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Proposed Cruise Berthing Facility, Grand Cayman

Environmental and Engineering Consultancy Services
Environmental Statement
Appendix Q - Rapid Impact Assessment Matrix (RIAM)
Summary of Methodology

June 2, 2015
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Innovation, Excellence & Service

Proposed Cruise Berthing Facility, Grand Cayman

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Summary of Methodology

Prepared for

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

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TABLE OF CONTENTS

1.0 INTRODUCTION

A key challenge with Environmental Impact Assessment (EIA) studies is that they can be perceived as subjective due to a number of factors, including:

- The lack, or inadequacy, of baseline data;
- The (often inadequate) time frame provided for data acquisition and analysis;
- The ability of the assessors to cover a wide range of issues in a comprehensive manner.

The Rapid Impact Assessment Matrix (RIAM) is an analytical tool that was used to consolidate and evaluate the environmental and socio-economic impacts that are expected to occur with the development of the proposed cruise berthing facility in George Town Harbour. The impacts include those identified within each discipline (task) of the Environmental Impact Assessment study (as presented in the Environmental Statement and its technical appendices) for both the construction and operation phases of the proposed project.

The RIAM method was originally developed in Denmark (Pastakia, 1998; Jensen, 1998; and Pastakia and Jensen, 1998), and allows one to provide a valuation of potential impacts on the environment as a result of development. Two recent uses of the RIAM methodology were reviewed so as to obtain a better appreciation of its range and flexibility of application. First, Kankam-Yeboah et al (2005) describe the application of the RIAM method to the water resources sector in Ghana, West Africa. In this application, the method was used to facilitate the prioritisation of water resources management problems, thereby guiding decisions related to the order in which solutions should be implemented. Second, Padash (2014) describes the application of the RIAM method as part of an EIA for a proposed desalination plant in Iran. In this case, the RIAM method was used primarily to support the selection of the optimum project development alternative, and to streamline and select the best mitigation approaches.

For the present project, the preferred project layout was developed prior to the application of the RIAM method, through a comprehensive effort that included extensive field and analytical investigations, as well as discussions with key stakeholders, including the CIG, PACI and several cruise lines. The RIAM method was subsequently applied to achieve the following:

- Provide a comparison between existing (baseline) conditions and future conditions with respect to the anticipated impacts of project development (construction and operation phases) on various factors grouped under three general categories: physical/chemical; biological/ecological; and socio-economic/cultural;
- Identify/prioritise the factors that would benefit most from mitigation measures;
- Demonstrate the importance of mitigation measures to the achievement of a beneficial project outcome.

A key advantage of the RIAM method is that it reduces subjectivity and introduces some degree of transparency and objectivity to the EIA process. It also provides a transparent and permanent record of the analysis process, while at the same time organizing the EIA procedure, thereby assisting in the efficient assessment of impacts and mitigation measures. The relatively simple form of the RIAM facilitates analysis, re-analysis (if the proponent wishes to investigate varying development scenarios) and subsequent in-depth analysis of selected project components in a rapid and transparent manner. This objectivity and form makes the method a useful tool for both executing and evaluating EIAs, and for selecting appropriate mitigation options.

Even where quantitative environmental data are available, the application and overall use of these data requires that a subjective judgment be made of the possible impacts, their spatial scale, and potential magnitude. The RIAM method allows both quantitative and qualitative data to be evaluated and interpreted, leading to an Environmental Score for the project, thereby reducing the level of subjectivity in the analysis.

Other advantages of the RIAM include the following:

- Production of easily interpreted and long lasting records, which can be independently checked, validated or updated;
- Ability to make multiple “runs” to compare different options and to allow comparison (on a common basis) of judgments made in different sectors, as the method follows a defined set of judgment rules.

This document provides an overview of RIAM method as used to evaluate the anticipated impacts associated with the development of the proposed cruise berthing facility in George Town Harbour. The RIAM method draws upon information generated by the EIA study, which was conducted within the context of the following realities:

- The cruise industry is of critical importance to the national economy of the Cayman Islands;
- The project will be developed in George Town Harbour;
- George Town Harbour lies in close proximity to natural and cultural resources (coral reefs, ship wrecks, marine life and beaches) that are of critical importance to the national economy;
- The project site must accommodate both cruise and cargo operations, and is immediately adjacent to the downtown business district;
- The development of the proposed cruise berthing facility is expected to impact the physical, chemical, biological, ecological, socio-economic and cultural aspects of George Town Harbour and its surroundings.

The RIAM results are incorporated at the end of relevant chapters in the Environmental Statement.

2.0 OVERVIEW OF RIAM METHOD

Using the RIAM method, the impacts of project alternatives and/or development phases (i.e. construction and operation) are evaluated against various environmental and socio-economic components. For each component, a score (using pre-defined criteria) is determined, with this score providing a measure of the impact that can be expected from the component. The scores from the various components are then aggregated/consolidated to provide an overall assessment of both the frequency of occurrence and extent of positive and negative impacts. The following pages provide a summary of the assessment criteria and scoring methods; additional detail is provided in Pastakia and Jensen (1998).

2.1 Assessment Criteria

The assessment criteria fall into two groups:

A. Criteria that are of importance to the condition, that individually can change the score obtained; and

B. Criteria that are of value to the situation, but should not individually be capable of changing the score obtained or resulting in a zero score.

For Group A, the overall evaluation system is implemented by multiplying the marks attributed to each criterion. The principle of multiplication insures that the weighting from each criterion is accounted for directly.

For Group B, the overall evaluation system is implemented by adding the marks attributed to each criterion. This insures that a mark taken in isolation cannot affect much the overall result.

The criteria, together, with their appropriate judgement scores, are summarized below.

2.1.1 Group (A) Criteria

Spatial Importance of Condition (A1)

A measure of the importance of the condition, which is assessed against the spatial boundaries or human interests it will affect. The scales are defined as follows:

4 = important to national/international interests

3 = important to regional/national interests

2 = important to areas immediately outside the local aspect-specific study areas

1 = important only to the local condition (e.g. immediate GTH port area)

0 = no importance

Magnitude of Change/Effect (A2)

Magnitude is defined as a measure of the scale of benefit/dis-benefit of an impact or a condition:

+3 = major positive benefit

+2 = significant improvement in status quo

+1 = improvement in status quo

0 = no change/status quo

-1 = negative change to status quo

-2 = significant negative dis-benefit or change

-3 = major dis-benefit or change

2.1.2 Group (B) Criteria

Permanence (B1)

This defines whether a condition is temporary or permanent, and should be seen only as a measure of the temporal status of the condition.(e.g. an embankment is a permanent condition even if it may one day be breached or abandoned; whilst a coffer dam is a temporary condition, as it will be removed at the end of the construction period).

1 = no change/not applicable

2 = temporary

3 = permanent

Reversibility (B2)

This defines whether the condition can be changed and is a measure of the control that can be exerted over the effect of the condition. It should not be confused or equated with permanence.

1 = no change/not applicable

2 = reversible

3 = irreversible

Cumulative (B3)

This is a measure of whether the effect will have a single direct impact or whether there will be a cumulative effect over time, or a synergistic effect with other conditions. The cumulative criterion is a means of judging the sustainability of a condition, and is not to be confused with a permanent/irreversible situation.

1 = no change/not applicable

2 = non-cumulative/single

3 = cumulative/synergistic

It is possible to change the cumulative component to one of synergism, if the condition warrants consideration of additive effects.

2.2 Calculating the Environmental Score (ES)

The Environmental Score (ES) is derived from the following set of equations (Jensen, 1998):

$$(a1) \times (a2) = aT \quad (1)$$

$$(b1) + (b2) + (b3) = bT \quad (2)$$

$$(aT) \times (bT) = ES \quad (3)$$

Where,

(a1) and (a2) are individual criteria scores that are of importance to the condition (Group A);

(b1) to (b3) are the individual criteria scores that are of value to the situation (Group B), but individually should not be capable of changing the score obtained;

aT is the result of multiplication of all A scores;

bT is the result of summation of all B scores; and

ES is the environmental assessment score for the condition.

2.3 Overall Assessment

The various ES values are grouped into descriptive range values (RV) and assigned both alphabetic and numeric codes (see Table 2.1) so they may be more easily compared.

Table 2.1 Environmental Scores and Range Values

Environmental Score (ES)	Range value (RV) (Alphabetic)	Range value (RV) (Numeric)	Description of Range Value
72 to 108	E	5	Major positive change/impact
36 to 71	D	4	Significant positive change/impact
19 to 35	C	3	Moderate positive change/impact
10 to 18	B	2	Positive change/impact
1 to 9	A	1	Slight positive change/impact
0	N	0	No change/status quo/not applicable
-1 to -9	-A	-1	Slight negative change/impact
-10 to -18	-B	-2	Negative change/impact
-19 to -35	-C	-3	Moderate negative change/impact
-36 to -71	-D	-4	Significant negative change/impact
-72 to -108	-E	-5	Major negative change/impact

3.0 APPLICATION OF RIAM METHOD TO THE PROPOSED PROJECT

In the application of the RIAM methodology to the proposed project, three main environmental headings were used to group the anticipated impacts, as follows:

- Physical and chemical parameters;
- Biological and ecological parameters; and
- Socio-economic and cultural parameters

The assessment and evaluation of impacts attributable to each of the tasks considered in the EIA study (tasks as originally defined in the EIA Terms of Reference) were captured under these three broad headings. The manner in which this was done is summarised in Table 3.1.

Table 3.1 Distribution of Tasks within Primary Parameter Headings

Task List	Physical and Chemical Components	Biological and Ecological Components	Socio-Economic & Cultural Components	Other
Task A - Summary of Alternatives				Not considered in RIAM
Task B - Natural Hazard Assessment	X			
Task B - Climate Change	X			
Task C - Geology and Soils				Not consideredin RIAM
Task D - Waves and Sediments	X			
Task D - Hydrodynamics and Dredge Plumes	X			
Task E - Sedsiment and Water Quality	X			
Task F - Storm Water	X			
Tyask G - Air Quality & GHG Emissions	X			
Task H - Noise and Vibration	X			
Task I - Terrestrial Ecology		X		Removed from study scope
Task J - Marine Ecology		X		
Task K - Cultural Heritage			X	
Task L - Traffic and Pedestrian			X	
Task M - Cruise and Cargo			X	
Task N - Socio-Economic Impact Assessment			X	
Task O - Business District Impact Assessment			X	
Task P - Landscape and Visual Impact Assesment			X	

The RIAM method was used to "quantify" the anticipated project impacts, as well as proposed mitigation measures, for the following situations:

- Existing (Baseline) Conditions;
- Dredging and Reclamation Phase;
- Construction (Post Dredging) Phase; and
- Operation Phase.

The results of the application of the RIAM method to the various EIA tasks are summarized in tables and graphs at the end of each EIA task chapter in the Environmental Statement.

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