as well as a preliminary site grading and drainage plan. Should the CIG decide to proceed with the project, a comprehensive landside master plan is required to address the following:

Definition and layout of buildings (including upgrade or replacement of existing buildings), other facilities and amenities, and parking/staging/storage areas required to support progressive growth in both cruise and cargo operations;

Functional layout of cruise and cargo operations, including safety and security requirements (ISPS and MARPOL);

Openings in the wave/flood wall to meet operational requirements (i.e. vehicular and pedestrian access), and modular closures to be installed in anticipation of storm events;

Services and utilities requirements for growing cruise and cargo operations (i.e. potable and fire water, power, telecommunications, fuel);

- Improvements along Harbour Drive, including pedestrian prioritization features as identified in the EIA traffic study;
- Integration with George Town Revitalization Plan.

Description: The landside master plan would be developed by a specialist consultant under contract to the CIG. It is anticipated that the scope of work would include the following tasks:

Review of background information (SOC, OBC, EIA, etc.);

Discussions with various CIG entities (Ministry of Tourism, Ministry of Planning, PACI, etc.) and other stakeholders to define functional requirements;

Development/assessment of alternative concept layouts and procurement strategies for site development;

Selection and refinement of preferred master plan;

Preparation of implementation plan for landside development, including estimated costs, recommended procurement approach and prioritized sequence/schedule.

Estimated Cost: The estimated cost to develop a landside master plan is expected to be in the order of CI$75-150K [to be confirmed]; the range in cost reflects uncertainty regarding the scope of the study, in particular the spatial extent of the study area (i.e. port lands only, or larger area) and the level of effort required related to cargo operations and infrastructure requirements (services and utilities). Should the CIG decide to proceed with the project, the landside master planning effort should be initiated immediately as part of the design development phase.

11.0 MITIGATION MEASURES FOR SOCIO-ECONOMIC IMPACTS

11.1 Carrying Capacity Study – Landside Infrastructure

Objective: [to be completed; CIG input required]

Description: [to be completed; CIG input required]

Estimated Cost: [to be completed; CIG input required]

11.2 Carrying Capacity Study – Other Tourist Attractions

Objective: Carrying capacity studies of other tourist attractions on Grand Cayman Island could be undertaken to determine the capacity of these attractions, in particular their ability to accomodate increased numbers of tourists.

Description: Carrying capacity studies could be undertaken for two categories of attractions:

1. Land-based attractions located in an enclosed environment on land;
2. Marine-based attractions located directly in the marine environment (with no physical boundaries/barriers).

Specific tourist attractions should be identified and the following tasks undertaken for each:

- Site visit;
- Documentation/literature review;
- Development of capacity indicators/criteria;
- Visitor assessment;
- Infrastructural capacity assessment;
- Management assessment;
- Ecological assessment;
- Capacity and alternative management evaluation;
- Summary report.

Estimated Cost: The estimated cost for completing carrying capacity studies for five land-based attractions and 12 marine-based attractions is in the order of CI$300,000.

11.3 Loss of Income/Livelihood Mitigation Program

Objective: The objective of this program would be to compensate specific businesses (and their employees) for loss of income/livelihood as a result of the project. The two business groups of specific interest are the tender operator (CMS) and GTH dive and water sports operators.

Description: The following details need to be assessed and considered in mitigating loss of income/livelihood:

- How many groups will be compensated for losses?
- How many persons make up each group?
- What are the current salaries/earnings for these individuals/groups?
- What new facilities will be developed to provide possible employment opportunities for groups who will be affected by the project?
- Will training be provided to enable change in occupation for affected groups?
- What is the budget allocated to training?
- How many persons will be trained?
- What type of training will be offered (type of discipline/technical field)?
- What is the maximum percentage of current salaries that will be paid out as compensation?
- Is there an existing pay out formula (for example, how many months income/salary is being paid out)?
- For persons employed under a company, how will compensation be handled?
- Will meetings be held with each group? If yes, what is the estimated number of meetings and what are the proposed venues and cost for venues?

Estimated Cost: The EIA study estimated the annual loss in income for affected groups (tender operator and dive and water sports operators) at CI$14.5M per year. This reflects current spend values identified in the socio-economic impact assessment, but does not include the following:

- Establish a process for the identification and verification of those impacted;
- Establish scope of program CIG is interested in implementing (level of compensation, skills training for alternative livelihoods, alternative employment opportunity);
- Implementation (training, reimbursements).

11.4 Community Liaison

Objective: Communication with stakeholders and the general public on the project impacts and updates on project milestones is very important in mitigating stakeholder perception impacts and keeping the community informed.

Description: Two to three Community Liaison Officers and one Coordinator should be hired to communicate with stakeholders throughout the construction phase of the project (estimated at three years). The Public Education and Communication Program should include the following:

- Full page advertisement at project startup, and refreshed annually (three runs);
- Smaller advertisement at major project milestones (estimate 12 runs, one per quarter);
- Strategically placed flyers and posters dispersed throughout the districts of Grand Cayman and the Sister Islands (estimate 250 flyers, printed twice per year).

Estimated Cost: The estimated cost of the community liaison activities described above is in the order of CI$310,000. The majority of the cost (95%) is for salary and travel for two Community Liaison Officers and a Coordinator. Salary costs were estimated based on published information on CIG salaries (from 2013) and a recent job posting. The remainding cost (5%) is for printing and advertising.

An additional cost should also be provided for public meetings to inform/sensitize stakeholder and community members on project stages and actual impacts, and to address/respond to concerns. It is recommended that one community forum (town hall meeting) be held each quarter (i.e. four per year), with a target audience of 50-100 persons per meeting. Costs associated with such meetings would include venue rental, presentation equipment rental, materials preparation, and refreshments.

11.5 Grievance Mechanism

Objective: A grievance mechanism should be established to address complaints and grievances related to the environmental and socio-economic impacts of the project.

Description: Key resources required for the grievance mechanism include the following:

- A Focal Point/Stakeholder Liaison Officer (this could be one of the Community Liaison Officers assigned to the project).
- Committee to review assess and resolve complaints.
- Establishment of the mechanism to receive and properly document complaints and grievances, as well as other comments related to project impacts on exiting conditions, perhaps similar to the website and comment submission locations established for the EIA study (email, post, public boxes at several locations).

- Release of information to the public (media costs).
- Settlement of legitimate claims by aggrieved parties.

Estimated Cost: Some of the costs associated with the grievance mechanism (personnel salaries, and some media costs) are incorporated under Community Liaison (Section 11.4). In order to develop more accurate costs for the community liaison and grievance mechansims, answers to the following questions are required:

- What type of consultation approaches will be used for engaging stakeholders?
- What is the target number for each stakeholder session?
- How many persons will be tasked with implementing the community liaison and grievance mechanism programmes?
- What are the positions/skill requirements for persons employed as part of the programmes?
- What is length of the programmes?
- What is the proposed salary scale for persons tasked with handling the community liaison and grievance mechanism programmes?
- Where will meetings be held? What are the proposed venues and costs associated with the meetings, including venue and equipment rental, materials preparationn, refreshements, etc?
- Will designated phone lines be established to address concerns by the general public? If yes, will a full-time position be created for handling queries? Will existing phone lines be used or will a 1-888 number be acquired? What is cost to acquire such service in the Cayman Islands?