CITY OF HAMILTON

PUBLIC WORKS DEPARTMENT
Hamilton Water Division

TO: Chair and Members Public Works Committee	**WARD(S) AFFECTED:** WARD 2
COMMITTEE DATE: April 8, 2013	
SUBJECT/REPORT NO: Hamilton West Harbour Waterfront Breakwater and Shoreline Municipal Class Environmental Assessment Study Report (PW13024) - (Ward 2)	
SUBMITTED BY: Gerry Davis, CMA General Manager Public Works Department	**PREPARED BY:** Udo Ehrenberg (905) 546-2424, Extension 2499 Chris Gainham (905) 546-2424, Extension 3421 Bhajan Sarker (905) 546-2424, Extension 5109
SIGNATURE:	

RECOMMENDATION

(a) That the General Manager, Public Works, be authorized and directed to file this Class Environmental Assessment Environmental Study Report with the Municipal Clerk for a mandatory minimum thirty (30) day public and all relevant agencies review period in May 2013;

(b) That the General Manager, Public Works, be authorized and directed to proceed with implementation of the Hamilton West Harbour Waterfront Breakwater and Shoreline works, subject to budget approval, at the completion of the Municipal Class Environmental Assessment process.

EXECUTIVE SUMMARY

The City of Hamilton has completed an Environmental Study Report to address shoreline and breakwater improvements in the Hamilton West Harbour. Work on this project began in 2006 as part of the Hamilton West Harbour Waterfront Recreation Master Plan, a follow-up to the Setting Sail planning process. The Hamilton West Harbour Waterfront Recreation Master Plan concluded in April 2010 with a Harbour West Concept to enhance and balance the recreational, ecological and marine functions of the West Harbour.

As part of the development of the Recreation Master Plan, the City initiated the Municipal Class Environmental Assessment (Class EA) process to address any infrastructure required to implement the Harbour West Concept. It was identified that improvements to the breakwater were needed to adequately protect the existing marina and any future expansion, and that improvements to the shoreline were needed to address structural issues and improve public safety, as well as meet flood standards. Breakwater infrastructure has been completed as a Schedule "C" project and shoreline improvements have been completed as a Schedule "B" project, under the Municipal Class EA process.

Shoreline Improvements

Design concepts were prepared for the shoreline on a reach by reach basis to address site specific characteristics. Where possible, improvements to aquatic habitat have been incorporated.

Breakwater Structural Design

Concepts for the breakwater structural design were evaluated. The preferred structural design will be based on the ability of the manufacturing industry to deliver as well as minimum performance specifications that will be set by the City of Hamilton at the time of tendering.

Breakwater Layout Alternatives

Layout alternatives (north-east facing entrance and north-west facing entrance) were evaluated with the north-west alignment being preferred.

Extensive stakeholder consultation was undertaken during the completion of the Municipal Class EA, as detailed in the Relevant Consultation section of this report.

The recommendations contained in this report support the Mission Statement of the Public Works Business Plan "Innovate Now" - "Provide safe, strategic and environmentally conscious services that bring our communities to life".

Alternatives for Consideration - See Page 21

FINANCIAL / STAFFING / LEGAL IMPLICATIONS

Financial:

The cost estimate for breakwater and shoreline improvements is broken down, as follows:

- The cost for the breakwater is expected to be approximately $5.40 million, including engineering, construction contingency, construction/contract administration, and taxes.
- Funding for the breakwater has been approved under the 2012 & 2013 capital budgets for $5.2 million under project ID 5181206222. Funding for engineering and preparation of the performance specifications for the breakwater has been

approved under the 2013 capital budget for $50,000 under project ID 4401356800.

- The shoreline improvements would be constructed in phases likely timed to coincide with changes or improvements to on-shore facilities; the approximate cost of sixteen hundred and ninety two (1692) linear meters of shoreline improvements is $15.90 million including construction contingency, engineering detailed design, construction/contract administration and taxes. An update on coordinated waterfront redevelopment implementation strategy will be presented for Council's consideration in the 2014 Capital Budget Process
- Funding in the amount of $680,000 was approved through 2013 Capital Budget , Project ID 4401356800 to implement the West Harbour Shoreline Rehabilitation and Transfer Docks at Pier 7 (reaches 1.2 & 1.3)

A detailed estimated cost break-down is shown in Appendix "C".

Staffing:

There are currently no staffing changes anticipated as a result of this report.

Legal:

In April 2010, City Council received the Hamilton West Harbour Waterfront Recreation Master Plan. Improvements to the shoreline and breakwater infrastructure are key to the successful implementation of the Master Plan.

Municipal infrastructure requires approval under the Environmental Assessment Act. The Municipal Class Environmental Assessment (October 2000, as amended in 2007 & 2011) provides an approved approach for municipalities to follow when planning infrastructure improvements.

Breakwater infrastructure is considered a Schedule "C" project, and shoreline improvements are considered a Schedule "B" project under the Class EA process. Requirements for Schedule "C" projects include the following four (4) phases:

1. problem identification
2. review alternative solutions
3. provide alternative design concepts for preferred solutions
4. provide a detailed environmental study report - **(We are here)**

The filing of the Environmental Study Report will take place at the completion of the Class EA process where the mandatory minimum thirty (30) day review by the public and all relevant agencies, will take place, and the right of the public to appeal the entire process.

The Environmental Study Report will be valid for the following ten (10) years, according to the current Municipal Engineers Association Municipal Class Environmental Assessment document (October 2000, as amended in 2007 & 2011).

HISTORICAL BACKGROUND

The Hamilton West Harbour study area stretches from Bayfront Park, in the west, to Pier 7, in the east (see Appendix "A"). The area has changed significantly over the years, with much of the industry that inhabited the waterfront now gone. While the Hamilton West Harbour has been an area cherished by the North End Neighbourhood and the boating community for a long time, it is only since the establishment of Bayfront Park (1993), Pier 4 Park (1992-1993) and the Waterfront Trail (2000) and subsequent trail existing between Piers 4 & 8, that this area has become more of a destination for other residents of Hamilton and the surrounding area.

Much of the Hamilton West Harbour area was owned by the Hamilton Port Authority, until 2000, when the Hamilton Port Authority transferred ownership of the bulk of Piers 1, 2, and 5-8 to the City.

Setting Sail

A planning exercise called the West Harbour Secondary Plan, or Setting Sail as it is commonly known, was initiated by the City to respond to the opportunities provided by ownership of the West Harbour lands. The Setting Sail Secondary Plan was approved by City Council in March 2005 and subsequently was approved by the Ontario Municipal Board in December 2012.

Setting Sail establishes a framework for improvement of public lands and private development aimed at enhancing the area as a community and recreational destination. The plan has two (2) primary purposes: to guide detailed planning, zoning, and development decisions and to identify the City's priorities for publicly funded initiatives. Setting Sail is a comprehensive plan for the West Harbour, with an emphasis on three (3) areas where major change is appropriate and desirable. These areas include the Waterfront, the area south of the CN rail yard (called Barton-Tiffany) and the former industrial lands along Ferguson Avenue (referred to as the Ferguson-Wellington Corridor).

***Eight Core Principles* from *Setting Sail*:**

1) Promote a healthy harbour
2) Strengthen existing neighbourhoods
3) Provide safe, continuous public access along the water's edge
4) Create a diverse, balanced and animated waterfront
5) Enhance physical and visual connections
6) Promote a balanced transportation network
7) Celebrate the City's heritage
8) Promote excellence in design

The Setting Sail planning process was guided by eight (8) core principles, which balance the aspirations of the city and local community for the West Harbour and reflect and build on the City's Vision 2020 goals for creating a healthy and sustainable city. These core principles also helped to guide the West Harbour Recreation Master Plan.

A key outcome of the secondary planning process was the recommendation that the City of Hamilton undertake a Waterfront Recreation Master Plan for those lands designated "Marine Recreational", including Bayfront Park and Pier 4 Park.

Hamilton West Harbour Waterfront Recreation Master Plan

The City of Hamilton initiated the Hamilton West Harbour Waterfront Recreation Master Plan in Spring 2006. The focus of this study was to better understand the current and future challenges in the West Harbour waterfront area, from Bayfront Park through Pier 7, and to consider ways to meet these challenges.

A key goal for the Hamilton West Harbour Waterfront Recreation Master Plan was to achieve the appropriate balance between the recreational, marine and ecological functions of the West Harbour area. To do this, the Master Plan addresses marina needs and boating facilities, fish habitat and terrestrial habitat issues, active and passive recreational uses including the waterfront trail, public amenities, services and transportation improvements needed to accommodate waterfront improvements.

Adhering to the eight (8) core principles from Setting Sail, and supporting the vision set out for the waterfront, the following objectives for the Waterfront Recreation Master Plan were outlined in the Setting Sail Secondary Plan:

- Accommodate and facilitate a range of recreational boating facilities
- Maximize public access to the water's edge, balancing the operational needs of marine and boating activities for safe and secure water access
- Minimize the size of paved areas for parking and storage
- Encourage sharing of facilities among boating organizations
- Ensure safety and security for boaters, trail users and park visitors

Discussions between the City and the Hamilton Waterfront Trust continued through 2008, and on January 12th, 2009, City Council endorsed the Waterfront Trust Plan. Through 2009, the City and the Hamilton Waterfront Trust Concept worked together with a team of consultants to finalize the waterfront concept and develop accompanying policies and guidelines for its implementation and development. This work has culminated in the preparation of the Master Plan, which was completed in April 2010. The waterfront concept that is the basis for the work in this Environmental Study Report is shown in Appendix "A".

Other Related Work

In addition to the West Harbour Secondary Plan: Setting Sail and the West Harbour Recreation Master Plan, the City has put significant effort into planning the West Harbour Waterfront. Studies to date have included:

- West Harbour Transportation Master Plan (2005)
- Gartner Lee Phase I (2003) and II (2004) Fisheries Study
- Stantec Environmental Review Hamilton West Harbour Planning Area (2003)

- Malone Given Parsons West Harbour Waterfront Commercial Opportunity Study (2008)
- North End Traffic Management Plan (on-going)

POLICY IMPLICATIONS/LEGISLATED REQUIREMENTS

No policies are affected by the recommendations.

The Project File Report published for the thirty (30) day public and all relevant agencies review period will be fully compliant with the Accessibility for Ontarians with Disabilities Act (AODA).

RELEVANT CONSULTATION

Consultation on the Hamilton West Harbour has been extensive, including events related to Setting Sail, the Hamilton West Harbour Waterfront Recreation Master Plan, and specific to this Hamilton West Harbour Waterfront Breakwater and Shoreline Municipal Class Environmental Assessment.

Consultation Specific to the Shoreline and Breakwater

To provide information for public review and input on the shoreline and breakwater, Public Information Centres (PIC), as well as meetings with stakeholders and agencies, were held. The following provides a summary of the consultation activities.

Stakeholder Meetings

The following stakeholder meetings were held:

- ***Technical Committee Meeting*** - *November 10, 2011*: The purpose of this meeting was to introduce City staff and key team members, ensure everyone had an understanding of the project history, and discuss the project plan and timeline. Key discussion items included: project objectives to fulfil the Class Environmental Assessment process that will result in a design for the shoreline and breakwater; project history and status; and stakeholder and agency consultation.
- ***Agency Meeting*** - *January 24, 2012*: This meeting involved a presentation of the project background, the problems and opportunities, alternative solutions considered and the work to be undertaken on alternative designs. Representatives from the Hamilton Conservation Authority and Department of Fisheries and Oceans were present at this meeting.
- ***Hamilton Waterfront Trust Meeting*** - *February 23, 2012*: This meeting involved a discussion with Waterfront Trust representatives to confirm that shoreline and breakwater works would fit in with the principles and intentions of the waterfront concept.
- ***Stakeholder Meeting*** - *May 24, 2012*: Boat club and marina operators at the waterfront were invited to attend a meeting prior to the Public Information Centre,

to learn about the on-going work on the breakwater and shoreline, and to provide their input, from a waterfront user perspective.

No contentious issues were raised and all questions/concerns were addressed at the time.

Public Information Centre

A Public Information Centre (PIC) was held to introduce and review the shoreline and breakwater study. The following provides information on the event.

June 12, 2012

This Public Information Centre (PIC) was held on Tuesday June 12, 2012 at Bennetto Elementary School from 6:00 to 8:00pm. Display panels were set up around the room to remind attendees of the work completed previously on alternative solutions for the breakwater and shoreline, and to illustrate the current work on alternative design concepts. Specifically, display panels showed the following for review and comment:

- Alternative layouts and types of floating breakwaters being considered
- Evaluation of these alternatives and the preliminary preferred alternative
- Proposed shoreline treatments
- Potential effects and proposed mitigation associated with the proposed shoreline and breakwater improvements

The City provides easy access to project information through its website, http://www.hamilton.ca/CityDepartments/PublicWorks/Environment_Sustainable_Infrastructure/StrategicPlanning/StrategicEnvironmentalPlanningProjects/.

The Public Information Centre (PIC) materials and reports were posted on the City website and a City contact was listed in order for the public to provide comments on the project.

One (1) stakeholder requested completion of a full Environmental Assessment instead of a Municipal Class Environmental Assessment and expressed an intention to request a Part II Order. The comments/concerns and the City's responses are summarized below:

1. ***Comment*** - There are concerns with the walkway at Macassa Bay specifically regarding pedestrian safety and boat security.

   Response - The Master Plan identifies the need for a combination of attractive security gates, security fencing and privacy landscape in this area.

2. **Comment** - There is a recommendation to prefer fixed fill breakwater.

   Response - A floating breakwater provides adequate protection in the wave climate in Hamilton Harbour, provides flexibility for future realignment/adjustment, and is more cost effective.

3. ***Comment*** - A full Environmental Assessment should be carried out because there is some landfilling involved in the modifications.

Response - It is noted that there is a minimal change in the shoreline. This has been discussed with the Hamilton Conservation Authority and the Department of Fisheries and Oceans and no concerns have been raised. The area of infill will be balanced or exceeded with removal of existing docks in the same area.

4. ***Comment*** - Engineering is very much in question as it is based on Computer Modelling.

   Response - Computer Modelling of wave condition is an acceptable method of analysis used by all practicing coastal engineering firms. A number of entrance configurations were developed including an option facing the east quadrant which provides most direct access to the open part of Harbour. It is the purpose of the Class EA to consider and evaluate alternatives.

5. ***Comment*** - A full Environmental Assessment must be done.

   Response - It is appropriate for municipalities to use a Class EA for projects that are identified in one of the Class EA Schedules.

6. ***Concern*** - There are flawed assumptions such as a 900 boat slip marina and dock lengths.

   Response - The Harbour West Concept Plan prepared by the Hamilton Waterfront Trust (January 2009) identified the desire for 750 + boat slips. New Slips would only be constructed based on demand. The configuration of the marina will be confirmed at the time that expansion occurs.

7. ***Concern*** - There are concerns about the effects on fish and wildlife in the area the construction is taking place.

   Response - The Environmental Study Report will address potential effects on the natural environment and proposed mitigation. Several meetings were held with the Hamilton Conservation Authority and Department of Fisheries and Oceans on how to deal with issues associated with water levels, flooding potential, fisheries and wildlife issues in the area. In-water works will be scheduled to mitigate any issues associated with water level, flooding potential, fisheries, and wildlife.

Consultation with the Ward 2 Councillor was undertaken during this Municipal Class EA process.

Previous Consultation for West Hamilton Harbour Waterfront Recreation Master Plan

The following is a summary of the consultation that was undertaken as part of the Master Plan.

Public Information Centres - Four (4) Public Information Centres (PIC) were held on the following dates:

- May 16, 2006

- December 14, 2006
- May 8, 2007
- June 23, 2009

Stakeholder Meetings

The following stakeholder meetings were held:

- ***Technical Team Meetings*** - Meetings were held on the following dates:
    - April 11, 2006 - to initiate the project and discuss background information and issues
    - June 13, 2006 - to present and obtain input on the draft Phase 1 Technical Report
    - August 9, 2006 - to discuss the long term concepts for the waterfront
    - February 21, 2007 - to discuss the preferred concept
    - May 7, 2009 - to review the Waterfront Trust Concept Plan
    - May 25, 2009 - prior to the fourth (4th) Waterfront Advisory Group meeting and fourth (4th) Public Information Centre
    - October 8, 2009 - to discuss the final waterfront concept plan prior to the fifth (5th) and final Waterfront Advisory Group meeting
- ***Waterfront Advisory Group*** - All meetings included a presentation, a question and answer session, and a small group discussion. Meetings were held on the following dates:
    - May 9, 2006
    - November 4, 2006
    - April 4, 2007
    - June 2, 2009
- ***Agency Meetings*** - Meetings were held with agencies as noted below:
    - May 19, 2006 - Department of Fisheries and Oceans and the Hamilton Remedial Action Plan Coordinator
    - February 16, 2007 - Hamilton Conservation Authority
    - January 28, 2008 - Department of Fisheries and Oceans, Hamilton Conservation Authority, Hamilton Remedial Action Plan Coordinator, and Bay Area Restoration Committee
    - July 30, 2009 - Hamilton Conservation Authority and Hamilton Remedial Action Plan Coordinator

ANALYSIS / RATIONALE FOR RECOMMENDATION

Breakwater infrastructure is considered a Schedule “C” project and shoreline improvements are considered a Schedule “B” project under Class Environmental Assessment (as previously noted on page 3-Legal). Requirements for Schedule “C” projects include the following four (4) phases:

1. problem identification
2. review alternative solutions
3. provide alternative design concepts for preferred solutions
4. provide a detailed environmental study report- **(We are here)**

Breakwater Alternative Solutions

Alternative solutions to addressing the wave conditions within the main basin were identified and include:

A "Do Nothing" alternative would continue use of the existing breakwater. The design of a floating breakwater is primarily governed by wave period. Floating breakwater structures become very inefficient when the design wave period is exceeded. Continued use of the existing breakwater would provide adequate wave reduction and protection for the existing mooring basin only up to the design wave period. This design wave period will be exceeded periodically, as it has been in the past. When exceeded, the docks and boats will be potentially subject to damage, as has occurred in the past. In addition, the length of the existing breakwater is not sufficient to allow for future expansion of the marina basin, as envisioned under the Waterfront Concept Plan. Thus, a "Do Nothing" option was not considered further.

Option 1: Repair Existing Breakwater

A review of the previously completed assessments that were carried out by others after significant damage to breakwater and docks in the early 1990s concluded that a replacement of the breakwater rather than a repair was required. Due to the overall physical limitations of the existing structure, it was determined that it cannot be upgraded to provide adequate wave reduction.

Option 2: New Breakwater - Fixed

A new fixed breakwater could be constructed along the outer perimeter of the expanded basin. A fixed breakwater refers to structures that are placed on the lake bottom and are statically stable. The most common type of fixed breakwater on the Great Lakes is a stone structure. Other types of fixed breakwater could include steel sheet pile caisson, crib structures or H Pile with lagging.

Option 3: New Breakwater - Floating

A new floating breakwater can also be constructed along the perimeter of the expanded basin. Preliminary assessment of wave climate at the location and review of commercially available floating breakwaters indicates that suitable floating breakwaters exist. The type of breakwater likely to be utilized is a pontoon type, which are most commonly concrete structures with integrated flotation systems. Pontoon breakwaters can be utilized as walkways or temporary docks. Other types of floating breakwaters can also be designed to provide the required protection.

A floating breakwater can be relocated should future plans for the marina basin size or shape be altered. The most common type of anchoring system for a floating breakwater for water depths in excess of ten metres (10m) is a concrete block connected to the breakwater with chain or cable. The concrete blocks can be readily moved.

A detailed evaluation was completed to compare the advantages and disadvantages of each alternative based on four main evaluation criteria groups:

- Natural environment considerations
- Socio economic and cultural environmental considerations
- Technical considerations
- Relative cost considerations

The preferred solution to addressing the wave conditions within the main basin is a new floating breakwater.

Floating Breakwater Structural Design Concepts

The breakwaters that can function with the local wave environment fall into two (2) basic design types. These design types include an "A" frame design and a concrete pontoon design, although other systems can be also designed for the site conditions:

- ***A-Frame***: Same type as currently used at the site. However, the main components of the breakwater, that is the spacing and size of the floats and the size of the baffle board, would need to be properly sized to function under design conditions.
- ***Concrete Pontoon***: A concrete pontoon breakwater is typically a concrete shell that encloses a foam core. The top of the concrete can be dressed with timber or other products to provide walking surface and fenders can be attached to the sides of the pontoon to accommodate fair weather mooring.

Both types of breakwater would be manufactured off-site and likely floated to the site from a remote location. Both breakwater types have similar anchoring systems consisting of chain connecting it to concrete blocks on the bottom of the Harbour.

The following summarizes the evaluation based on each of the criteria groups.

<u>*Natural Environment*</u> - The anchoring system for both alternatives is similar and there is limited impact to the aquatic environment for either alternative.

Socio-Economic and Cultural Environment - Both design types, i.e. "A" frame or concrete pontoon, are well suited for application at this location. They can be designed to perform well within the wave climate of the site adequately reduce the waves providing protection for the marina as well as an element of flood protection for the shoreline features. Neither alternative will impact cultural heritage.

<u>*Technical*</u> - Both alternatives have a reasonable lifespan up to forty (40) years and are readily available. The only difference between alternatives relates to their ability to provide an opportunity for docking during special events. The concrete pontoon

breakwater can readily provide additional mooring for special events during light wave conditions. It can also potentially provide pedestrian access if appropriate ramps are provided. Public access to the main east breakwater would also require appropriate controls in place to restrict access during times of severe weather. The evaluation process assumes that no public access is being provided.

Cost - Costs are expected to be similar for both options and it is anticipated that the cost would be approximately $5.40 million including, engineering, construction contingency, construction/contract administration and taxes.

Overall, the breakwater types have very similar impacts and both would be appropriate for this location. Since there is no clear preference between the alternatives, it is recommended that the determination of breakwater type be based on the market response to minimum performance specifications set by the City of Hamilton at the time of tender.

Floating Breakwater Layout Alternatives

Two (2) alternative breakwater entrance configurations were developed. These include entrances as follows:

1. Northeast Facing Breakwater Layout (***Figure 1.1***) - this option provides protection to boats entering and exiting from the more frequent but smaller waves from the west.
2. Northwest Facing Breakwater Layout (***Figure 1.2***) - this option provides protection to boats entering and exiting from the less frequent but larger waves from the east.

The configurations were developed to assist in the illustration and assessment of the function and costs of the design concepts of the breakwaters. Each breakwater layout protects a marina basin designed to accommodate up to nine hundred (900) boat slips using a typical boat size of 9m. The breakwater layouts are conceptual only, as the final marina slips design will be undertaken as a separate project.

Both concept designs provide a main entrance fifty (50) metres wide. In addition to this wide entrance, access to the basin can be potentially obtained around the ends of the two (2) main breakwaters.

Figure 1.1: Option 1 - North East Facing Entrance Breakwater Concept

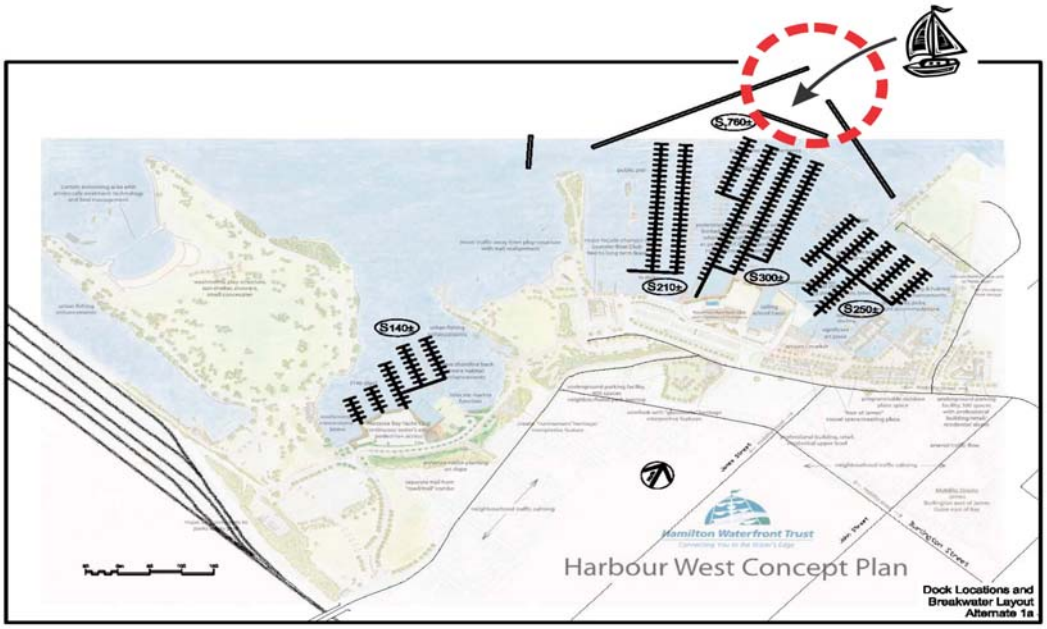
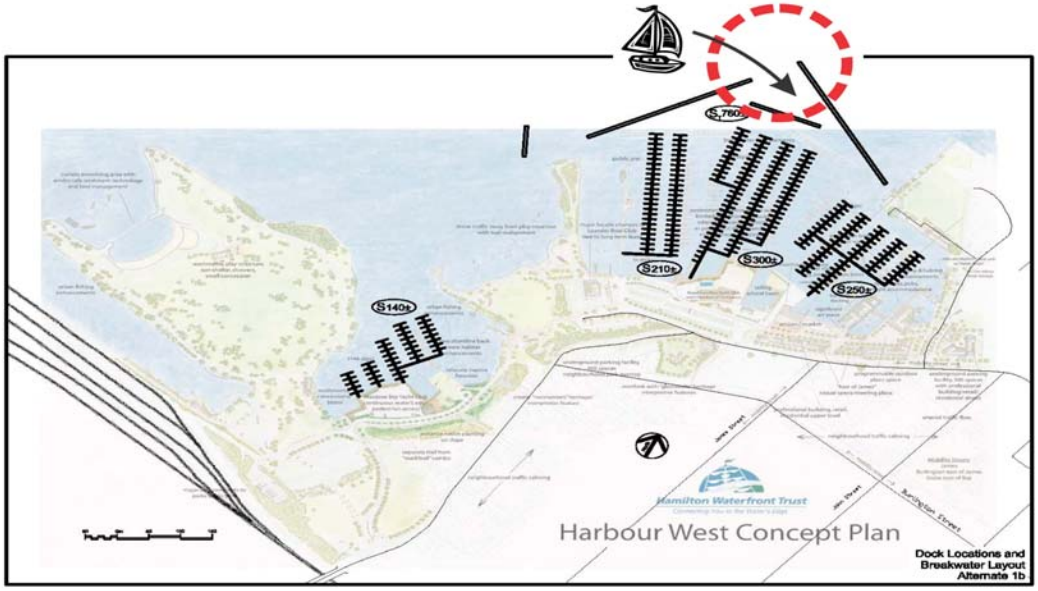


Figure 1.2: Option 2 - North West Facing Entrance Breakwater Concept (Preferred)



Using the evaluation criteria developed early in the project, the alternative breakwater layouts were evaluated. The following summarizes the evaluation based on each of the criteria groups.

Natural Environment - The layout of the breakwater will have no impact on the natural environment.

Socio-Economic and Cultural Environment - Both layouts provide adequate protection for the marina. During the consultation process with stakeholders, the boaters expressed a slight preference for the northwest facing entrance.

Technical - There is no technical difference between the layout alternatives.

Cost - There is no cost difference between the layout alternatives.

Overall the differences between the layout alternatives relate solely to the type and frequency of wave they protect against for boaters entering or leaving the basin. As noted above, during consultation boaters indicated a slight preference for a northwest facing entrance so that there is protection from the less frequent but larger waves coming from the east. Thus, Option 2 (the northwest facing entrance) is preferred.

Shoreline Flood Hazards Alternative Solutions

The following alternative solutions to address potential flood hazards were identified:

Option 1: Raised Shoreline

This option would involve the raising of the shoreline to adequate elevations and reconstruction or upgrading/reinforcement of the shore protection structures to accommodate the raised shoreline. The work would include placement of additional fill to raise lands above the flood level. The shore structures would need to be modified to accommodate the placement of clean fill. The decision on the exact type of action with respect to the shore structure would be governed by a detailed assessment of the structure at the time of design.

Option 2: Construction of Raised Edge along the Shoreline

This option involves raising the edge of the shoreline to prevent wave overtopping. It does not involve the raising or filling of the backshore areas. The work would involve the construction of walls along the edge or near the edge of the shoreline. These wall structures could provide a secondary function such as a seat wall or railing, depending on its height. The height of the wall in each reach would vary depending on the wave exposure and the elevation of existing shoreline edge. The construction of such a seawall on top of a repaired shoreline structure or as part of a reconstructed seawall is technically feasible.

The raised edge could also be constructed as a secondary wall set some distance back of the primary shore protection structure. This would require that the surface between the two (2) walls would need to be constructed of non-erodible material. Depending on the amount of overtopping that would occur, access to part of the site may need to be controlled during extreme storm events.

Option 3: Flood Proofing of the Buildings

This option would involve the wet flood proofing of all existing buildings and dry flood proofing of all new buildings, to ensure that no damage occurs as a result of flooding associated with Lake Ontario. Finish floor elevations of existing buildings are, with the exception of a portion of the Royal Hamilton Yacht Club above the 1: 100 years

instantaneous water level (76m). The flood proofing requirements are therefore limited to modifications of the exterior walls to prevent water from penetrating the wall. The actual level of flooding would depend on the wave uprush on the wall of the building structure, which is dependent on the distance back from the water's edge and the type of surface finish and grade of the land between the building the water's edge. This option may also require entrance doors be located on sides of the buildings away from direct wave attack. This option assumes that the flood proofing requirement of the existing building would be relatively minor and readily achieved.

Option 4: Wave Protection by Breakwater

This option involves the reduction of the wave uprush by constructing offshore breakwaters to reduce wave activity at the shore and therefore reducing the wave uprush. Most of the shoreline is above the 1:100 years instantaneous water level and the flood hazard is associated with wave uprush. Breakwaters can be either fixed or floating.

The use of permanent or fixed breakwater structures for the reduction of wave activity and therefore wave uprush at the shore is considered standard practice. However, the consideration of reduction of hazard due to wave activity behind a movable floating structure, as it relates to shoreline hazard regulations is not common. This option was discussed with staff of the Hamilton Conservation Authority and was found to be a feasible option to consider.

A detailed evaluation matrix was completed showing the advantages and disadvantages for each alternative, based on four (4) main evaluation criteria groups:

1. Natural environment
2. Socio economic and cultural environmental considerations
3. Technical considerations
4. Relative cost considerations

The preferred solution to reduce flood hazard is a comprehensive approach that considers a combination of raised edge along the shoreline, flood proofing of buildings and a breakwater. The option of raising the shoreline (Option 1) was considered to be less preferred overall given its significant impact and relatively high cost.

Shoreline Improvements Design Concepts

The design concepts for the shoreline improvements all maintain the existing alignment and increase the height of the shore to seventy six point three (76.3m) metres (76.5m on James St. Pier). The following points are noted about the areas to be replaced:

- Steel sheet pile structures are being repaired, only if it was determined that steel sheet pile has a remaining design life of fifty (50) years, based on normal rusting rates

- Support Structures for the existing buildings (except the police building) are proposed to be replaced when the buildings are repaired/reconstructed
- Most of the repairs are to areas where there is existing sheet pile along the shore; areas of rock shoreline that are identified for repair or replacement mostly involve raising the shore elevation to seventy six point three (76.3m) metres
- Replacement of structures is being undertaken where existing steel sheet pile walls do not provide fifty (50) year design life or existing gravity structures do not meet normal engineering and public safety requirements

The shoreline has been divided into six (6) reaches in the main basin and one (1) in Macassa Bay as shown in Appendix "B". The following describe the characteristics of each reach along the existing shoreline. In all instances, opportunity for providing fish habitat has been included, where possible. Cross sections of generic examples of the proposed improvements can be found in Appendix "B".

Detailed cross sections area available in the ESR. Following table is a proposed improvement on each sub-reach along the shoreline.

Table: Proposed Improvements along the Shoreline

Basin	Reach	Sub-Reach	Proposed Treatment	Reference To Cross Sections & Generic Examples
Main	1	1.1	No Work is required	
		1.2	Reinforced Concrete Cap	Appendix 'B' See Drawing 1
		1.3	Rip Rap Revetment and Armour Stone Cap	Appendix 'B' See Drawing 5 & Image A
	2	2.1	Installing Pedestrian Bridge	Appendix 'B' See Drawing 2
		2.2,2.3,2.4,2.5	Reinforced Concrete Cap	Appendix 'B' See Drawing 1
	3	3.1,3.2,3.3,3.4,3.5, 3.6 & 3.7	Reinforced Concrete Cap	Appendix 'B' See Drawing 1
	4	4.1,4.3 & 4.5	Reinforced Concrete Cap	Appendix 'B' See Drawing 1
		4.2	Rip Rap Stone	Appendix 'B' See Drawing 5 & Image A
		4.4	Rip Rap Revetment	Appendix 'B' See Drawing 5 &

Basin	Reach	Sub-Reach	Proposed Treatment	Reference To Cross Sections & Generic Examples
				Image B
	5	5.1 A	Anchored Wall with Steel Sheet Pile	Appendix 'B' See Drawing 4
		5.1B,5.2 & 5.3	Boardwalk with Concrete Pier	Appendix 'B' See Drawing 4
	6	6	No Work is required	
In between Main & Macassa Bay	7	7	No work is required	
Macassa Bay	8	8.1 & 8.2	No Improvement is required	
		8.3	Armour Stone	Appendix 'B' See Drawing 3 & Image B
		8.4A	Armour Stone / Cobble	Appendix 'B' See Drawing 3 & Image F
		8.4B & 8.5A	Steel Sheet Pile with Incorporating Aquatic Habitat	Appendix 'B' See Image D
		8.5B	Boardwalk with Concrete Pier & incorporating Aquatic Habitat	Appendix 'B' See Image D

Main Basin

The shoreline of the main basin is divided into six (6) reaches. Reach 1 starts at the northeast part of the main basin and numbering continues in a clockwise direction along the shore of the basin. Each reach was further subdivided into sub-reaches. Descriptions of the proposed design concepts for each sub-reach of the main basin are provided below. Typical Cross-sections of the proposed improvements can be found in Appendix "B".

Reach 1

Reach 1 represents an area in the northeast part of the main basin. The shoreline in the reach is approximately two hundred and fifty five (255m) metres long.

The proposed design concepts for Reach 1 include the following structures for the various sub-reaches:

1.1 Requires no improvements (existing structure was not reviewed but observed to be in good condition)

1.2 Improvements consist of raising the crest elevation of the wall by provision of a reinforced concrete cap

1.3 Improvements consist of placing additional rip rap to produce a more stable and uniform appearance and provision of an armour stone cap to raise the crest elevation of the structure

Reach 2

Reach 2 represents an area in the east part of the basin. The shoreline in the reach is approximately two hundred and twenty one (221m) metres long, not including the timber pier at the north end of the reach. The shore includes a semi-enclosed area fronting the present police marine unit dock/building. It also includes the north end of the shore along the east side of the James Street basin.

The proposed design concepts for Reach 2 include the following structure improvements for the various sub-reaches:

2.1 Removing the existing timber pier above elevation seventy two point two (72.2m) metres and installing a pedestrian bridge

2.2 Installing a steel sheet pile wall in front of the existing timber pile wall and removing the timber piles above the waterline

2.3 Provision of a reinforced concrete cap to raise the crest elevation of the wall

2.4 Replacing the existing structures when the existing police marine unit boathouse is relocated (maintenance of the existing function is likely to require a steel sheet pile wall)

2.5 Installing a concrete capped steel sheet pile wall in front of the existing timber pile wall and removing the timber pile above the water line

Reach 3

Reach 3 includes the south east part of the main basin. The shoreline in the reach is approximately four hundred and eighty five (485m) metres long.

The proposed design concepts for Reach 3 include the following structure improvements for the various sub- reaches:

3.1 Installing a concrete capped steel sheet pile wall in front of the existing wall and removing the existing wall above the water line. The new wall would have a higher crest elevation.

3.2 Installing a concrete capped steel sheet pile wall in front of the existing structures and removing the existing structures above the water line.

3.3 Installing a concrete capped steel sheet pile wall in front of the existing wall and removing the existing wall above the water line.

3.4 Installing a concrete capped steel sheet pile wall in front of the existing wall and removing the existing wall above the water line.

3.5 Replacing the existing structures when the existing haul out structure is replaced. Maintenance of the existing function is likely to require a steel sheet pile wall.

3.6 Replacing the existing structures when the building is replaced. Maintenance of the existing function is likely to require a steel sheet pile wall.

3.7 Installing a concrete capped steel sheet pile wall in front of the existing wall and removing the existing wall above the water line.

Reach 4

Reach 4 includes shores on all sides of a small basin on the east side of the Royal Hamilton Yacht Club. The shoreline in the reach is approximately two hundred and thirty (230m) metres long.

The proposed design concepts for Reach 4 include the following structure improvements for the various sub- reaches:

4.1 Installing a concrete capped steel sheet pile wall in front of the existing wall and removing the existing wall above the waterline.

4.2 Raising the crest elevation of the revetment by placing additional rip rap stone.

4.3 Raising the crest elevation of the concrete wall and grading to maintain the launch ramp function.

4.4 Replacement of the existing structures. Maintenance of the existing function is likely to require a rip rap revetment with a deck supported on piles or a steel sheet pile wall.

4.5 Replacement of the timber wall with a concrete capped steel sheet pile wall. No aquatic habitat improvements are proposed along the base of this wall to accommodate intense boating use in the area.

Reach 5

Reach 5 includes shore along the south and west shores of the headland fronting the Royal Hamilton Yacht Club building and boat storage area. The shoreline in the reach is approximately one hundred and fifty six (156m) metres long.

The proposed design concepts for Reach 5 include the following structure improvements for the various sub-reaches:

5.1 Improvements considered for two (2) potential structures. Alternative designs include steel sheet pile wall and a steel sheet pile seawall with boardwalk supported on piles. Both systems will include aquatic habitat improvements along the seawall. The seawall and boardwalk section would be used where

insufficient space exists on land to accommodate existing land uses and provide public access the waterfront.

5.2 Steel sheet pile seawall with a boardwall supported on piles. This system is required to provide public access in the confined area between the pool and the shore. Aquatic habitat features and improvements, such as boulders and other structural habitat, will be incorporated along the toe of the seawall under the boardwalk.

5.3 Same as 5.2

Reach 6

The shoreline in Reach 6 was reconstructed as part of site redevelopment by the City and no work is required.

Reach 7

Reach 7 represents an area in between Main Basin & Macassa Bay. The shoreline in Reach 7 was reconstructed as part of site redevelopment by the City and no work is required.

*Reach 8 (*Macassa Bay)

Reach 8 represents the area in the west part of the harbour that is presently used by Macassa Bay Yacht Club, MacDonald Marine Services and the Hamilton Bay Sailing Club. It includes approximately six hundred and thirty (630m) metres of shoreline.

The proposed design concepts include the following structures for the various sub-reaches:

8.1 Requires no improvements

8.2 Requires no improvements

8.3 Improvements include raising the crest of the existing armour stone wall by one (1) stone, to an elevation of approximately seventy-six point three (76.3m) metres. This is the only alternative design concept proposed for this sub-reach. It is the most economical, functional and environmentally appropriate correction of a deficiency related to flood level only.

8.4 Improvements include a combination of two (2) typical structures. The first structure consists of an armour stone seawall similar to that used in sub-reach 8.2 and proposed improved seawall in sub-reach 8.3. The second structure includes a gently sloping shore (slopes at 4h:1v to 6h:1v) covered with randomly placed boulders, cobbles, cobble and soil mixture. The shore is to be planted with various plant materials, both below and above water. The types of structures used will create an undulating shore that will enhance aquatic habitat.

8.5 Improvements will include a steel sheet pile wall and a steel sheet pile seawall with boardwalk supported on piles. Both systems will include aquatic habitat improvements along the seawall.

ALTERNATIVES FOR CONSIDERATION

There is one (1) alternative for Council to consider with respect to the recommendations of this Report:

- To not file the Hamilton West Harbour Waterfront Breakwater and Shoreline Class Environmental Assessment Environmental Study Report with the City Clerk for a minimum thirty (30) day public review period and, as a consequence, not proceed with implementation.

Should Council choose not to approve the filing of the Class Environmental Assessment Environmental Study Report, the Municipal Class Environmental Assessment process will be considered by the provincial government as incomplete and the City will not have approval under provincial environmental legislation to construct a new breakwater and proceed with shoreline improvements. The outcome would be equivalent to the "Do Nothing" alternatives, and to not fulfil the recommendations from the Hamilton West Harbour Waterfront Recreation Master plan which was presented to and received by Council in 2009. Eventually the City would have to repeat the Environmental Assessment process. The alternative of not filing the Class Environmental Assessment Environmental Study Report is not recommended.

ALIGNMENT TO THE 2012 - 2015 STRATEGIC PLAN

This staff report supports the City of Hamilton 2012-2015 Strategic Plan in the following ways:

- **Strategic Priority #1.3. (v)** - Completion of the Waterfront Master Recreational Official Plan Amendment, the implementation of the Zoning By-law and financing strategy. The West Harbour Waterfront Master Plan includes a number of infrastructure development initiatives (shoreline reconstruction and rehabilitation, installation of a new breakwater). The completion of the Class Environmental Assessment Environmental Study Report will satisfy the West Harbour Waterfront Master Plan recommendations.
- **Strategic Priority #1.3. (ix)** - Initiate development in the West Harbourfront and Waterfront. The West Harbour Waterfront Master Plan includes a number of infrastructure development initiatives (shoreline reconstruction and rehabilitation, installation of a new breakwater). The completion of the Class Environmental Assessment Environmental Study Report will start this process.

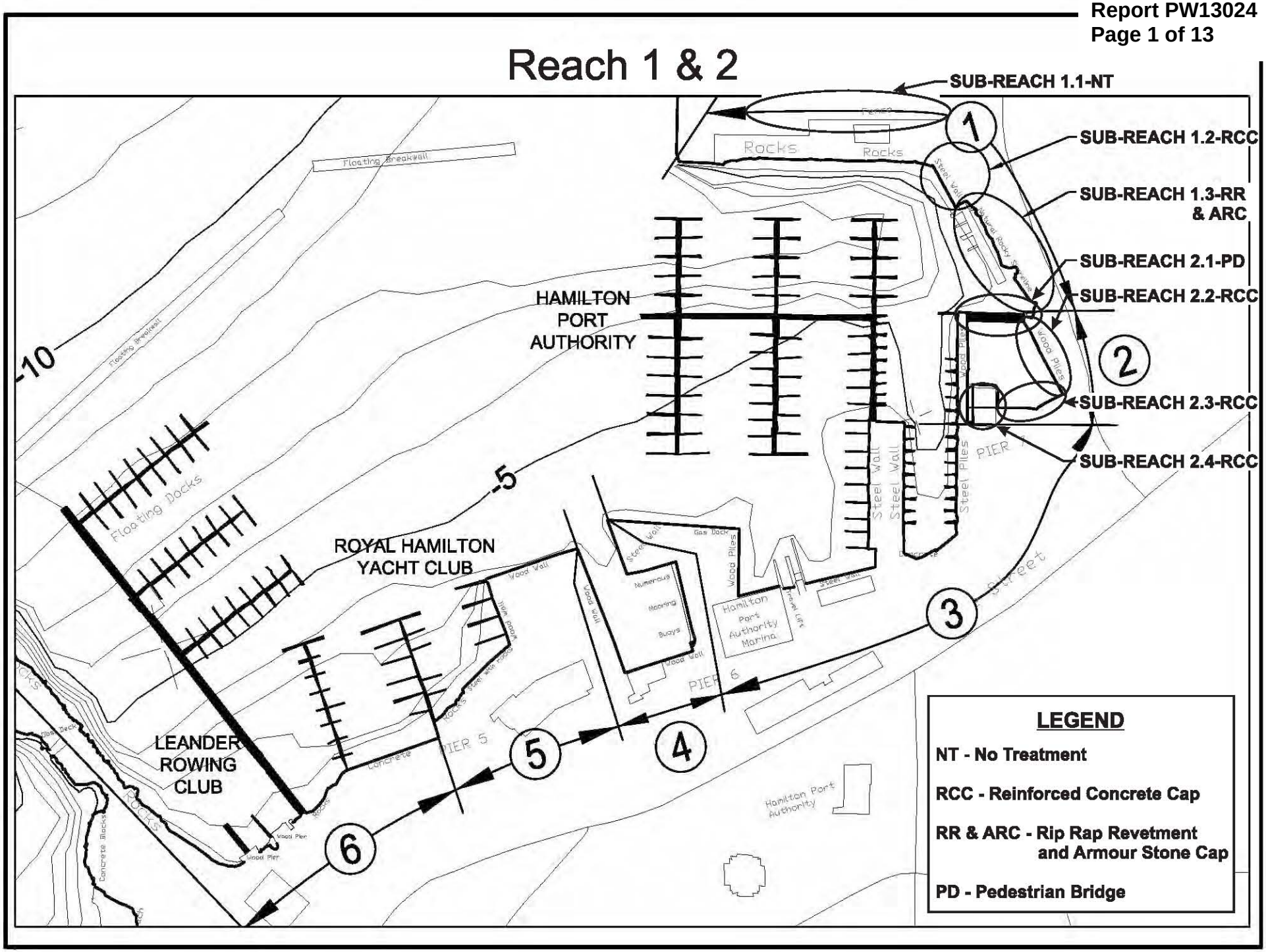
APPENDICES / SCHEDULES

Appendix "A"	Hamilton West Harbour Concept Plan
Appendix "B"	Shoreline Cross Sections with Generic Images
Appendix "C"	Harbour West Harbour Concept Plan with a detailed estimated cost break-down

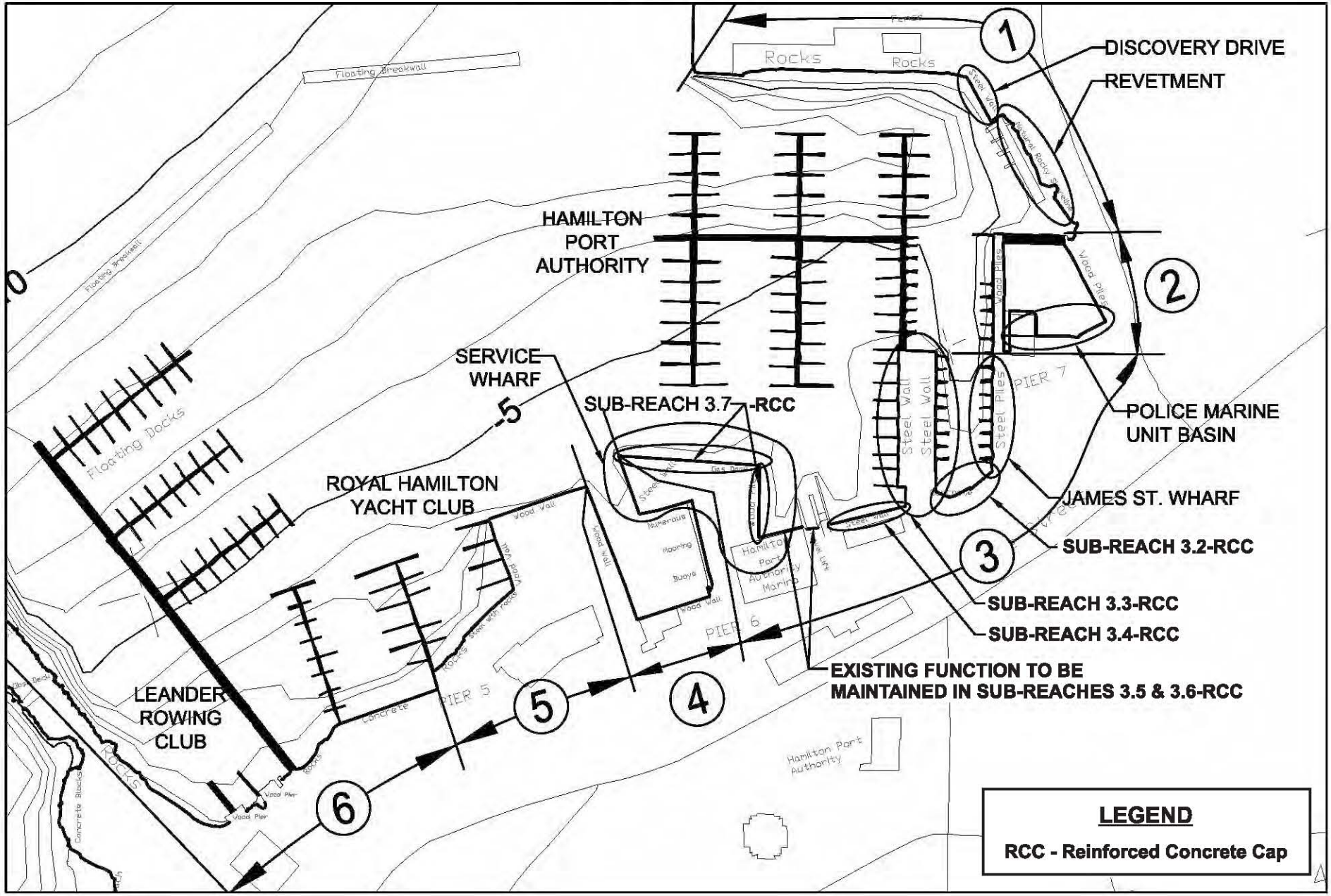
Appendix A
Report PW13024

Hamilton West Harbour Concept Plan

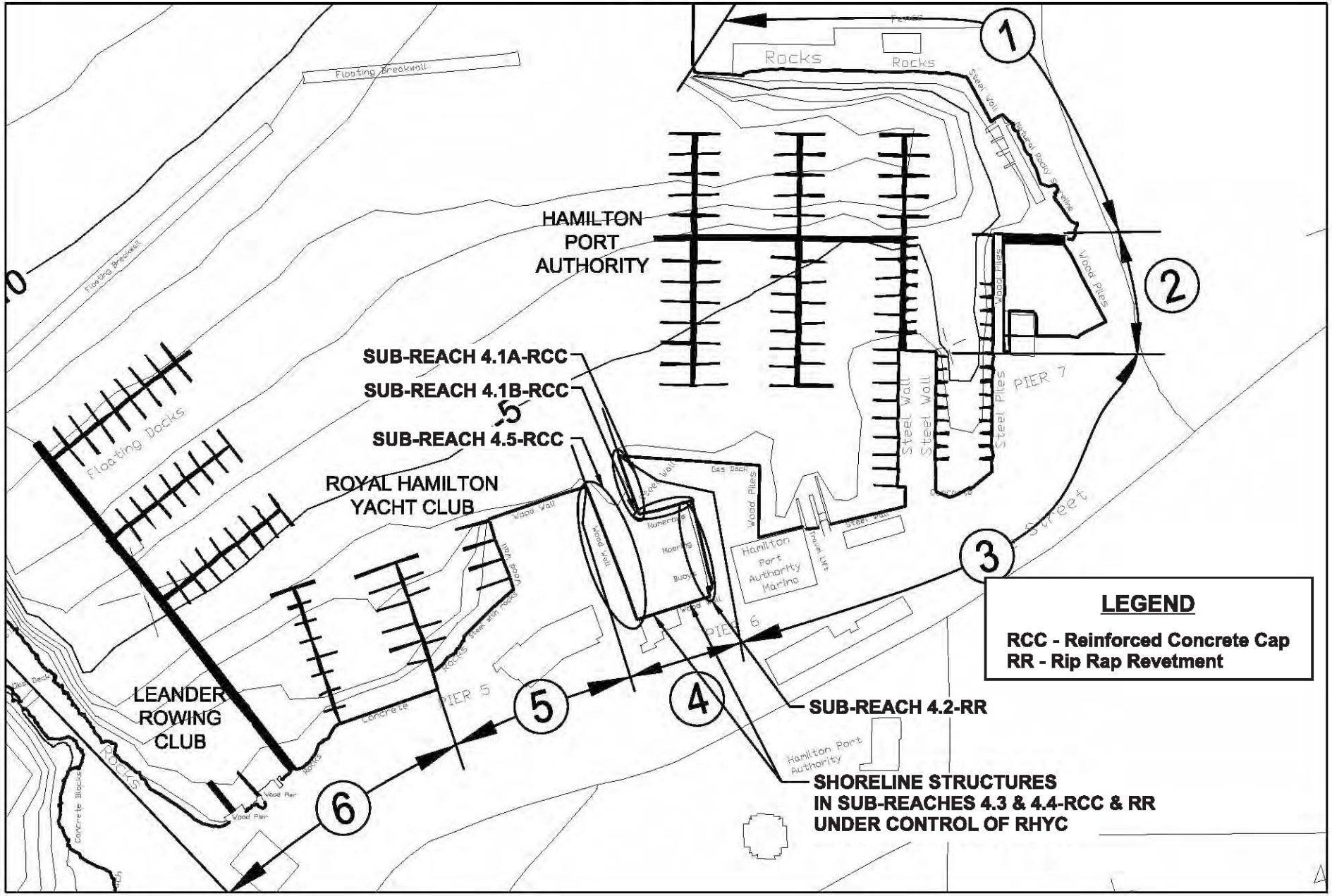
Reach 1 & 2


SUB-REACH 1.1-NT
SUB-REACH 1.2-RCC
SUB-REACH 1.3-RR & ARC
SUB-REACH 2.1-PD
SUB-REACH 2.2-RCC
SUB-REACH 2.3-RCC
SUB-REACH 2.4-RCC
HAMILTON PORT AUTHORITY
ROYAL HAMILTON YACHT CLUB
LEANDER ROWING CLUB
Floating Breakwall
Floating Docks
Rocks
Steel Wall
Wood Piles
Steel Piles
PIER 5
PIER 6
Hamilton Port Authority Marina
Hamilton Port Authority
Concrete Blocks
Wood Pier
-10
-5
1
2
3
4
5
6
LEGEND
NT - No Treatment
RCC - Reinforced Concrete Cap
RR & ARC - Rip Rap Revetment and Armour Stone Cap
PD - Pedestrian Bridge

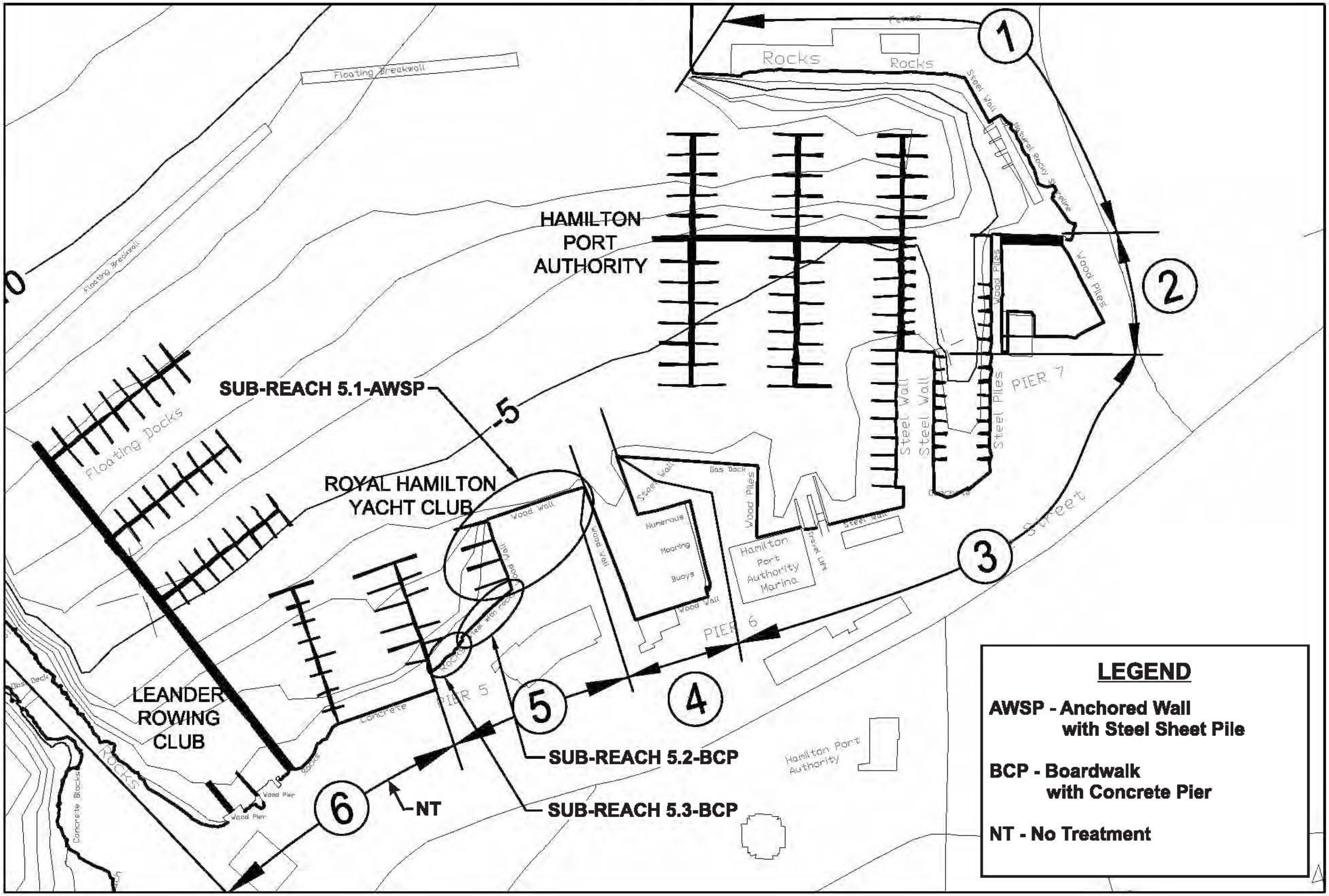
Reach 3


1
DISCOVERY DRIVE
REVETMENT
HAMILTON PORT AUTHORITY
2
SERVICE WHARF
SUB-REACH 3.7-RCC
POLICE MARINE UNIT BASIN
ROYAL HAMILTON YACHT CLUB
JAMES ST. WHARF
3
SUB-REACH 3.2-RCC
SUB-REACH 3.3-RCC
SUB-REACH 3.4-RCC
EXISTING FUNCTION TO BE MAINTAINED IN SUB-REACHES 3.5 & 3.6-RCC
LEANDER ROWING CLUB
5
4
6
LEGEND
RCC - Reinforced Concrete Cap

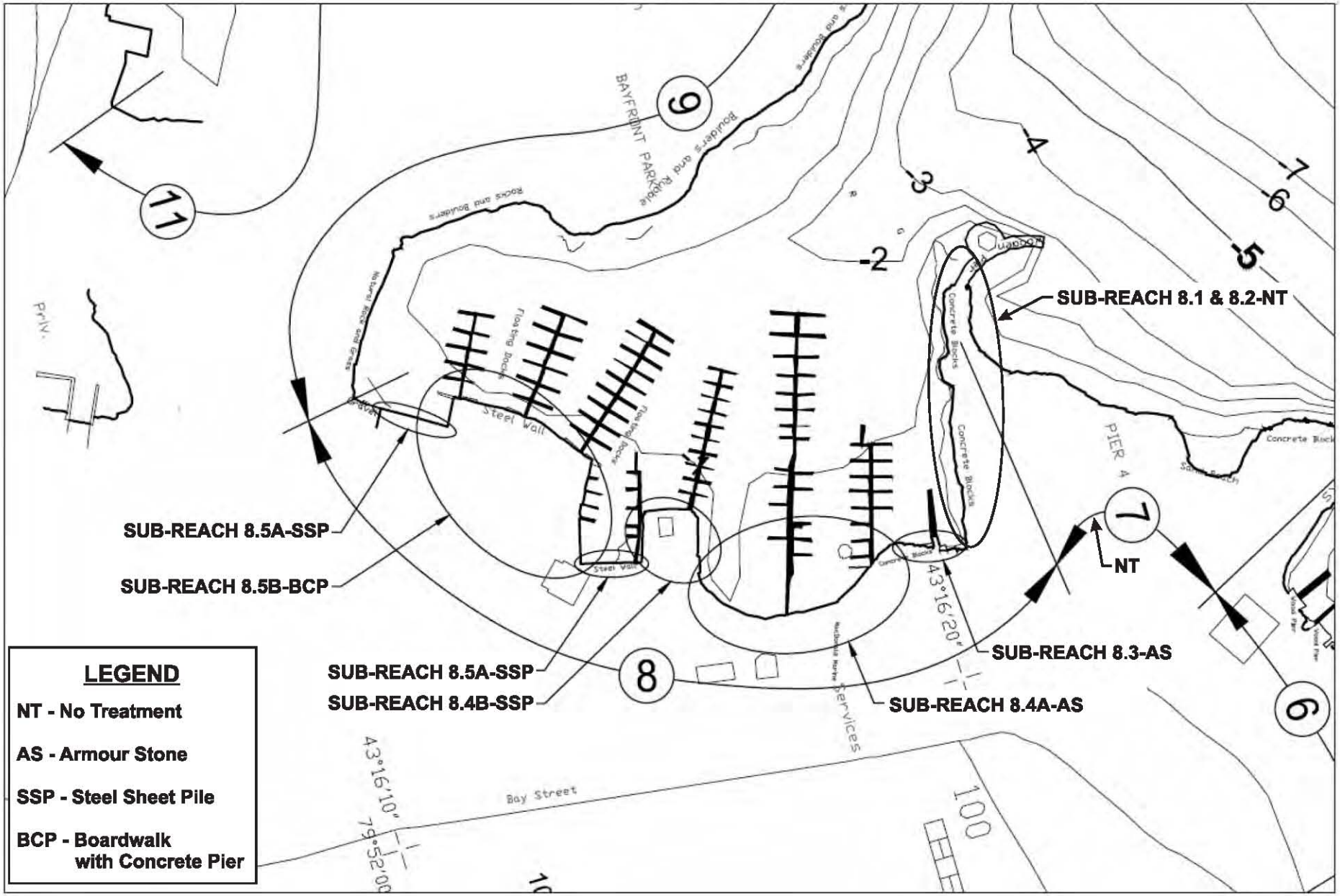
Reach 4


HAMILTON PORT AUTHORITY
SUB-REACH 4.1A-RCC
SUB-REACH 4.1B-RCC
SUB-REACH 4.5-RCC
ROYAL HAMILTON YACHT CLUB
LEANDER ROWING CLUB
SUB-REACH 4.2-RR
SHORELINE STRUCTURES IN SUB-REACHES 4.3 & 4.4-RCC & RR UNDER CONTROL OF RHYC
LEGEND
RCC - Reinforced Concrete Cap
RR - Rip Rap Revetment
Floating Breakwall
Floating Docks
Rocks
Steel Wall
Wood Piles
PIER 5
PIER 6
PIER 7
Hamilton Port Authority Marina
Hamilton Port Authority
Concrete
Wood Pier
1
2
3
4
5
6

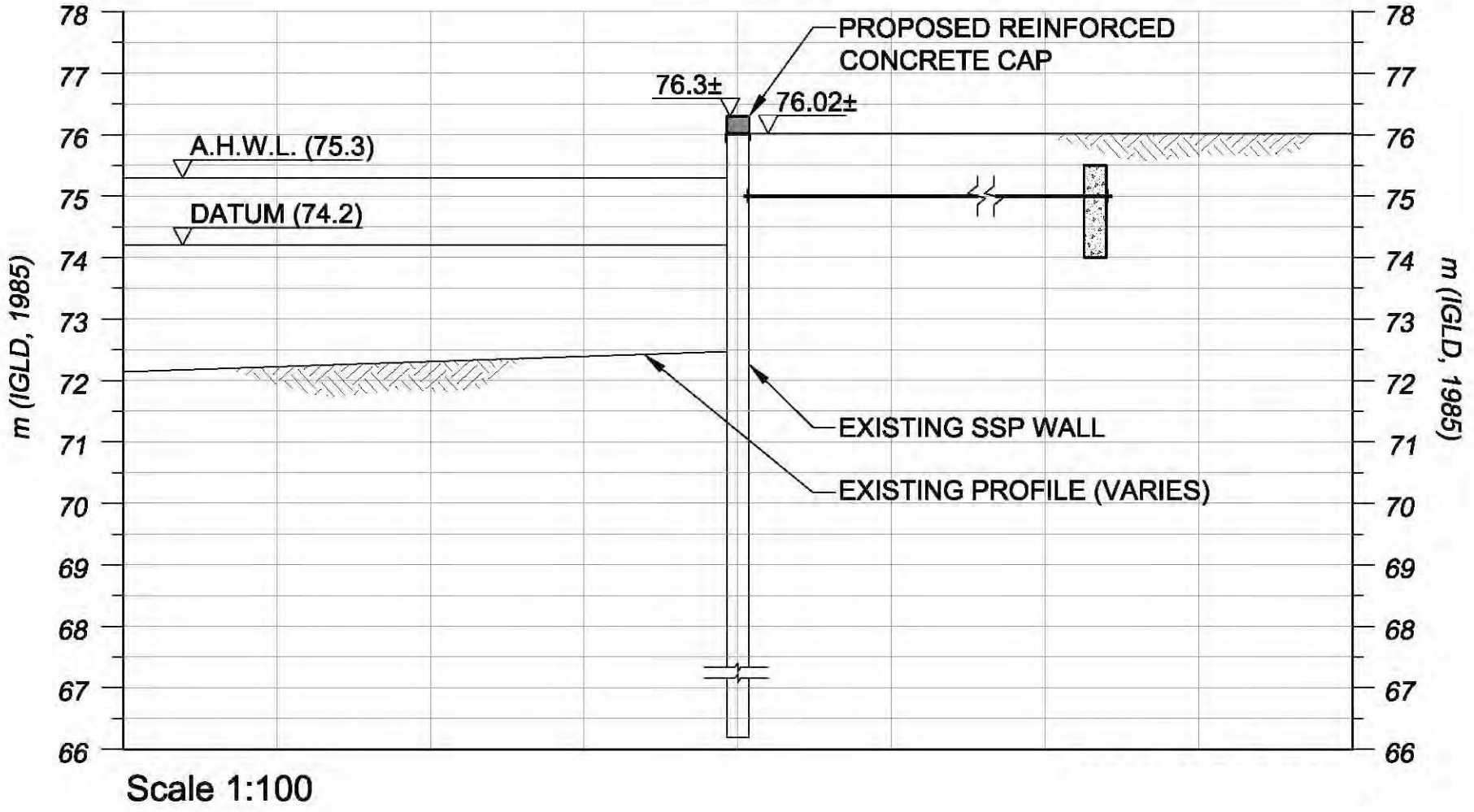
Reach 5 & 6


HAMILTON
PORT
AUTHORITY
SUB-REACH 5.1-AWSP
ROYAL HAMILTON
YACHT CLUB
LEANDER
ROWING
CLUB
SUB-REACH 5.2-BCP
SUB-REACH 5.3-BCP
NT
1
2
3
4
5
6
Floating Breakwall
Floating Docks
Rocks
Steel Wall
Natural Rocky Shoreline
Wood Piles
Steel Piles
PIER 7
PIER 6
PIER 5
Wood Wall
Hamilton Port Authority Marina
Numerous Mooring Buoys
Gas Dock
Travel Lift
Concrete
Hamilton Port Authority
Concrete Blocks
Wood Pier
Street
LEGEND
AWSP - Anchored Wall with Steel Sheet Pile
BCP - Boardwalk with Concrete Pier
NT - No Treatment

Reach 7 & 8


SUB-REACH 8.1 & 8.2-NT
SUB-REACH 8.5A-SSP
SUB-REACH 8.5B-BCP
SUB-REACH 8.5A-SSP
SUB-REACH 8.4B-SSP
SUB-REACH 8.3-AS
SUB-REACH 8.4A-AS
NT
BAYFRONT PARK
Bay Street
PIER 4
Concrete Blocks
Steel Wall
43°16'20"
43°16'10"
LEGEND
NT - No Treatment
AS - Armour Stone
SSP - Steel Sheet Pile
BCP - Boardwalk with Concrete Pier

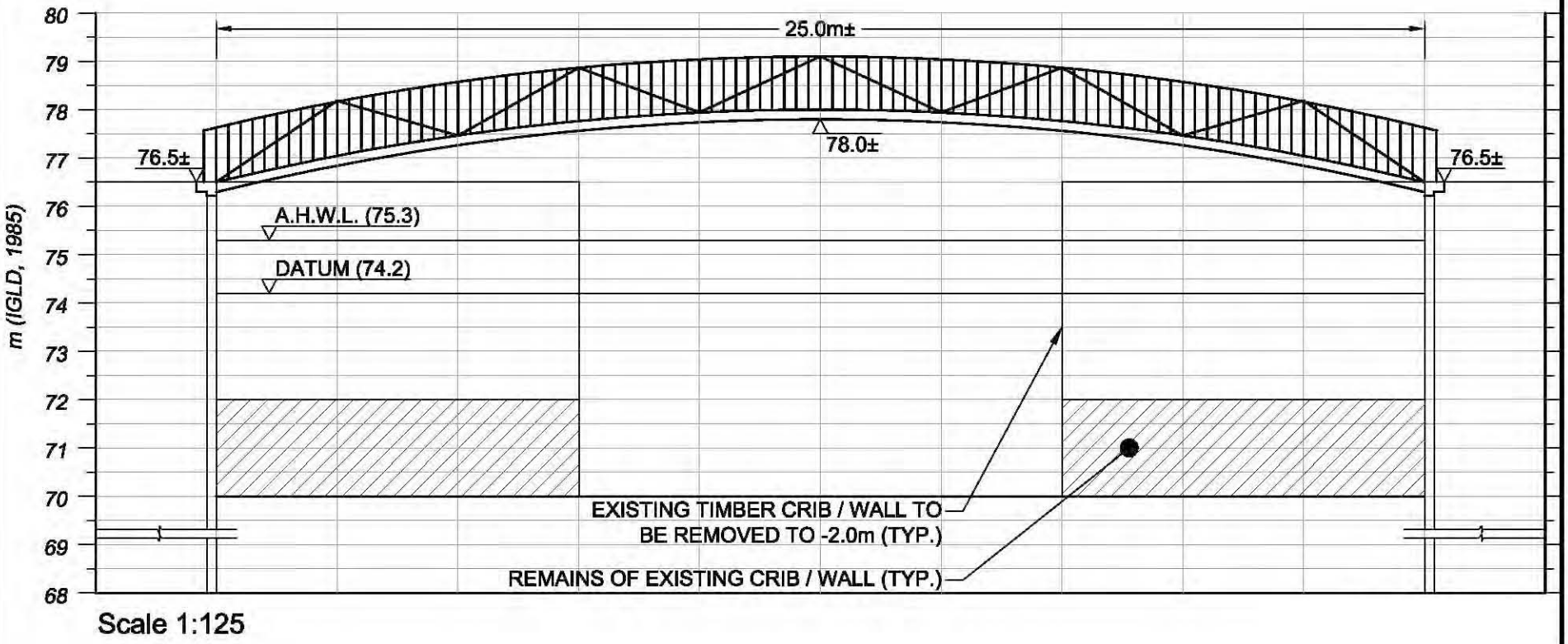
Drawing 1: Typical Section of Reinforced Concrete Cap



Scale 1:100

AHWL - Average High Water Level
IGLD - International Great Lakes Datum

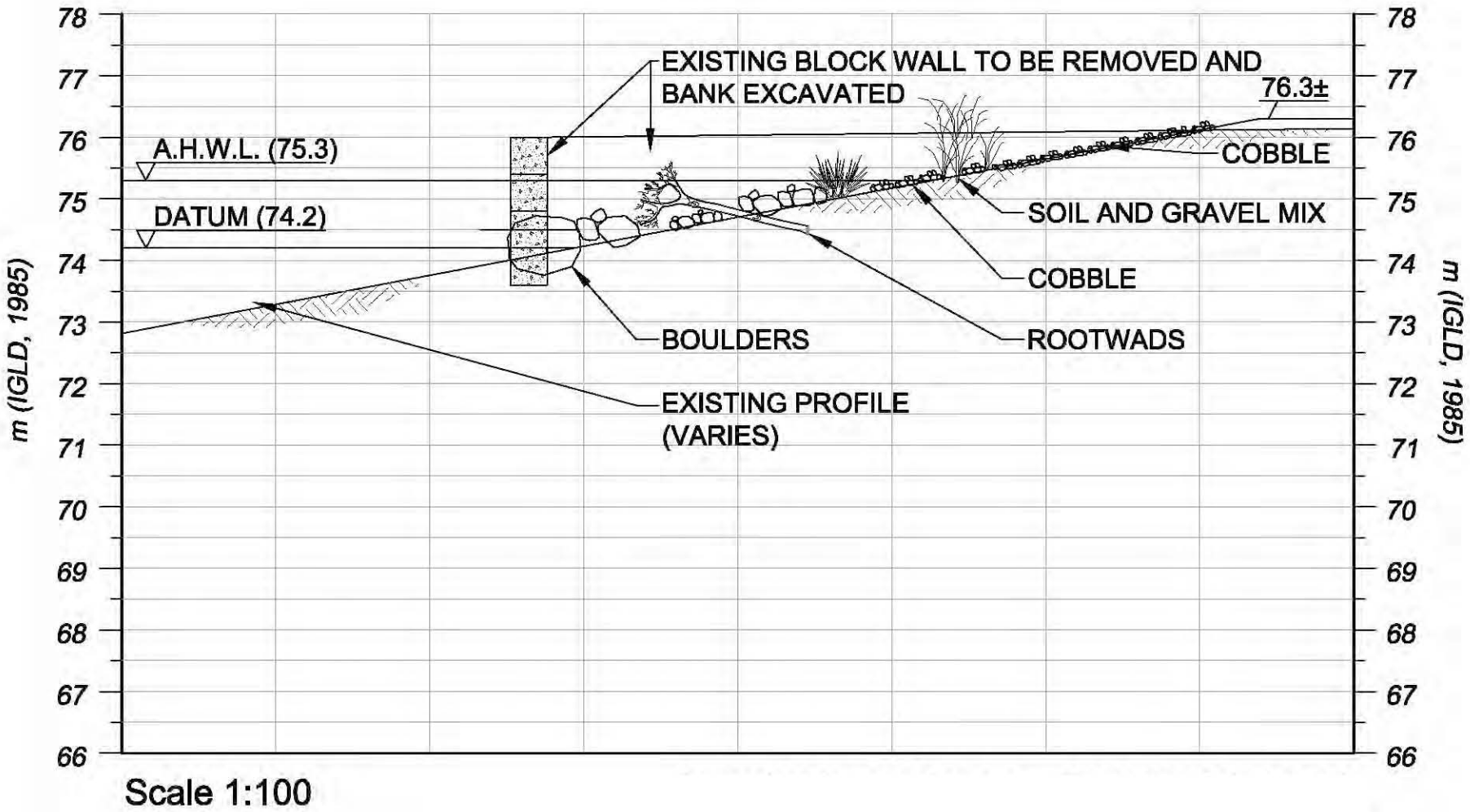
Drawing 2: Typical Section of Pedestrian Bridge



Scale 1:125

AHWL - Average High Water Level
IGLD - International Great Lakes Datum

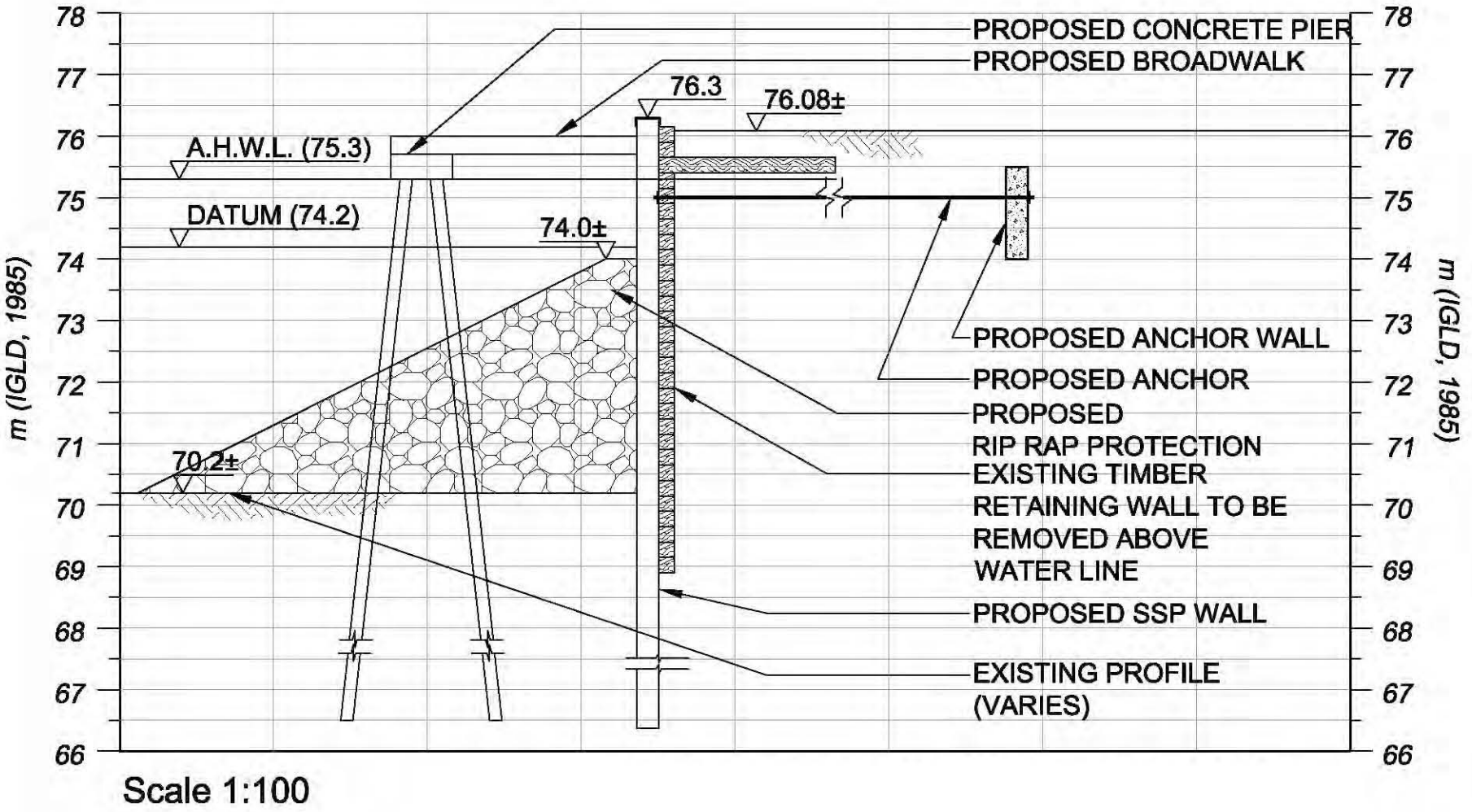
Drawing 3: Typical Section of Armour Stone / Cobble



Scale 1:100

AHWL - Average High Water Level
IGLD - International Great Lakes Datum

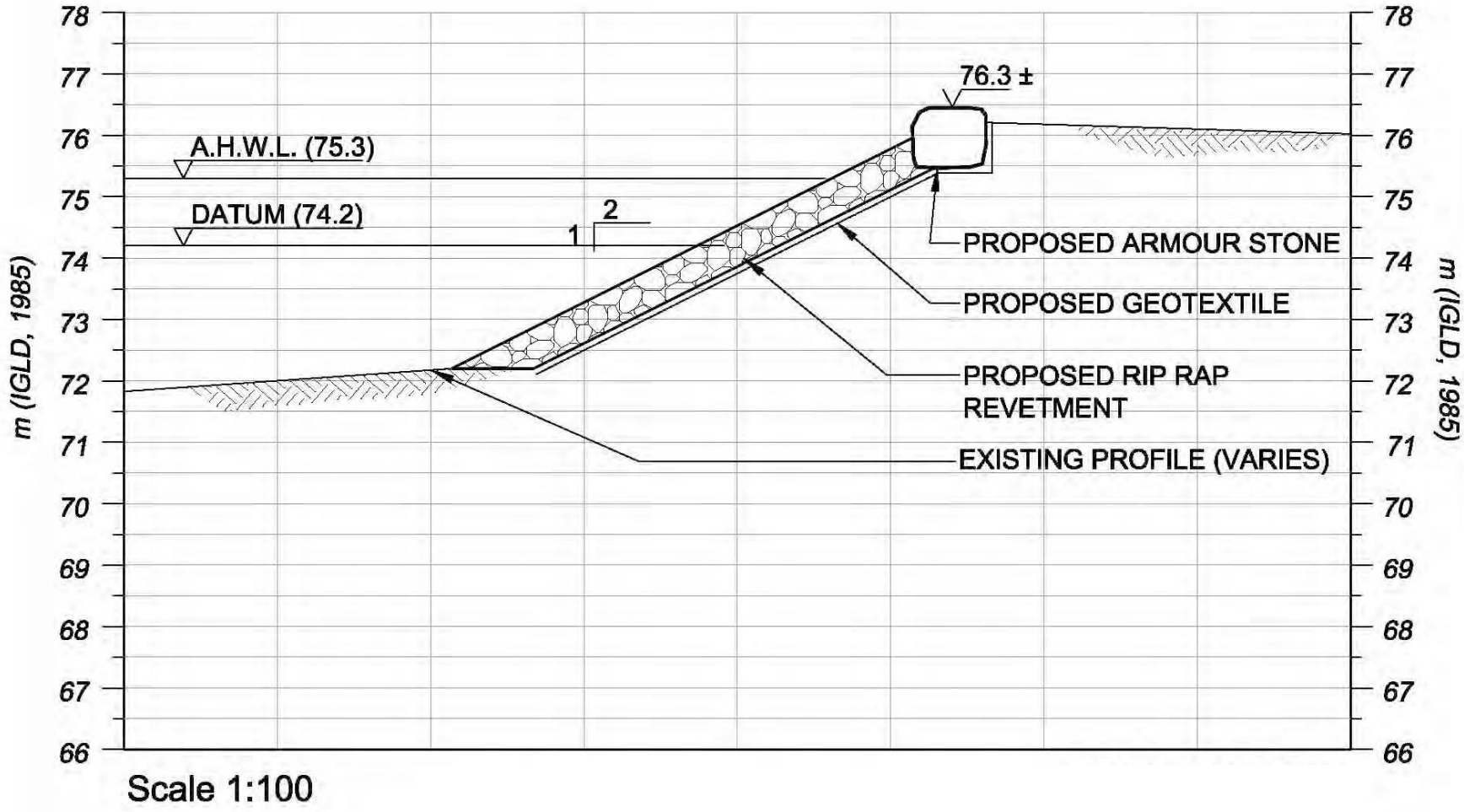
Drawing 4: Typical Section of Boardwalk with Concrete Pier



Scale 1:100

AHWL - Average High Water Level
IGLD - International Great Lakes Datum

Drawing 5: Typical Section of Rip Rap Revetment & Armour Stone



Scale 1:100

AHWL - Average High Water Level
IGLD - International Great Lakes Datum

Generic Examples of the Proposed Improvements along the Shoreline

Image A – Rip Rap Revetment with Armour Stone Cap (Similar to concrete cap)

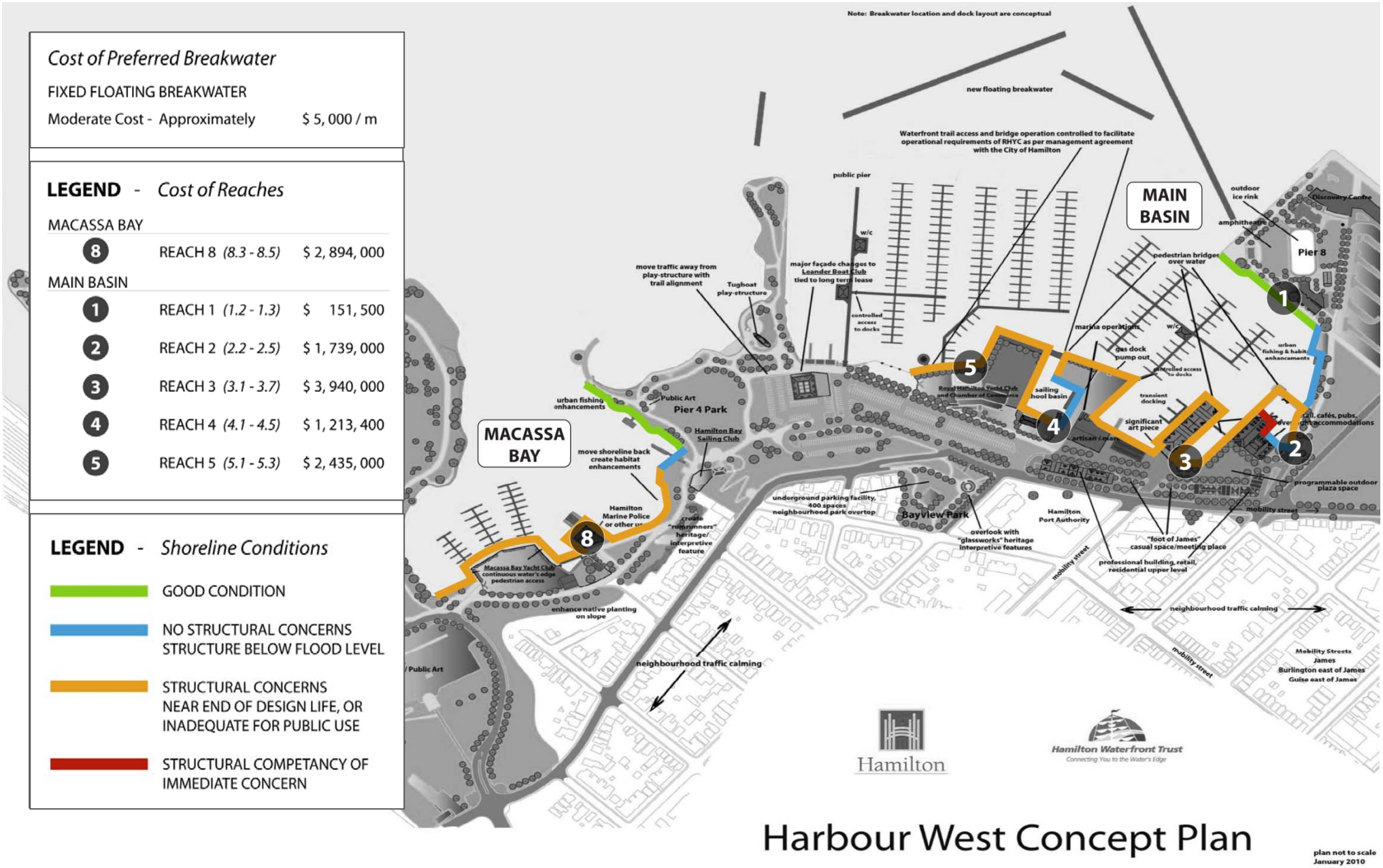
Image B – Armour Stone Revetment

Image C – Cobble Revetment with Aquatic Habitat

Image D – Armour Stone with Aquatic Habitat

Image E – Armour Stone Seawalls

Image F – Armour Stone with Cobble


Cost of Preferred Breakwater
FIXED FLOATING BREAKWATER
Moderate Cost - Approximately $ 5, 000 / m
LEGEND - Cost of Reaches
MACASSA BAY
8 REACH 8 (8.3 - 8.5) $ 2, 894, 000
MAIN BASIN
1 REACH 1 (1.2 - 1.3) $ 151, 500
2 REACH 2 (2.2 - 2.5) $ 1, 739, 000
3 REACH 3 (3.1 - 3.7) $ 3, 940, 000
4 REACH 4 (4.1 - 4.5) $ 1, 213, 400
5 REACH 5 (5.1 - 5.3) $ 2, 435, 000
LEGEND - Shoreline Conditions
GOOD CONDITION
NO STRUCTURAL CONCERNS
STRUCTURE BELOW FLOOD LEVEL
STRUCTURAL CONCERNS
NEAR END OF DESIGN LIFE, OR
INADEQUATE FOR PUBLIC USE
STRUCTURAL COMPETANCY OF
IMMEDIATE CONCERN
Note: Breakwater location and dock layout are conceptual
new floating breakwater
Waterfront trail access and bridge operation controlled to facilitate operational requirements of RHYC as per management agreement with the City of Hamilton
public pier
MAIN BASIN
MACASSA BAY
Pier 4 Park
Pier 8
Bayview Park
Hamilton Port Authority
Hamilton Bay Sailing Club
Macassa Bay Yacht Club
Royal Hamilton Yacht Club and Chamber of Commerce
Hamilton Marine Police
move traffic away from play-structure with trail alignment
Tugboat play-structure
major façade changes to Leander Boat Club tied to long term lease
move shoreline back create habitat enhancements
urban fishing enhancements
underground parking facility, 400 spaces neighbourhood park overtop
overlook with "glassworks" heritage interpretive features
"foot of James" casual space/meeting place
professional building, retail, residential upper level
programmable outdoor plaza space
neighbourhood traffic calming
enhance native planting on slope
Mobility Streets
James
Burlington east of James
Guise east of James
Hamilton
Hamilton Waterfront Trust
Connecting You to the Water's Edge
Harbour West Concept Plan
plan not to scale
January 2010