JAMAICA ENVIRONMENT TRUST

Review of the Final Report Environmental status of the Falmouth Cruise Ship Pier, Falmouth, Trelawny prepared by CL Environmental, Kingston, Jamaica for the Port Authority of Jamaica

July 2013

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September 2015

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September 2015

Disclaimer

This document contains the professional opinion of the reviewers. In arriving at our opinion we made every reasonable attempt to ensure that our resource persons are informed and reliable and experts in the area in which their comment and analysis is sought. The reviewers encourage readers to apply their own critical analysis to the information provided in this document and by others, particularly where the opinion of the reviewers differs from those others.

Background

The Falmouth Cruise Ship Terminal was constructed 2009/2010 on Jamaica's north coast. The project was described on the Port Authority of Jamaica's website on August 21st, 2015 as "*an initiative of the Port Authority of Jamaica (PAJ) and Royal Caribbean Cruise Lines (RCCL) to host the largest cruise ships in the world*" but this has recently been removed. A similar project report can be read at PortTechnology.com.[1]

The main contract was awarded in 2009 to E. Pihl and Son A.S., with Boskalis Westminster St Lucia Ltd. being given the contract for the marine works. The Falmouth Cruise Ship Terminal required dredging and reclamation works including the creation of the cruise ship terminal itself, while the marine works consisted of the dredging of an access channel and two berthing pockets alongside the terminal.

The Environmental Impact Assessment (EIA) contracted to Mott MacDonald and subcontracted to Technological and Environmental Management Network (TEMN) in Jamaica indicated "*…the presence of sensitive benthic marine resources within and adjacent to the footprint of the proposed structure, namely the coral reef system and Oyster Bay. Some 112 species were identified in the area (22 scleractinian corals, 29 algae, eight sponges, 15 invertebrates and 45 fish), coral cover was as high as 30 percent and Diadema antillarum, the keystone invertebrate herbivore, had densities of 8–13 individuals per square meter according to previous studies. Oyster Bay, also called 'Glistening Waters', is one of only four bioluminescent bays in the world,*" according to the Port Technology website.[2]

In 2007, with the help of the Environmental Law Alliance Worldwide (ELAW), the Jamaica Environment Trust (JET) reviewed the EIA. The review found several serious deficiencies, including the absence of a detailed mitigation plan: "*This EIA study has several deficiencies. The EIA fails to identify the location of dredged spoil disposal sites, lacks a mitigation plan, fails to assess the shoreline response, fails to adequately address the value of the heritage of the area and impacts from tourism, jobs and housing as well as omits a significant amount of information.*"[3] JET went on to recommend that the EIA be redone in a submission to the National Environmental and Planning Agency (NEPA), Jamaica's environmental regulatory body. Although NEPA may have required improvements to the EIA via Addenda, these details were never shared with JET.

Boskalis was responsible for the dredging of the access channel and therefore also the "*…protection and care of the coral reefs, seagrass and benthic fauna which were abundantly present. To achieve the dredging requirements to modernize the port, and still respect the sustainability of the marine environment, Boskalis organized and supervised a massive campaign of coral relocation and seagrass transplantation. Although this role was stipulated in the contract for marine works, the extent of the removal and relocation efforts was far greater than anticipated based on the estimations in the EIA.*

[1] http://www.porttechnology.org/technical_papers/jamaican_cruise_ship_terminal_respects_environment/
[2] http://www.porttechnology.org/
[3] Pg 2, Evaluation of the Environmental Impact Assessment for the proposed cruise ship terminal at Falmouth

Among the dredging contractor's responsibilities were monitoring water quality, such as turbidity, Total Suspended Sediments (TSS), dissolved oxygen and water temperature; the installation of silt screens around the work area of the dredging vessels; the use of a High Density Polyethylene (HDPE) pipeline to pump excess water from the reclamation area to the disposal area; coral, seagrass and benthic fauna relocation and the installation of reef havens and reef towers. As a compensation measure, 1200 Ecoreef modules were also installed."[4]

Construction phase

The Falmouth Cruise Ship Terminal began construction in 2009. With the assistance of Windsor Research Centre, located about 20 km from Falmouth, JET monitored the work. Numerous problems were observed and reported – destruction of wetlands, siltation, failure to cease dredging work in rough conditions and poorly deployed silt screens. While the work was sometimes stopped for short periods by NEPA, the environmental impacts continued to be evident.

In 2011, JET applied for and received the 2009 and 2010 monitoring reports for the Falmouth Cruise Ship Terminal, using the Access to Information Act. Monitoring was carried out by the EIA sub contractors, TEMN, NEPA, and a new EIA Consultant, CL Environmental. JET presented the results of its review in a document **entitled *Environmental Regulatory Failure: the National Environment and Planning Agency and the Falmouth Cruise Ship Pier***[5]. This document was supplied to NEPA, the Jamaican media and posted on JET's website. There was no response from anyone.

The main environmental mitigation measures for the Falmouth Cruise Ship Terminal were to be:

- Suspension of dredging in rough conditions, use of silt screens
- Relocation of approx. 140,000 healthy corals
- Replanting of 20 hectares of seagrasses to replace those removed
- Replanting of 40 hectares mangroves, to replace those destroyed for the market, parking and a sewage plant

The 2009 and 2010 monitoring reports revealed:

- Dredging commenced before removal of coral and continued in rough conditions
- Silt screens were often poorly deployed and ineffective, failing to function for extended periods
- Sewage from the dredging vessel was dumped in the harbour on at least one occasion
- Dredge spoils were dumped on the reef
- The coral reef replanting was poorly done. "*There appears to be a rush to move and replace items and thus to make a daily quote of numbers of items moved. Little or no regard is being given to their long term chances eventual survival (sic) which is directly impacted by the manner*

[4] http://www.porttechnology.org/technical_papers/jamaican_cruise_ship_terminal_respects_environment/
[5] http://www.jamentrust.org/advocacy-a-law/campaigns/falmouth.html

in which the transplant is carried out and the apparent lack of training or expertise of the crew/individuals involved." TEMN Report No 7, Dec 1-31, 2009

- There were at least two incidences of ship grounding, destroying large areas of coral reef, resulting in NEPA requiring the installation of two different types of artificial reef
- The artificial reef structures were improperly sited and impacted by the high turbidity
- A wastewater pipeline was poorly anchored and shifted, causing extensive damage to benthic resources, including the reef.
- Only phase one of the seagrass replanting was ever done and the plugs were reported as heavily silted.
- All the wetlands were cleared, sewage and dredge spoils were dumped in the area – the monitoring officer did not know if the required restoration plan had even been submitted.

The first ships started arriving at the Terminal in early 2011. JET has now (September 2015) received a copy of the **Final Report of the Environmental Status of the Falmouth Cruise Ship Terminal**, done by CL Environmental for the Port Authority of Jamaica in July 2013, hereafter referred to as the CL Report. Their field work was done in May and June 2013. Following is a review of this report. This review does not consider the cost of the mitigation measures.

Summary

The 2013 CL Report is a summary of field data collected in 2013 on the main environmental elements of the Falmouth Cruise Ship Terminal project. The report offers some data and important status updates on the state of some key environmental variables but the data is insufficient to evaluate the true impacts of the project or the current condition of the marine habitats described. General indications of success, however, are poor.

Water Quality

These data are generally useful and important to include, particularly to assess the impacts of the dredging event. Data were compared to May 2010 data – the reviewers suspect these were pre-dredging data, but it is not clear – and to post dredging data. The sampling sites seem to be reasonable and cover the area adequately, although a site to the west of the terminal area could have been included as the coastal currents would carry water from the terminal and bay to the west.

The one-off sampling does not give sufficient data to draw many conclusions but the data do not give any evidence that the terminal construction has had a significant impact on water quality. Sediment levels in the vicinity of the Cruise Ship Terminal are minimal.

The N and P concentrations, however, are very high despite there being minimal fresh water (salinities are all close to 35) in the bay. The reviewers question these numbers as they seem unreasonably high.

In addition, the explanations offered for the data mostly serve to generate more questions. For example, the turbidity data are explained as follows:

"*Turbidity values varied across stations ranging from 0.5 – 91.6NTU (Figure 13). Highest turbidity value was observed at FPD11 and the lowest value was observed at FPD12. When compared with depth, most stations varied little, however a few stations showed an increase in turbidity with depth. The stations with the elevated values were shallow and the fine silty substrate could be easily disturbed by any movement."*[6]

It is very hard to know whether these are significant differences without pre-dredging data collected over at least one year. That data would show if silt suspension occurs on a regular basis or only happens under bad weather or other conditions. Much more information is needed – time of sampling, weather conditions, activities within the area at time of sampling, but in the main a lot more data collected over an extended time. Snapshot data are only of value if there are considerable historical data AND the conditions at the time of the snapshot are detailed.

Coral Relocation

In a 2009/2010 Project Sheet, Boskalis claimed *"… high total survival rate (for coral replants) of 86% and a small number of colonies showing total colony mortality (4%). Environmental monitoring showed that the mitigating measures implemented during the works were successful and no major impact on the environment was recorded."*[7]

147,947 corals were relocated, the majority being hard corals >10cm.[8]

The CL Report describes challenges in assessing the effect of the Falmouth Cruise Ship Terminal development itself and the coral reef relocation, as there was no baseline data on either the source sites or on the recipient sites. "*The comparison between the baseline data set and the current data set is therefore much generalized*," according the CL report. Control sites at nearby Bush Cay were selected, but this area had already been impacted by a large unfinished hotel development, and the reviewers contend it would not present baseline conditions suitable for comparison. In fact, the 2005 EIA done by Environmental Solutions Ltd. for the Bush Cay/Oyster Bay development described a healthy marine environment: *A total of 112 species were identified including 22 scleractinian corals, 29 algal species, 8 sponge species,15 invertebrate species and 45 fish species (Table 4.7.1 in Appendix)*[9]. (Interestingly enough, these species numbers were identical in every respect to those reported by Mott McDonald/TEMN for the Falmouth site, as reported on the Port Technology website).

The Environmental Solutions Ltd. EIA Bush Cay stated: "*Coral cover at all three transect were relatively high ranging from 32% at Time n Place, 35% at Split Rock and 30% at Bush Cay. Fleshy macroalgal cover*

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[6] Final Report: Environmental Status of the Falmouth Cruise Ship Terminal, Trelawny, Jamaica (Final Report). July 2013. CL Environmental Consultants. Kingston, Jamaica. 99 pgs. p. 21.
[7] http://www.boskalis.com/uploads/media/Jamaica_-_Falmouth.pdf
[8] http://www.boskalis.com/uploads/media/Jamaica_-_Falmouth.pdf
[9] https://www.elaw.org/system/files/OysterBayEIA-Report.pdf Environmental Impact Assessment, Oyster Bay, Falmouth, Trelawny

was low averaging 5-7% at all three sites. The substrate was dominated by bare rock. The incidence of the herbivorous Diadema antillarum was also quite noticeable. Density of individuals averaged between 8 m-2 at Time 'n' Place to 13 m-2 at Bush Cay. Density of coral recruits recorded were also high ranging from 7 m-2 to 10 m-2 (Table 4.6.2)."[10]

Seven years later, the 2013 CL Report on Falmouth described a much degraded marine environment at Bush Cay with mean coral cover of 9.8% and macroalgal dominance of 57.6%.

It would have been extremely helpful to have had a summary paragraph at the beginning of Section 3.2 of the CL Report that provided the scientific rationale for how the control and relocation sites were selected, particularly in the context of the Bush Cay development.

The burden here should be on the researchers to demonstrate that the conditions and pressures were indeed similar between the control and relocation areas, and to show that the impacts, which were expected to be minimal, were in fact minimal when measured. Instead, the report states: "*The control site was assumed to not have been influenced by the dredging and construction activities of the development but this cannot be confirmed."*[11] Without a clear explanation for what the control represents or its actual suitability as a control site for this study, the reader can have very little confidence that it is a meaningful control.

The CL Report concluded that there was **no significant difference in live coral cover between the baseline, control and relocation sites**, although the Mott McDonald/TEMN EIA stated 30% live coral cover was typical of the area before the terminal was constructed. The CL Report, however, described **significant increases in macroalgal cover** at all relocation sites. The CL Report presented many images of relocated coral colonies with various impacts – overturned, diseased, dead. There were few images of thriving coral. The report concluded: "*Coral cover similar to the post development and relocation activities suggests that the survivability of either the relocated colonies or the natural population was low and has not resulted baseline and control areas while also having significantly higher macroalgal coverage. Instead, the relocation areas have similar coral coverage to the baseline and control areas while also having significantly higher macroalgal coverage. The significant increase and dominance of macroalgal (sic) also indicates that the reef community is not in better health and could be declining in health."*[12]

The CL Report outlines the many causes of coral reef decline in general and concludes that "*the deterioration in reef health cannot be attributed directly or solely to the development activities in the area*."[13] It is true that there is no way to understand how well or poorly the coral relocation sites

[10] https://www.elaw.org/system/files/OysterBayEIA-Report.pdf Environmental Impact Assessment, Oyster Bay, Falmouth, Trelawny
[11] Final Report, p. 57.
[12] Final Report, p. 92
[13] Final Report, p. 93

are doing from the CL Report. "*The following plates (Plate 12- Plate 16) are some typical examples of corals in Relocation Site 3, including the giant M. cavernosa colony (Plate 12) and the large A. palmata (Plate 13) colony, both relocated during the project. The M. cavernosa colony appears to be in a similar condition, with limited growth and areas of dieback. The A. palmata colony did not survive. This may be due to the stress of the relocation exercise, the smothering it experienced during dredging activities or the suitability (depth/light and water flow) of the relocation site. It may also be a combination of all of the above. Acropora palmata corals are extremely sensitive and relocation success of such species is highly unpredictable."*[14]

The only information the reader can reliably ascertain is that these relocated coral sites are not thriving, with "*significantly higher*"[15] levels of macroalgae and low levels of coral.

While it is undeniable that coral reefs along the Jamaican north coast are under threat from many different sources, it strains credulity to suggest that the construction of the Falmouth Cruise Ship Terminal was not a major factor in compromising coral reef health in that area.

Coral transplant success rates are often low but it is concerning that for such a large scale project, the transplanting may have been done in areas where coral were not likely to thrive. According to one author: "*There is no point in attempting active restoration unless the area to be restored is under effective management (e.g. within a marine protected area) or not under significant local anthropogenic pressure.*"[16]

It is not clear that the Falmouth sites selected for relocation met these criteria.

As a final comment, the report states: "*The true effects of the project will be seen over a longer time period, including the coral reef community structure (percent coral cover versus the percent macroalgae cover), diversity as well as recruitment. It is advisable to assess the recovery of both relocated species and natural resident coral species by their fecundity, which is their ability and frequency of reproduction. Assessing the area for recruits as well as certain colonies and/ or spawning events would give a better picture of the current and expected functionality of the relocation areas*."[17]

While it is fair to say that the coral relocation will have to be assessed over a longer period of time, it is also true that survival rates of the relocated coral were **4.0%, 14.0%,** and **8.8 %**[18] at relocation sites 1, 2, and 3, respectively, according to the CL Report. **This is evidence of a loss of tens of thousands of corals.** These mortality levels signify an important impact that can be assessed right now, especially in light of any proposed expansion.

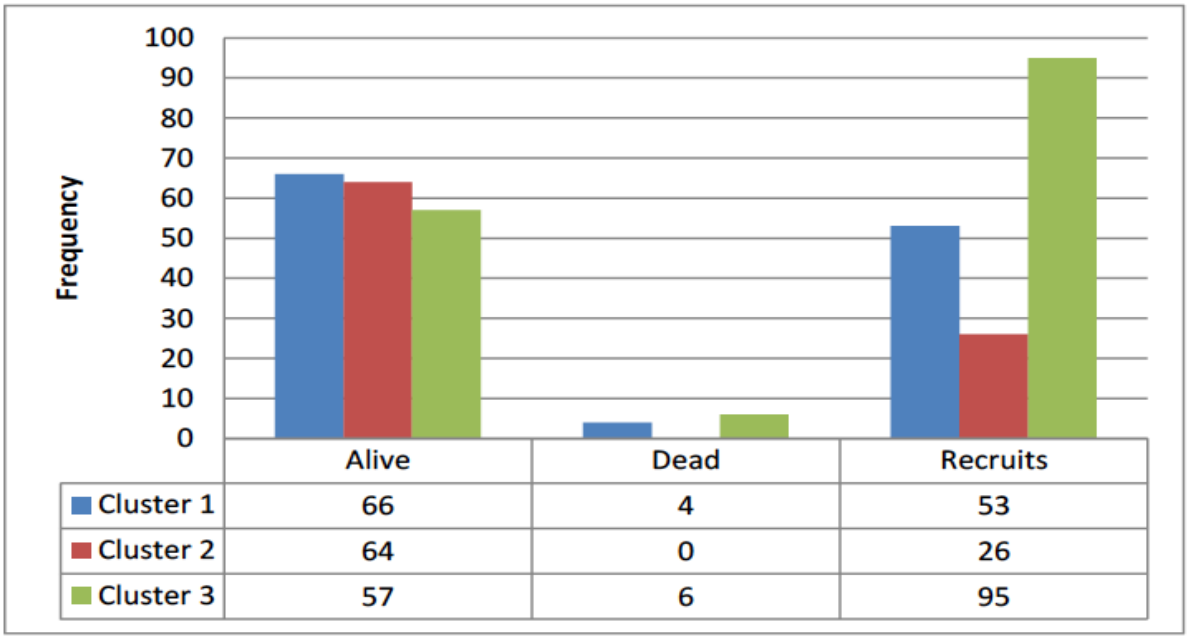
[14] Final Report, p. 41.
[15] Final Report, p. 57.
[16] Edwards, A. J. (ed.). 2010. Reef Rehabilitation Manual. Coral Reef Targeted Research & Capacity Building for Management Program: St Lucia, Australia. ii + 166 pp. p. 10.
[17] Final Report, p. 57.
[18] Final Report, p.33-47

It should also be noted that 1,183 sponges were relocated.[19] Their success rates for relocation were even more dismal, at **1.2%, 0.7%, and 0.4%**, for relocation sites 1, 2, and 3, respectively. Unfortunately, the report does not address this relocation effort, so it is impossible to know why it was unsuccessful. It is clear, however, that these communities, which were to have been saved despite the pier construction, were not preserved by the relocation efforts.

It is difficult not to see the coral relocation as a failure.

Artificial reefs

The use of two different types of artificial reef were required by NEPA, after a ship grounding event – Ecoreef Snowflakes and Reef Pyramids – but there is no information offered regarding the original state of the pyramids, which makes it difficult to interpret Figure 28 from the report:[20]



	Alive	Dead	Recruits
Cluster 1	66	4	53
Cluster 2	64	0	26
Cluster 3	57	6	95

Figure 28 Graph showing summary data for each cluster

The column for "Alive" is fairly meaningless without knowing how many corals were on these clusters and alive initially. The reader has no reference point for interpreting these results. Likewise, the number of recruits is difficult to understand. What sizes are these recruits? What is the likelihood for their survival? The reef pyramids showed some live coral from relocation, as well as the expected microalgae but beyond that very general observation, it is hard to assess the effects of using these pyramids as part of the restoration plan. The snowflakes were completely covered in microalgae and had no suitable cover for corals.

[19] Final Report, p. 27.
[20] Final Report, p. 58.

Pipeline damage

The report states that the damage to the reef done by the pipeline was still evident but gives no indication of the total area affected. *"The substrate is now mainly rubble and is dominated by macro algae. No live coral was seen in this scar footprint."*[21] The CL Report does not mention any mitigation or restoration measures to address the damage.

Seagrass

This section was particularly sparse with regard to information that would help characterize the success of the project impacts and restoration efforts. While there are maps for the water quality sampling stations and for the coral sites, there is no map showing where the seagrass restoration sites are located, although the GPS coordinates for the three sites (5, 7, and 8) are displayed in Table 3. No explanation is given for the odd numbering of these three sites. Are there more sites that were considered and not used, or used and failed? Sites numbered 5, 7, and 8 imply that there were at least 8 sites, yet the final report refers to them simply as "the restoration sites."[22]

There is no mention of the species (One? More than one?) of seagrass used in the restoration effort. While there is some similarity among seagrass species (*e.g.*, basic requirements of light penetration in the water column to photosynthesize), there are significant differences in terms of reproductive strategies, growth patterns, nutrient requirements, tolerance for particular abiotic conditions, and the attendant fish, invertebrate, and epifaunal communities. Ideally, the project proponents would have included more than one species of seagrass in the restoration effort, as diversity is considered an important response variable for restoration monitoring and a potentially significant factor in determining overall success rates.[23]

As is the case for the coral relocation area, there are no data provided to describe the spatial extent of the restoration area. Instead, blade length data are reported in Table 13 and Figures 29 and 30. (N.B. the text of the report incorrectly states that Figure 31 shows average blade lengths but Figure 31 describes fish species data.)

Blade length is not the most critical or even a common response variable to measure in seagrass restoration studies, although it is sometimes included. More widely used and more useful factors include:

- water depth;
- seagrass species;
- abundance;

[21] Final Report, p. 70-71

[22] Final Report, p. 8.

[23] Fonseca, M. S., W. J. Kenworthy, & G. W. Thayer. 1998. Guidelines for the Conservation and Restoration of Seagrasses in the United States and Adjacent Waters. NOAA Coastal Ocean Program Decision Analysis Series No. 12. NOAA Coastal Ocean Office, Silver Spring, MD. 222 pp.

- total percentage cover;
- attendant fish and invertebrate communities;
- epiphyte density;
- sediment type and characteristics;
- shoot density;
- canopy height;
- aboveground biomass, and
- belowground biomass.[24,25]

The report should have included more of these response variables.

Finally, the explanation given in the CL Report concludes with the vague statement, "Most of the replanted seagrass plugs are still in place and are in fair condition."[26] What is "most"? What is "fair condition"? This discussion of the survey data is not sufficient to enable readers to understand the status of these sites or to evaluate whether the seagrass replanting was successful or not.

Dinoflagellate counts

The bioluminescent lagoon at Oyster Bay in Falmouth is a natural phenomenon caused by tiny organisms called dinoflagellates (*Pyrodinium bahamense).* The 2013 monitoring found abundance values ranged from 30 cells per litre to 59,080 cells per litre. Concentrations usually exceed 100,000 cells per litre[27], so this is a significant reduction. Low abundance has been observed in the past associated with siltation, mangrove clearing and dry periods. No conclusion is drawn by the CL Report as to the cause of the much lower abundance of *P.bahamense.*

Fish survey

The data are presented in such a way that deep analysis or meaningful comparisons are difficult to make. It would have been better to present the dominant species across all sites, or species selected for some other reason other than dominance (*e.g.*, their role in the food web, or role as indicator species in other studies of Jamaican reefs), across the control and relocation sites. Also, some interpretation of the size data would have been extremely helpful.

[24] Florida Seagrass Integrated Mapping and Monitoring Program. 2011. Summary Report for Rookery Bay National Estuarine Research Reserve. SIMM Report #1. Yarbro and Carlson, Eds. p. 145-149. p. 148.
[25] Bell, S. S., A. Tewfik, M. O. Hall, & M. S. Fonseca. 2008. Evaluation of Seagrass Planting and Monitoring Techniques: Implications for Assessing Restoration Success and Habitat Equivalency. Restoration Ecology 16(3): 407–416. p. 413.
[26] Final Report, p. 76.
[27] Final Report, p.92, no other reference presented

Mangrove replanting

The CL Report did not mention mangrove replanting. A large area of mangroves was cleared, dumped with dredge spoils, allegedly for a new market and parking, and remains in that state. A narrow strip of replanted mangroves all died.

Photo: Windsor Research Centre 23 August 2015

Discussion

The summarizing statements offered at the end of the CL Report clarify that the restoration efforts have not met expectations: "*The relocation of the coral colonies should have acted as restoration or enhancement tool for the remaining reef area. Coral cover similar to the post development and relocation activities, suggests that the survivability of either the relocated colonies or the natural population was low and has not resulted in an increase in coral and/or community health. Instead, the relocation areas have similar coral coverage to the baseline and control areas while also having significantly higher macroalgal coverage. The significant increase and dominance of macroalgal also indicates that the reef community is not in better health, and could be declining in health. The reef could be experiencing additional stresses from activities in the areas such as; the regular passage of large ships causing excess sedimentation and/or exposure to harmful and toxic oils/substances…"*[28]

The CL Report presents no discussion section so the results as described do not include any analysis of project objectives, whether or not these were realistic, or whether there are lessons learned for other similar projects. This is particularly important in the context of possible expansion to the Falmouth Cruise Ship Pier or similar mitigation measures being considered in other parts of the Caribbean. The comment in the CL Report that the "*long term effects of the project will be seen over a longer time scale*"[29] is fair but does not override the fact that some

[28] Final Report, pp. 92-93.
[29] Final Report, p. 93.

measurement of success surely can be made after three years, and the results so far are unimpressive. If it is truly too soon to be assessing the impacts of the terminal and the effectiveness of the mitigation measures, then at best, despite the expending of large sums of money both on implementation of mitigation measures and monitoring, no conclusions can be drawn about the effect of the Falmouth Cruise Ship Pier on the marine environment at Falmouth.

Nearly all of the discussion in the CL Report seem to be generalizations from limited data. Why was more data not collected? Why has NEPA not required that the Port Authority of Jamaica or Royal Caribbean Cruise Lines monitor the impact of their development after completion so as to require mitigating measures, if required? It will always be very hard to assess the impacts of developments such as this one unless pre and post data are available. It should be required that pre-development data over at least 12 months are collected, a baseline site near to and similar to the development site be monitored over the same time frame. Monitoring should continue through the development and from then on a regular basis. The cost of ongoing monitoring is tiny compared to the operating costs of these developments. Industrial companies are required to monitor waste streams – why not companies that build ship terminals and hotels etc.?

The reviewers also question the Report's conclusion that "*coral cover appears to be similar in the baseline sites, the control and relocation sites*"[30] The Mott McDonald EIA reports baseline coral cover in proximity to Falmouth of approx. 30% prior to the construction of the Falmouth Cruise Ship Terminal. Using this measure, the coral relocation exercise failed to achieve baseline conditions three years after relocation. The reviewers do not believe the success of the seagrass replanting can be assessed from the data presented and there is no information at all about the mangrove replanting.

29th September, 2015

[30] Final Report, p. 92