B. Seawall Assessment Appendix

Katherine Andruchuk, Seth Lizotte

Seawall Assessment Appendix Contents

Communication Records

Communication Record

Date:	***January 20, 2009***
Time:	***4:30 pm – 5:00 pm***

Meeting with:	Professor Gress
Group Members Present:	Seth Lizotte, Katie Andruchek
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Office Visit

Minutes

- Discussed the issues occurring with the seawall at Wood Island. Possible issues include effects of chemical action of seawater constituents on cement hydration products, alkali-aggregate expansion, crystallization pressure of salts within concrete if one face of the structure is subject to wetting and others to drying conditions, frost action in cold climates, corrosion of embedded steel in reinforced members, and physical erosion due to wave action.
- A core of the wall is needed to be cut and polished to determine the exact state of the existing seawall and in turn determine the effective rehabilitation
- Four distinct alternatives were determined, each dependant on the evaluation of the core sample (*please see attached sketches, in additional notes, for clarification):
  - Chip away deteriorated outer concrete, drill and place rebar into existing concrete to tie into newly formed rebar cage, pour new concrete around existing sound concrete, use chipped material for pathway construction.
  - Destroy existing seawall, use material for pathway construction, replace with a cast-in-place, pre-cast, or retaining wall with earthen back-fill seawall.
  - Chip away brittle outer damaged area, spray foam around existing seawall to allow for expansion due to existing chemical decay, form rebar cage around foam, pour new outer shell for seawall.
  - Leave structure as-is.

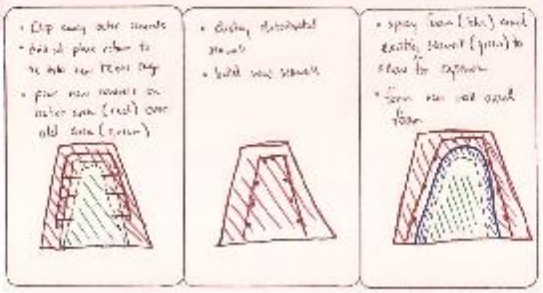
Other Information

Relevant Contact Information:

Name:	Professor David Gress
Email:	David.Gress@unh.edu
Phone:	603. 862. 1410

Additional Notes:

- Need to obtain sample from Krystian and follow-up with Professor Gress to evaluate sample
- Attached sketches for alternatives:



CIE 788 Project Planning and Design Wood Island Life Saving Station

Communication Record

Date:	***January 23, 2009***
Time:	***10:30 am – 11:00 am***

Meeting with:	Professor Gress
Group Members Present:	Seth Lizotte, Katie Andruchuk
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Office Visit

Minutes

- A piece of core from the seawall was shown to Professor Gress and determined that from the looks of it, it was a still a good piece of concrete and might have had help being taken off the wall seeing it's relatively large size
- Discussed using interlocking concrete blocks as a seawall alternative and received company advertisements from a magazine in order to look further into this type of possibility
- The piece of core from the seawall was left with Professor Gress and discussion about getting one of his students to cut the core into three sections in order to polish the pieces of seawall occurred
- Once the core has been cut and polished the three of us will meet in order to closely look at the concrete under a microscope

Other Information

Relevant Contact Information:

Name:	Professor David Gress
Email:	David.Gress@unh.edu
Phone:	603. 862. 1410

Additional Notes:

- Received email from Professor Gress following the meeting to check out WWW.stonestrong.com and www.tensarcorp.com/ss9
- January 27th, was informed by one of Professor Gress' students that the core has been cut and is ready to be polished

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Communication Record

Date:	***February 08, 2009***
Time:	***2:30 pm – 4:00 pm***

Meeting with:	Professor Gress
Group Members Present:	Seth Lizotte, Katie Andruchuk
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Laboratory Testing

Minutes

- Two pieces of seawall were cut and polished by Katie and myself and then examined under a microscope to determine the extent of weathering on the samples.
- It was determined that freeze-thaw cycles have caused cracking in the samples, parallel to the face of the concrete wall; causing cracks in the wall structure. Also, a brownish haze is seen at the face of the samples which indicates carbonation. Dark rings around the aggregate within the sample indicate Alkali-Silica Reaction taking place which is detrimental to the structure long term.
- To determine the extent of ASR within the samples, a sample was fractured to obtain an untouched face and then radioactive uranyl acetate was added. Under Ultraviolet Lighting, the radioactive uranyl acetate would glow a bright green, indicating ASR was present and active. The samples we examined did show signs of ASR, though it was not found to be a rapid condition.
- Alternatives, based on the results of testing, were discussed and it seems that the cheapest and easiest alternative would be to chip of the fractured areas of the seawall, and encase the existing structure with a series of stirrups and then cast at least 4 inches of new concrete onto the surface. Also, the amount of steel needed for the rehabilitation, under the assumption that the seawall is not in everyday use as a protective barrier, would be the minimum as required by the American Concrete Institute guidelines.
- Further research will be done to determine the extent of damages to the samples, and then a design will be provided to economically and effectively rehabilitate the seawall.

Other Information

Relevant Contact Information:

Name:	Professor David Gress
Email:	David.Gress@unh.edu
Phone:	603. 862. 1410

Additional Notes:

CIE 788 Project Planning and Design Wood Island Life Saving Station

Communication Record

Date:	***February 10, 2009***
Time:	***1:30 pm – 1:50 pm***

Meeting with:	Professor Gress
Group Members Present:	Seth Lizotte, Katie Andruchuk
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Phone Conversation

Minutes

- Since laboratory testing is complete and results found, the next step for looking into capping the existing structure would be to develop a mix design for the proposed cap
- Upon talking to Professor Gress, various specifications pertinent to a cap were needed , such as:
  - Greater or equal to 4000 psi strength
  - Less than or equal to 0.4 w/c ratio
  - High quality Type II cement paste (sulfate exposure)
  - ¾" maximum aggregate size or 3/8" maximum aggregate size for a pump mix if needed (ASTM 33 reference and Appendices in EB001 for ASR)
  - High range water reducer if designed slump needed to increase for placement
- It was recommended to look through EB001: Portland Cement Association: Design and Control of Concrete Mixtures, to arrive at further specifications needed to be met for the capping process
- The idea of placing riprap from crushed seawall in a cage as a means for wave energy dissipation was discussed and will deem reason to look into

Other Information

Relevant Contact Information:

Name:	Professor David Gress
Email:	David.Gress@unh.edu
Phone:	603. 862. 1410

Additional Notes:

CIE 788 Project Planning and Design Wood Island Life Saving Station

Communication Record

Date:	***February 19, 2009***
Time:	***5:30 pm – 6:00 pm***

Meeting with:	Redi-Rock ® Representative
Group Members Present:	Seth Lizotte, Katie Andruchuk
Topic of Meeting:	Precast Alternatives for Seawall Rehabilitation
Type of Communication:	Conversation with Redi-Rock ® Representative

Minutes

- Received a product catalog with information pertaining to the various alternatives which we could use
- Representative said due to environmental conditions present at the site, it would be his recommendation that the product used would be the 2400 lb "Big Block."
    - The "Big Block" is 18" high, 46" wide, and 36" deep
    - This would require 3'- 4' of porous fill (gravel and pea stone) behind it to serve as a means for water to not build up behind the wall and pose further freeze-thaw action
- During the conversation, he called an individual out of his office and calculated that for materials alone (delivery and placement of "Big Blocks, "excluding the footings, demolition of the existing wall, and porous backfill), it would cost approximately $210,000 for a 6' tall, 420' wall to be constructed

Other Information

Relevant Contact Information:

Company Name:	Redi-Rock: a Carroll Company
Website:	www.REDIROCK.com
Phone:	603. 863.1000

Additional Notes:

- Due to the cost of the Redi-Rock ® alternative, it was decided to not look into that system further as a means for the seawall rehabilitation of Wood Island.

CIE 788 Project Planning and Design Wood Island Life Saving Station

Communication Record

Date: *March 10, 2009 to present*

Meeting with:	Robert G. Armando, President of Tectonics, Inc.
Group Members Present:	Seth Lizotte
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Email Conversations

Minutes

- The following are excerpts from emails between Robert Armando and myself:

"I surveyed the project using Google Earth Pro and was able to measure the existing wall at 600 LF - if your 420 LF stated plans the exclusion of certain parts of the existing wall, I wouldn't recommend that - the ideal concrete installation would include a poured n place base slab pinned to the rock and a precast superstructure bolted together. All operations can be done using amphibious barges.

I think you have some data on the rock depth and composition in your report - if not, I would need that. Some pictures of the existing facility and the seawall would also be helpful.

Also the new structure could be installed in front of the existing wall - the existing could remain, but be knocked down to below the new back of wall grade saving the cost of demolition and removal of material.

After I review your study, I will send you some drawings and a 3-d model - download Sketchup 7 Free to be able to view my files. I will also do a conceptual cost estimate after I make some calls to suppliers and potential subs in the area for pricing."

"Got your report - the REDI-Rock system will be about $500per LF of wall - figuring a 6 foot height which is 4 layers of Redi-Block This would amount to approximately 1/3 of the final cost.
The demolition, anchored base slab, tie backs and fill in place would be the other 2/3 and the Means and Methods selected will make or break the project.

The cost to do the entire project right with a lasting value would be about $650,000 - if you do the entire 600 foot perimeter area to preserve the integrity of the wall system the cost would be about $900,000. This very preliminary cost estimate is using a poured in place base slab and a precast superstructure.

Cost can be a function of the weather and tidal surges - work would have to be performed at low tide cycles using amphibious barges.

I would carry a 15% contingency to cover possibility of extraordinary weather and the possibility of storm damage he the system while under construction.

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Communication Record

Date:	***March 23, 2009***
Time:	***3:30 – 4:00pm***

Meeting with:	Robert G. Armando, President of Tectonics, Inc.
Group Members Present:	Seth Lizotte
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Phone Conversation

Minutes

- $1500 per linear foot to cast in place footing with tie anchors and bedrock grinding, place precast seawall, and grind existing seawall as backfill material behind new wall
- Footing will consist of an 18" thick concrete slab with the precast wall sitting 8" back from front of slab which will dissipate energy from breaking waves onto wall
- The footing will be placed partially into the existing bedrock and the bedrock will be of a constant elevation with one or two steps for each face (north and south)
- Recommended to do entire 600' length of wall to provide complete protection and will in turn have the seawall last up to 50 year design life
- Weepholes will be cast every 8' along the footing to allow for drainage. Perforated pipe will lie behind the wall and direct water towards the weepholes, with filter-fabric covering it and then covered with backfill of the demoed wall to allow for proper drainage.
- The footing, having been placed into the bedrock, will withstand a great amount of undermining forces, solving the existing problem
- Work can only be done in low tide and done with an amphibious barge
- 1" to 1 ½" tiebolts will be used every 8' and made of high strength coil bolt inserts with steel plates which will tie into buttresses and into slab, which tie into the rebar present in the footing
- Recommended 4000-5000 psi concrete for footing and precast seawall
- Grinder to be used for bedrock and existing seawall for use as backfill material and should be done prior to placement of footing
- Look into mobile-mix concrete trucks on an amphibious barge for footing placement

Other Information

Relevant Contact Information:

Name:	Robert G. Armando
Email:	rga@tectonicsystems.com
Phone:	631-220-1098

Additional Notes:

CIE 788 Project Planning and Design Wood Island Life Saving Station

Communication Record

Date:	*April 23, 2009*
Time:	*12:00 – 12:30pm*

Meeting with:	Robert G. Armando, President of Tectonics, Inc.
Group Members Present:	Seth Lizotte
Topic of Meeting:	Seawall Rehabilitation
Type of Communication:	Phone Conversation

Minutes

Cast in Place Seawall

- Would need a battered seawall
- 36" width at bottom tapering to 12" width at top, 72" height
- Formwork needs to be heavily barricaded to prevent blowout
- Would need C or U shapped tie reinforcing bar
- Foundation in the same fashion and size as the precast alternative
- Batter helps to resist wave force moment
- Cast in place concrete including formwork and reinforcing bar would be approximately $1000 per cubic yard, includes use of water proof cement
- Would need a 40-50 ton amphibious barge to transport 6 ft wide grinder for existing wall and then to transport concrete trucks
- Tie anchors would be grouted into bedrock and stick up at least 18" above foundation
- Would have flexible construction joints every 10-15 ft with water seal
- Epoxy coated reinforcing bar to be used
- 100 +/- year design life

Demolition

- Grinder cost about $3000 per day
- Demolition and grinding would take about 5 work days
- Would leave material on site and in place as gravel since transporting off-site would be very expensive relative to grinder cost
- Mobilization/ Demobilization cost $1000
- Would need to torch off tie backs as they are found to prevent grinder damage
- Could use material for sustainable pathway material

Other Information

Relevant Contact Information:

Name:	Robert G. Armando
Email:	rga@tectonicsystems.com
Phone:	631-220-1098

Additional Notes:

CIE 788 Project Planning and Design Wood Island Life Saving Station