



November 4, 2008

Director of Public Works
Ministry of Works & Transportation
John F. Kennedy Drive
P. O. Box N-8156
Nassau, Bahamas

Attention: Mr. Robert Garraway

Dear Sir:

**Re: Nassau Harbour Port Improvement Project
Revised Turbidity Monitoring Plan**

Further to our letter of October 25, 2008, we are sending attached, a revised Turbidity Monitoring Report prepared by Elko Coastal Consultants, dated November 4, 2008. As noted previously, Elko Coastal are consultants from Madeira Beach, Florida who have extensive experience with dredging projects in Florida and the Florida standards applied to these projects, particularly requirements associated with acceptable turbidity levels.

This Turbidity Monitoring Report has been modified to take into account some very recent changes by the Florida Environmental Protection Agency with respect to mixing zones, increasing the allowable size of the down drift mixing zone distance from 150 to 1,000 metres.

A copy of this revised Turbidity Report is being forwarded to Blue Engineering who will revise their draft Environmental Impact Assessment Report to suit the contents of this recently revised report.

It would be appreciated if the revised Elko Coastal Consultant's November 3, 2008 Report could be forwarded to all agencies involved in reviewing the Draft EIA Report on the understanding that it be considered as an addendum to the EIA Report.

Yours very truly,

Cox & SHAL Consultants

A handwritten signature in black ink, appearing to read "Tom Hluchan".

T. H. Hluchan, P. Eng.
Consulting Engineer

Cc George Cox; Adrian Rollins; Michelle Lakin

November 3, 2008

Tom Hluchan
SHAL Consulting Engineers
20 Packham Circle
Brampton, ON

**RE: Nassau Harbor Port Improvement Project
Turbidity Monitoring Plan - FINAL**

Dear Tom:

This letter outlines the requested turbidity monitoring plan for the above referenced project.

1. Turbidity Monitoring

Monitoring of turbidity levels shall be conducted throughout project construction at the dredge and disposal sites as described below. The goal of this turbidity plan is to avoid elevated turbidity offshore of the harbor and to limit turbidity within the harbor and surrounding inshore waters while controlling project costs.

Section 62-4.244 of the Florida Statutes defines a mixing zone as a limited, defined region adjacent to a dredge or point of discharge in which water quality may be temporarily degraded. The Florida Department of Environmental Protection (FDEP) grants a variance to this statute for all dredging projects in tidal waters. The variance increases the allowable size of the mixing zone from 150 m to 1,000 m (3,000 ft). In fact, the FDEP is presently pursuing a rule change to codify this departmental policy. For this project, two 3,000-foot-long mixing zones, in the vicinity of the dredge and the discharge point, have been defined (Figure 1). Mixing zones shift from one side of the operation to the other, depending on the current direction. The mixing zones also extend 1,000-ft offshore. This follows similar Florida projects, such as the Miami River dredging, for which the quality of the adjacent natural resources is fair (as defined Nassau Harbor EIA, pg. 4).

a. Dredge Mixing Zone

Sample locations:

Background: At least 2,000 feet upcurrent from the dredge, clearly outside the influence of any artificially generated turbidity.

Compliance: Two compliance stations have been established for the dredge mixing zone. The samples should be taken within the densest portion of any visible turbidity plume. Examples of the limits of the dredge mixing zone, as it moves with the location of the dredge, are illustrated in red on Figure 1.

- 1) No more than 1,000 feet offshore from the mouth of the deep-water entrance to the harbor. Compliance station 1 shall be stationary at this location while dredging is ongoing within the harbor. When dredging proceeds offshore, Compliance station 1 shall continuously move with the dredging to always be 1,000 feet offshore from the dredge.
- 2) No more than 3,000 feet downcurrent from the dredge. Compliance station 2 continuously moves with the dredging.

Depth of sampling: Three (3) feet from the surface at each station.

Frequency: Every six daytime hours during initial operations (no more than 10 days)
Once per day thereafter

b. Disposal Mixing Zone

Sample locations:

Background: At least 2,000 feet upcurrent from the point where discharge water is returning, clearly outside the influence of any artificially generated turbidity.

Compliance: Two compliance stations have also been established for the disposal area mixing zone. The samples should be taken within the densest portion of any visible turbidity plume. The disposal area mixing zone moves when the location of the discharge water return is relocated; however, only one example of the limits of the disposal area mixing zone is illustrated on Figure 1.

- 3) No more than 1,000 feet offshore from the mouth of the inlet between Silver Cay and Long Cay. Compliance station 3 remains stationary throughout the project.
- 4) No more than 3,000 feet downcurrent from the point where discharge water is returning, within the densest portion of any visible turbidity plume. Compliance station 4 moves when the outfall location changes.

Frequency: Every six daytime hours during initial operations (no more than 10 days)
Once per day thereafter

c. Exceedance of established limits

The four (4) compliance locations given above shall be considered the limits of the temporary mixing zone for turbidity allowed during construction. The plan applies the Florida Class III Waters standard of **29 NTU** above existing background concentration. Class III waters are designated for “recreation, propagation and maintenance of healthy, well-balanced population of fish and wildlife” by Section 62-302.400 Florida Statutes. Existing background turbidity is XXX (as determined during cruise ship movements). The pre-determined limit of turbidity levels at the compliance stations shall be $XXX + 29 = YYY$ NTUs.

However, if background measurements exceed the pre-determined limit of YYY NTUs, the background measurement shall be used for comparison of compliance measurements. In other words, compliance measurements shall be compared with the daily background measurement or the pre-determined limit of YYY NTUs, whichever is higher.

If monitoring reveals turbidity levels at the compliance sites in excess of the limit of YYY NTUs or the background measurements, whichever is higher, **construction activities shall cease immediately** and not resume until corrective measures have been taken and turbidity has returned to an acceptable level. Any such occurrence shall also be immediately reported to the Project Manager.

d. Monitoring Submittals

Daily monitoring reports will include the following information for each sample: a) time of day; b) antecedent weather conditions; c) tidal stage and direction of flow; and d) wind direction and velocity. Reports shall be compiled daily even when no sampling is conducted. When sampling is not conducted, a brief statement shall be given to explain the rationale, such as “dredge not working” or “no sampling due to high seas”.

Weekly summaries of the daily turbidity monitoring data will be submitted to the Project Manager within one week of analysis with documents containing the following information: 1) dates and times of sampling and analysis; 2) state plane coordinates (X and Y) of the sampling stations and the dredge and discharge locations, and the distance between the sampling stations and the dredge/discharge for each sample to demonstrate compliance with the above required distances; 3) a statement describing the methods used in collection, handling, storage, and analysis of the samples, as well as the authenticity, precision, limits of detection, and accuracy of the data; 4) results of the analysis; and 5) a description of any factors influencing the dredging or disposal operation or the sampling program. The summaries shall be submitted in Excel Spreadsheet (*.xls) format and follow the attached example.

It is rare for Florida specifications to require the dredging contractor procure an independent monitoring agency to conduct the turbidity sampling. Rather, the responsibility and, thus liability, is typically placed upon the contractor. It requires that the dredging contractor self-regulate, which is more efficient and effective than an independent third party. This approach has been very successful in Florida and is recommended for this project.

In addition, it is rare for Florida projects to require the installation of turbidity curtains in areas with currents that exceed 1 ft/sec. Turbidity curtains are not recommended to be required around the dredge or disposal area during this project.

2. Specifications for turbidity measurements

Turbidity monitoring samples shall be taken using a 12 volt DC low velocity sampling pump. The pump shall be thoroughly flushed during each sample taken. Sample shall be placed in a clean collection bottle and placed in a closed container for transport to a controlled location. Each vial shall be clearly marked and labeled. Samples shall then be transferred into the appropriate vial specifically designed for use with the LaMotte 2020 (or similar) turbidity meter. The samples

shall then be analyzed. A degree of accuracy shall be less than $\pm 2\%$. Control depth for extraction of the samples from the water column will be accomplished using a calibrated grade rod indicating water depth at that location.

3. Disposal area – Extension of Arawak Cay

The use of Arawak Cay and a westward extension as proposed in the Specifications is an acceptable disposal area; however, due to the design and location of the disposal area, the potential for elevated turbidity exists at this location. Disposal area management will be a significant cost for the dredging contractor. It is recommended that language similar to the following is added to the specs: “The contractor may need to construct baffle dikes or containment berms to slow the flow within the disposal area in order to maintain water quality at the outflow. Diking and/or stockpiling within the disposal area to create additional space is acceptable. Turbidity curtains may be used within the disposal area.”

4. Public relations concerns - Turbidity

When carbonate material is dredged, the turbidity plume generated is often more harmful aesthetically than environmentally. Paragraph 5.1.4, page 34, of the Draft EIA downplays the significance of the visual element. During previous dredging projects in clear Florida waters, a pro-active public relations campaign has helped to avoid negative publicity and disgruntled user groups. Holding a public meeting with surrounding property owners prior to construction may be useful. The following elements may be discussed with public and private interests who will be affected by the project:

- a. The perception of high turbidity within the harbor mixing zone. The plume will essentially look worse than it actually is.
- b. Inform the property owners of the potential for elevated turbidity and suggest the use of turbidity curtains at beaches along the perimeter of the harbor that will not be covered by the contract. The turbidity plume will be unsightly and will likely have an odor.
- c. The expectation of siltation at the east breakwater. It is assumed that any degradation of resources will be remediated during the subsequent breakwater improvement project.
- d. Relocation or installation of turbidity barriers at the dolphin pen.

Please contact me at (727) 439-4774 with any questions.

Sincerely,
Elko Coastal Consulting, Inc.



Nicole Elko, Ph.D.
President

Attachment



Figure 1. Illustration of disposal and dredge mixing zones. Not to scale. For illustration purposes only.