4. Project Approach

4.1 Identification and Approach to Address Key Challenges

The design and construction of repair/rehabilitation/upgrade works for an existing rubble mound breakwater is significantly more complicated than the design of a new structure. Baird has extensive and unrivaled experience in such projects, with this experience to be fully leveraged for the South Shore Breakwater Project. We have described the key challenges we see for the project below.

1. ***Communication of Basis of Design.*** In contrast to land-based engineering, where decisions are effectively dictated by a design code, coastal engineering requires significantly more input from the Owner. As coastal engineering does not rely upon a code, it is up to the Owner to determine the level of risk he/she desires against the likelihood of storm events that cause damage. This is a complex decision given the high costs of coastal structures, with most Owners selecting a level of protection that is likely to result in intermittent damage over the life of the structure rather than expend exorbitant capital for a higher level of protection. This cost versus risk decision is generally not well documented by consultants, and the Owner often has expectations for the performance of the structure that exceed reality. Our process incorporates a Basis of Design (BoD) which accurately communicates the anticipated performance of various alternatives being assessed, including armor stability, damage associated with wave overtopping, and wave agitation criteria.

   Accurately documenting the functional (performance) requirements of the rehabilitated breakwater with respect to protection of the Oak Leaf Trail, South Shore Yacht Club, and South Shore Boat ramp will be critical during the project initiation phase. Ideally, each of these facilities would have a well-documented BoD describing the protection they require from the breakwater. Unfortunately, this may not be the case, as we have found that most consultants working in the coastal space concentrate on describing existing conditions in the BoD rather than focusing on critical design decisions and performance expectations.

   Clear communication regarding breakwater performance at stakeholder meetings will be critically important in the event Milwaukee County needs to make budget-based decisions. For instance, cost prohibitive breakwater improvements (i.e., through a significant increase in the crest elevation) may be required to limit overtopping as required to fully protect the South Shore Yacht Club during significant storm events at high lake levels. The BoD needs to clearly and accurately communicate the conditions expected in the lee of the breakwater so that future arguments/litigation do not arise over its performance. Similar statements can be made regarding the south breakwater segment.

2. ***Project Schedule.*** The RFP requires a completion date of December 31, 2021 for the final design of the north section and the feasibility study for the south section, with the final design of the south section to be complete by March 31, 2022. Advancing both projects in parallel, which both rely upon the acquisition of field data, will be a challenge. Baird is in an excellent position to meet this challenge given its history with the project, in-house database of existing site conditions and coastal design conditions, unique field data and data processing techniques, and familiarity with Milwaukee County documentation requirements.

   Given the above, we can advance many tasks at the onset of the project without having to wait for the completion of field data acquisition and processing. For instance, we can develop concepts and prepare for stakeholder meetings without having to wait to finalize the modeling and analysis of coastal processes (we have a significant head start on this work through our prior studies in the area). We can also commence many backend tasks, such as project manual preparation, based on extensive history with similar projects (with similar specifications) and Milwaukee County's requirements for contract documents.

Additionally, our experience processing the mega-datasets that are produced from high resolution UAV topographic and MBS hydrographic surveys will be a major advantage. Our proprietary tools and access to cloud computing platforms will assure smooth and efficient delivery.

Lastly our rigorous process of documenting decisions in a BoD and transparently presenting any ideas to clients during the preliminary phase of projects eliminates re-work or backtracking. We will pursue only the concepts having the highest likelihood to satisfy the criteria of the stakeholders.

3. ***Permitting.*** As previously mentioned, the RFP requires that the final design of the north section be complete by December 31, 2021 with the final design of the south section complete by March 31, 2022. While the schedule laid out in the RFP can be accommodated from a stakeholder engagement and engineering perspective, it has some risk with respect to permitting. The current permitting cycle for coastal/shoreline projects on Lake Michigan is approximately six months from submittal to completion. This generally means that permits will not be approved prior to the start of final design for either of the projects, with the associated risking of some potential re-work.

   It is noted that the north section as envisioned has very little permitting risk given that the rehabilitation works will not likely require additional lakebed or significantly lakebed disturbance during construction. One possible caveat may be a scenario whereby the timber cribs along the northern section prevent a simple overlay concept and require lakebed impact. The south segment carries a permitting higher risk as the final solution is contingent upon the completion of the feasibility study and may include a new shoreline revetment.

4. ***Uncertainty of Existing Conditions.*** Uncertainty associated with the existing condition of the deteriorated breakwater structure is the most likely item to result in a claim during construction. Unfortunately, small variations in geometry across a breakwater can lead to significant errors in the calculation of required stone volumes. In addition, the exact location (some may be scattered) and size of stones that may need to be recovered may drastically impact equipment selection and thus a contractors bid. Both issues are exasperated at the South Shore facility due to the irregular plan and profile of the historic breakwater. If these items are incorrectly documented in the project manual, claims are very likely to result. Many experienced professionals believe that this risk can be mitigated by putting the risk of existing conditions on the Contractor through the contract documents. Our experience has demonstrated that this strategy is full of loopholes unless an EPC (turnkey) delivery methodology is utilized to put 100% of the project risk (design, construction, and existing conditions) in the Contractor's hands. The EPC Contractor's bid price then includes an allowance for this risk; this results in a significantly higher project cost than if the risk is shared between the Owner and the Contractor.

   We have proposed a detailed field data collection campaign utilizing tools that capture full coverage, high resolution data of the above and below water portions of the existing breakwater, with the interpretation of these data utilizing proprietary software to address the uncertainties noted above. Baird has taken advantage of significant improvements in survey technology over the past 10 years to develop a comprehensive approach to document and assess the structural condition of coastal and marine structures, including the use of laser scanners, UAVs, and multi-beam sonar systems. For rubble mound breakwaters, these approaches allow the development of a high-resolution digital terrain model (DTM) of the entire structure (above and below water) that can be used to assess and quantify deterioration and damage to the structure, such as displaced or broken armor units, gaps in the armor layer, variations in packing density, toe scour, etc. Two examples are provided in Figure 4.1.

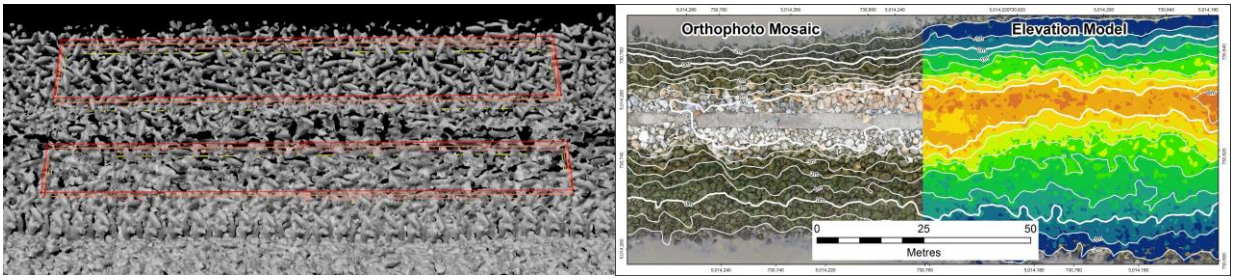


Figure 4.1: Example DTM for Rubble Mound Breakwaters

5. ***Changes During Construction.*** Given the variability in conditions over the 5,800 ft length of the existing north and south sections of the breakwater (as described above), as well as the variability in stone size, shape, and density sourced from various quarries, it is inevitable that some change to the project will be requested by the Contractor during construction. Baird has developed a process to accommodate such changes through specification of a "test section" whereby the Contractor builds a small section of the breakwater at the onset of the project. Most coastal consultants include a "test section" in their specifications; however, in practice they primarily use it to point out inadequacies in the Contractor's methods rather than for its critical purpose, which is to adjust the cross section to meet the realities of the project. We have executed this process of adjusting the design section in the field numerous times over the past 10 years without compromising breakwater performance. This process has resulted in significant savings on a number of projects. We note we are in a unique position to evaluate Contractor change requests and subsequently execute rapid adjustments where they make sense, based on our significant experience and database of physical model results. Of note, a similar change was executed for the central segment of the South Shore Breakwater rehabilitation project.

4.2 Proposed Methodology

As noted in the RFP, the Milwaukee South Shore Breakwater project has been split into the following two phases:

- Phase I - North Section Planning/Design + Condition Assessment of Center Section
- Phase II - South Section Alternatives Analysis + Planning/Design

The overall objective of the project is to develop a full set of construction documents for each project phase. The proposed project methodology includes a series of tasks, some of which are common to both phases. For the purpose of this proposal, we have created an initial study phase (Phase 0) to cover these common tasks. For the project cost estimates presented later in this proposal, the cost of the Phase 0 tasks has been split 60/40 between Phase I and Phase II based on the relative lengths of the north and south breakwater sections (3,400 ft and 2,400 ft respectively).

4.2.1 Phase 0 - Preliminary Studies (60/40 Split for Phases I/II)

4.2.1.1 Task 0-1 – Project Management and Quality Control

Professional project management will be critical to delivering a quality project on budget and schedule. Baird has assigned one of its top PMs to the project, Mr. Brent Sumner. The PM task includes ad-hoc communication (generally emails and calls) with Milwaukee County and various stakeholders, regularly scheduled update meetings with the Milwaukee County (every second week), client invoicing, project budget and schedule updates, and Baird's quality control process. Additional detail on Baird's proposed approach to project management and quality control for this study is provided in Section 5.

4.2.1.2 Task 0-2 - Kickoff Meeting

A project kick-off meeting will be conducted with representatives from Milwaukee County to verify/clarify the scope of services, schedule, and communication channels for the project, and to confirm the design criteria, goals, and objectives for the project. The following are expected to be key discussion topics at this meeting:

- Level of protection required for the range in marine and landside infrastructure and facilities protected by the north and south sections of the breakwater (existing shoreline protection and waterfront trails, South Shore Yacht Club, South Shore Boat Launch, and South Shore Beach);
- Key site opportunities and constraints;
- Design life and acceptable risk of damage to new coastal structures (rehabilitated breakwater for north and south sections, and new shoreline revetment for south section);
- Water quality (in particular with respect to South Shore Beach and its possible relocation);
- Public access to/along the shoreline (particularly for the south section);
- Cost versus risk (i.e., a reduction in the risk of damage typically requires an increase in capital cost) and the County's ability to commit to future maintenance/repair costs.

Following the kick-off meeting, Baird will conduct a site reconnaissance visit with the County to become familiar with the existing conditions, perform limited measurements, and photo document the site. This initial site visit will support the detailed planning of the proposed field investigation (refer to Section 3.1). Baird's participation will include their project manager and a senior coastal engineer.

The discussions held during the Kick-Off Meeting and site visit will provide a clear understanding of the project objectives and site specific challenges and opportunities that must be considered in the planning and design of rehabilitation works for the north and south sections of the South Shore breakwater. Baird will prepare minutes that summarize the discussions and key outcomes of the kickoff meeting.

Deliverable: Kickoff Meeting Minutes (to be included as Appendix to Phase 0 report)

4.2.1.3 Task 0-3 - Review Available Information

Baird will identify and review available information of relevance to this project. The County has already provided the following information:

- Historical records on South Shore Breakwater construction timeline;
- South Shore Breakwater Rehabilitation Feasibility Study (USACE Report, 2001);
- South Shore Breakwater Planning - Conceptual Design Report - Center Section (Baird, 2003);
- South Shore Breakwater Rehabilitation Works - Bid Drawings - Center Section (Baird, 2005);
- South Shore Revetment – As-Built Drawings (Baird, 2006);
- South Shore Beach Improvements – Basis of Design (SmithGroupJJR, 2018)
- South Shore Beach Improvements – Water Quality Modeling (SmithGroupJJR, 2019)
- South Shore Beach Improvements – 95% Design Drawings (SmithGroupJJR, 2019)

Complementary to this information, Baird also has copies of the As-Built drawings (Baird, 2008) for the rehabilitation works for the center section of the breakwater and a prior study related to the potential relocation of South Shore Beach (Baird, 2013).

In addition, Baird will identify and obtain available information of relevance from various third parties, including the following (Baird already has much of this information available in-house through prior projects in the Milwaukee area and around Lake Michigan):

- Long-term historical metocean data, including measured and modeled wind, wave, and water level data;
- Nearshore LiDAR surveys undertaken by the USACE in 2008 and 2012;
- Previous estimates of extreme wave and water level conditions in the Milwaukee area;
- Geotechnical information available from prior studies;
- Historical and recent aerial and satellite imagery.

Review of the information described above will provide an understanding of the range in physical conditions that currently exist along the South Shore Breakwater and the typical and extreme environmental conditions to which the structure may be exposed. This information will be used as input to the various modeling and analyses tasks described below. In addition, any key gaps or uncertainties in the available information will be identified, along with recommendations to address these gaps or uncertainties, either as part of this project or in a future design phase.

Deliverable: The results of Task 0-3 will be documented in the Phase 0 report

4.2.1.4 Task 0-4 - Field Investigations

The proposed field investigations include above water visual reconnaissance, topographic and bathymetric surveys, jet probes, and a stone size assessment. The scope of the various field investigations (i.e., north, center, and/or south sections) is described below. The topographic and bathymetric surveys will be undertaken by sub-consultants (as noted below) while Baird will complete the above water visual reconnaissance, jet probes and stone size assessment.

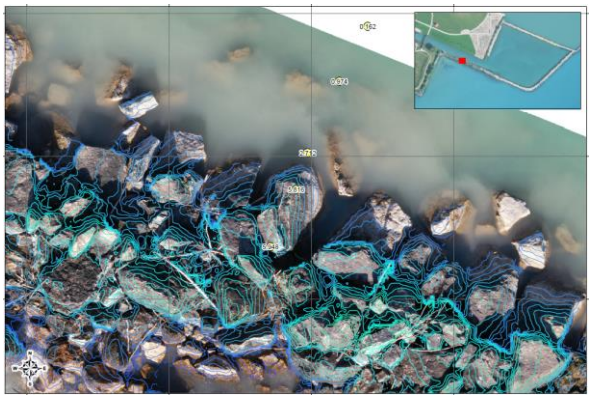
Visual Reconnaissance and Photo Documentation (North, Center, and South Sections)
To the best of our knowledge, the last above water observations of the South Shore Breakwater were conducted in 2004, while the last below water observations were conducted in 1996. An above water visual reconnaissance will be undertaken, including photographic documentation of the structure from the crest and also from the water (both sides). The visual reconnaissance will be undertaken by a senior Baird engineer familiar with the project and will identify any specific areas of concern along the above water portions of the breakwaters. The photo documentation will duplicate photos those in earlier monitoring efforts at pre-established 200 ft stations.

It is our opinion that below water (diver) observations are not required to support design development for this project, as the proposed high resolution bathymetric survey will provide detailed information on the underwater portions of the breakwater. However, a dive inspection may provide useful supplementary information for inclusion with the bidding documents and could be undertaken as an extra cost option if Milwaukee County desired to pursue the risk reduction measure. We would recommend the survey take place as close to the release of bid documents as possible.

UAV Topographic Survey (North, Center, and South Sections)
High resolution aerial imagery and photogrammetric mapping of the breakwater and shoreline will be collected with an Unmanned Aerial Vehicle (UAV); it is assumed that Milwaukee County will approve the use of a UAV in the project area. The UAV imagery will be reviewed to assess the breakwater and shoreline conditions in the project area, in particular to identify the location/nature/extent of deficiencies in the breakwater and shoreline protection structures (i.e., gaps in the armor layer, displaced armor stone at the toe). The UAV imagery will also be post-processed to define the topography along the breakwater and shoreline.

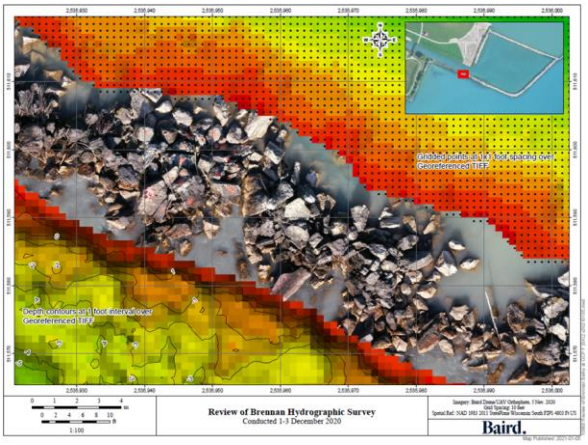
If possible (given safety considerations), conventional survey data will be collected to cover the gap in the critical area between the UAV topographic data and MBS bathymetric data (see below).

The UAV imagery will also be used to support an assessment of the size, quality, and quantity of existing armor stone in the project area, in particular along the north and south sections of the breakwater. Specifically, Baird will utilize a proprietary in-house data processing tool (Stone-ID) to estimate the size of individual armor stones along the breakwater, with groundtruthing provided by in-situ measurements of stone sizes in representative areas (see section 3.2.4). This information will allow us to accurately and efficiently estimate the quantity of armor stone that can be salvaged for reuse. The UAV survey will be undertaken by Resolution Studio, LLC, our TBE sub-consultant.



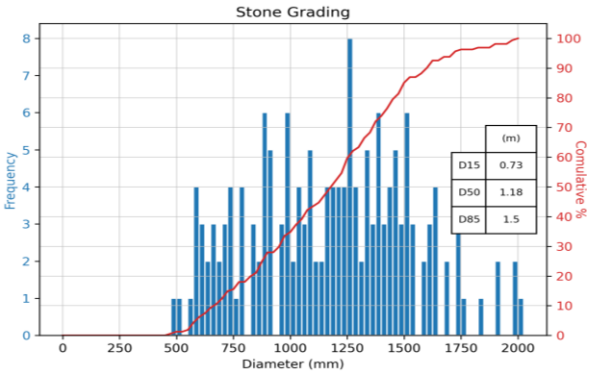
MBS Bathymetric Survey (North, Center, and South Sections)

A high resolution multibeam sonar (MBS) bathymetric survey will be undertaken of the breakwater and adjacent lakebed area to provide a detailed understanding of the underwater sections of the structure. The MBS unit will be rotated to a near horizontal position for survey lines adjacent to the front and rear slopes of the breakwater in order to maximize the survey coverage between the lakebed and the water level. The resolution of the MBS survey data will be sufficient to identify significant deficiencies in the structure, such as oversteepened slopes, gaps in the armor layer, and displaced armor stone on the lakebed adjacent to the toe of the structure. The MBS survey will be undertaken by J.F. Brennan Company, Inc. While we understand other relatively recent bathymetric surveys have been carried out in this area, we recommend a detailed survey if the project is going to proceed to construction in the near future.



Stone Size Assessment (North and South Sections)

Visual inspection and in-situ measurements of armor stones will be undertaken at selected sample locations along the north and south sections of the breakwater. This will include an assessment of armor stone placement (i.e., coverage, interlock, and gaps), rock type and quality (i.e., evidence of degradation), damage (missing or displaced armor, exposure of underlying materials, extent of scour), and stone size measurements to estimate the range in stone shape (aspect ratio) and weight. We anticipate measuring 150-200 armor stones at 5-6 sample locations along the length of the north and south sections of the breakwater.



The stone size measurements will provide ground-truthing for the UAV/Stone-ID assessment of armor stone size for the full length of the north and south sections of the breakwater. This information will assist in determining the ability to excavation/reconfigure the existing breakwater and the stone quantity and sizes that could be salvaged for reuse in the rehabilitation works as a potential cost savings measure.

Jet Probes (North and South Sections)
In order to complement information available from prior studies, Baird will complete a series of jet probes to define the depth of loose sediment cover over hard material (till or bedrock). It is anticipated that a minimum of 10 jet probes will be performed in the vicinity of the north section of the South Shore Breakwater and a minimum of 10 jet probes will be performed in the vicinity of the south section. This information will be considered in the coastal modeling and also in the identification/assessment of toe details for proposed shoreline protection structures.

Figure 4.2: Historical Jet Probe Locations (center segment)

Digital Terrain Model of Breakwater (North, Center, and South Sections)
The UAV topographic survey data and MBS bathymetric survey data will to be merged to create a high-resolution digital terrain model (DTM) of the above and below water areas along the breakwater, with this information to be incorporated into base map of existing conditions. The resolution of the DTM will be sufficient to identify significant deficiencies in the structure, such as oversteepened slopes, gaps in the armor layer, and displaced armor stone on the lakebed adjacent to the toe of the structure.

Subsequently (as part of Task I-3), the DTM will be compared to the as-built drawings available for the center section of the breakwater during Phase I (Baird, 2008) in order to identify significant changes in the structure since its completion in 2008 (refer to description in Task 1-3).

Deliverable: The results of Task 0-4 will be documented in the Phase 0 report

4.2.1.5 Task 0-5 - Coastal Modeling and Analysis (North, Center and South Sections)

Baird has undertaken extensive coastal modeling and analyses for previous studies in the Milwaukee area, including wave climate and water level analyses, assessment of wave overtopping for the South Shore Breakwater, and water quality modeling for the South Shore Beach. Much of this information is directly applicable to the present project, so it will be leveraged to the greatest extent possible.

The coastal modeling and analysis proposed for this project considers the following key points:

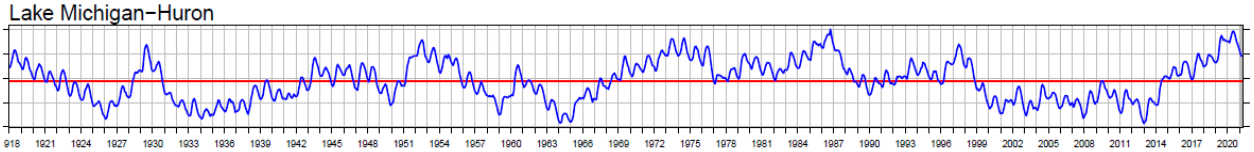
- Lake Michigan reached near record high lake levels in 2020, with several storms causing widespread damage along the WI and IL shorelines. Previous modeling and analyses will be updated through 2020 to develop an understanding of the severity of 2020 storm events relative to the historical database.
- There is tremendous uncertainty regarding the potential effects of climate change on Great Lakes water levels and storm events. A sensitivity analysis will be undertaken to assess the potential implications of climate change on key design parameters, in particular extreme water levels and wave conditions.
- Baird's (2003) study for rehabilitation options for the center section of the breakwater demonstrated a significant reduction in wave overtopping and transmission as the breakwater crest elevation is raised, but found that the extreme wave conditions at the shoreline are not significantly reduced as they are depth-limited. More specifically, Baird (2003) assessed the costs associated with breakwater crest elevations ranging from +4 to +13 ft LWD along with associated requirements for revetments along unprotected sections of the shoreline. This study clearly demonstrated that the most cost-effective way to protect the shoreline is by building a revetment and not by raising the crest of the offshore breakwater. This analysis will be updated for the south section of the breakwater, as per the requirements in the RFP. Other options, such as rehabilitation of south revetment into an underwater reef and buried revetments will be discussed with Milwaukee County at the kickoff meeting. These options will only be added to the feasibility study if desired by Milwaukee County.
- For the rehabilitation of the center section, which was completed in 2007, the County elected to raise the breakwater (5,200 ft length) in order to address navigation safety concerns, as this was a key issue at that time. In addition, the project included the construction of an armor stone revetment over a 2,220 ft length of shoreline fronting Shore Park to provide full protection to a new waterfront bike path.
- The final design for the rehabilitation works for the center section of the breakwater (Baird, 2006) utilized a crest elevation of +7 ft LWD. However, the Contactor who was awarded the project (Luhr Brothers, Inc.) offered to build the structure a higher elevation at the same unit costs in order to limit the requirement for excavation of the existing breakwater, as the excavation work was found to be very challenging. A change order was issued, and the breakwater was reconstructed to an average elevation of +11.5 ft LWD, as documented in the as-built drawings (Baird, 2008). On subsequent breakwater rehabilitation projects, Baird has attempted to minimize excavation of the existing structure due to the challenges associated with the excavation work. This will be an important consideration for this project as well.

The following sub-sections provide an overview of the coastal modeling and analyses proposed for this project. Of note, extreme wave conditions at the breakwater, and at the shoreline, are depth-limited, so the design water level and lakebed elevation at the toe of the breakwater and shoreline structures are the controlling design variables. The variation in lakebed elevations will be defined by the MBS bathymetric survey described earlier, with modeling and analyses of water levels and waves to be undertaken as discussed below.

Water Levels

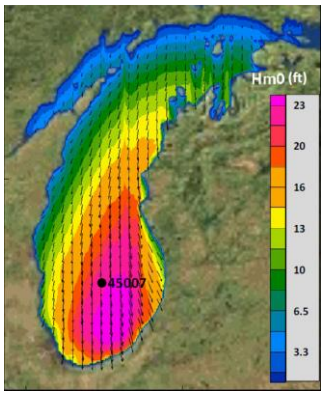
Water level fluctuations on Lake Michigan are caused by long-term and seasonal variations in climatic conditions over the Great Lakes drainage basin, as well the short-term, localized influence of individual storm events. Baird has completed detailed analyses of historical water level records and numerical modeling of storm surges for many other projects along the Milwaukee shoreline and will update these analyses to reflect

the recent period of high lake levels. More specifically, Baird will complete statistical analyses of the long-term water level records from the NOAA gauge at Milwaukee to define lake level exceedance curves and extreme high and low water levels as for return periods ranging from 2 to 500 years. This information will be used as input to the modeling and analyses of nearshore waves, hydrodynamics, and wave runup/overtopping/ transmission and for use in the development of designs for breakwater rehabilitation works (north and south sections) and new shoreline revetment (south section).



Wave Climate

Baird has an in-house long-term (1980-2020) wave hindcast database for Lake Michigan and will use these data to define the wave climate in deep water offshore of the project site. Empirical and/or numerical modeling of shallow water wave transformations will be undertaken for a representative range in offshore wave conditions to define the nearshore wave climate at the project site. Various statistical analyses will then be completed to define the operational (day to day) and extreme wave conditions at the site, with this information being used as input to the modeling of nearshore waves, hydrodynamics, and wave runup/overtopping/ transmission and for use in the development of designs for breakwater rehabilitation works (north and south sections) and new shoreline revetment (south section).



Nearshore Waves and Hydrodynamics

Baird will complete empirical and numerical modeling of nearshore waves and wind and wave induced hydrodynamics in order to define the wave conditions and circulation patterns (currents) in the sheltered area behind the breakwater. The modeling effort will include consideration of wave transmission due to overtopping of the breakwaters as well as wave diffraction through the gaps between the north, center, and south breakwaters.

Wave transmission levels for the north, central, and south sections of the breakwater will be estimated using published empirical methods and our in-house database of physical model results for similar rubble mound structures. Figure 4.3 presents a summary of this database (wave transmission coefficient, Kt, versus relative breakwater freeboard, F/Hs); this proprietary database includes a compilation of results from numerous 2D and 3D model tests of submerged and low crested breakwaters.

Wave diffraction through the breakwater gaps will be simulated using the MIKE21 numerical model, as illustrated in Figure 4.4. The MIKE21 model will include an internal wave generator to simulate the contribution of wave transmission due to overtopping of the breakwaters.

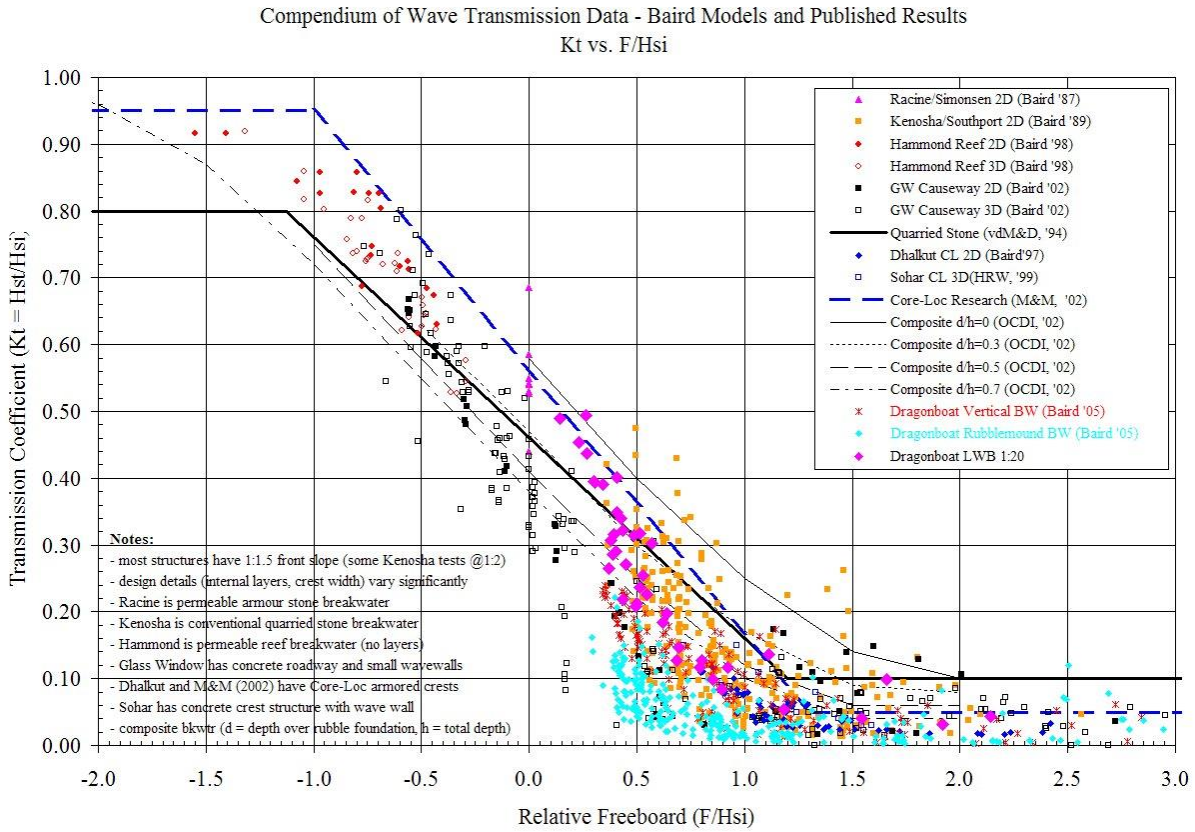


Figure 4.3: Summary of Baird's Physical Model Database of Wave Transmission by Overtopping

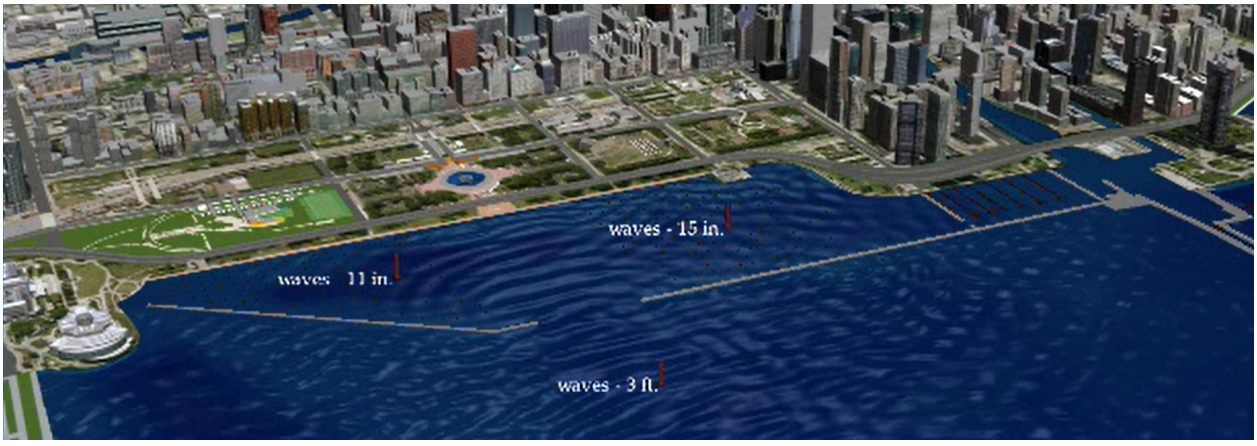


Figure 4.4: Breakwater diffraction modeling, 2016 Olympic Bid

Deliverable: The results of Task 0-5 will be documented in the Phase 0 report

4.2.1.6 Task 0-6 - Sustainability

Just prior to the commencement of the design development process, the LEED checklist will be consulted and high likelihood areas will be targeted for consideration in the project, including:

- Innovation: LEED Accredited Professional (1 credit)
- Materials and Resources: Construction and Demolition Waste Management (re-use of existing stone and incorporation into the project, 1-2 credits)
- Materials and Resources: Building Product Disclosure and Optimization Sourcing of Local Raw Materials (1-2 credits)
- Sustainable Sites: Site Assessment (1 credit)
- Sustainable Sites: Site Development – Protect or Restore Habitat (1-2 credits)
- Sustainable Sites: Open Space (1 credit)
- Sustainable Sites: Rainwater Management (1-3 credits)

As previously mentioned, we would not expect rubble mound breakwaters alone to qualify for enough credits to secure any level of LEED certification unless bundled with other facilities/ structures. Therefore, we have not anticipated official submission for LEED credits but rather an unofficial report submitted directly to Milwaukee County to illustrate we are following the LEED thought process.

Deliverable: LEED Considerations Register and Report to County

4.2.1.7 Task 0-7 - Phase 0 Report

Baird will prepare a report that documents the key results of Phase 0, including the following information:

- Summary of project goals, objectives, opportunities, and constraints;
- Summary of available information;
- Summary of field investigation program and key results;
- Updated project base map depicting existing conditions;
- Summary of key results of coastal modeling and analyses, including:
    - Typical and extreme water levels, wave conditions, and ice conditions,
    - Wave overtopping/transmission for the north and south sections of the breakwater,
    - Circulation patterns for existing conditions and various alternatives,
    - Design wave conditions for the south shoreline revetment for existing conditions and various alternatives,
    - Summary of sensitivity analysis for climate change.

Baird will present the Phase 0 report to representatives from the County. A key objective of this meeting will be to review/discuss the path ahead for design development for the north section (Phase I) and the south section (Phase II).

4.2.2 Phase I - North Section Planning/Design + Condition Assessment of Center Section

4.2.2.1 Task I-1 - Basis of Design

Baird will coordinate with the County to establish functional requirements and design criteria for the north section of the project, including consideration of the specific requirements associated with protecting existing marine and landside infrastructure, including Cuperton Park, South Shore Yacht Club, South Shore Boat Launch, and South Shore Park, in particular South Shore Beach. This information will be incorporated into a draft Basis of Design (BOD), with the BOD to include the following information:

- Owner's Project Requirements (OPR), including functional requirements of the project, project goals, expectation of design life and acceptable risk of damage versus cost, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information, including applicable codes and standards, accessibility requirements, and safety requirements.
- Physical site conditions (topography, bathymetry, subsurface conditions).
- Metocean conditions (water levels, surges, waves) and ice conditions.
- Applicable codes, design standards, and guidelines.

The BoD is important because it establishes the key objectives of the project and their justifications and serves as a record of what choices were made and why. For example, the BOD will document the level of wave protection that is required by existing marine and landside infrastructure, with this information ultimately dictating the design elevation of the breakwater rehabilitation works. The BoD is a living document that will be updated throughout design process and will provide written documentation of key cost versus risk decisions.

Deliverable: Draft Basis of Design

4.2.2.2 Task I-2 – Risk Management

Risk management encompasses the approaches, tools, and methods to plan risk management, identify risks, perform qualitative and quantitative risk analyses, plan risk responses, and monitor and control risks on a project or program.

Risk for the proposed project entails the possibility of economic loss, damage, or any other undesirable event with a negative impact emanating from the planning, permitting, design, and construction process. Such events may impact the project's cost, schedule, quality and, ultimately, the project's mission and usefulness. Active and ongoing risk management is critical to the success of any major project. Early identification of key risk factors enables project delivery teams to:

- Anticipate potential challenges;
- Recognize opportunities for improvement;
- Develop a risk-sharing plan and incorporate this plan into procedures and contracts;
- Make timely and informed decisions;
- Select the best methods and processes for the project; and
- Deal with challenges or opportunities as they arise and/or evolve.

In executing its internal risk management approach for other projects, Baird has followed published risk management standards, including four general risk management steps, as shown in Figure 4.5.

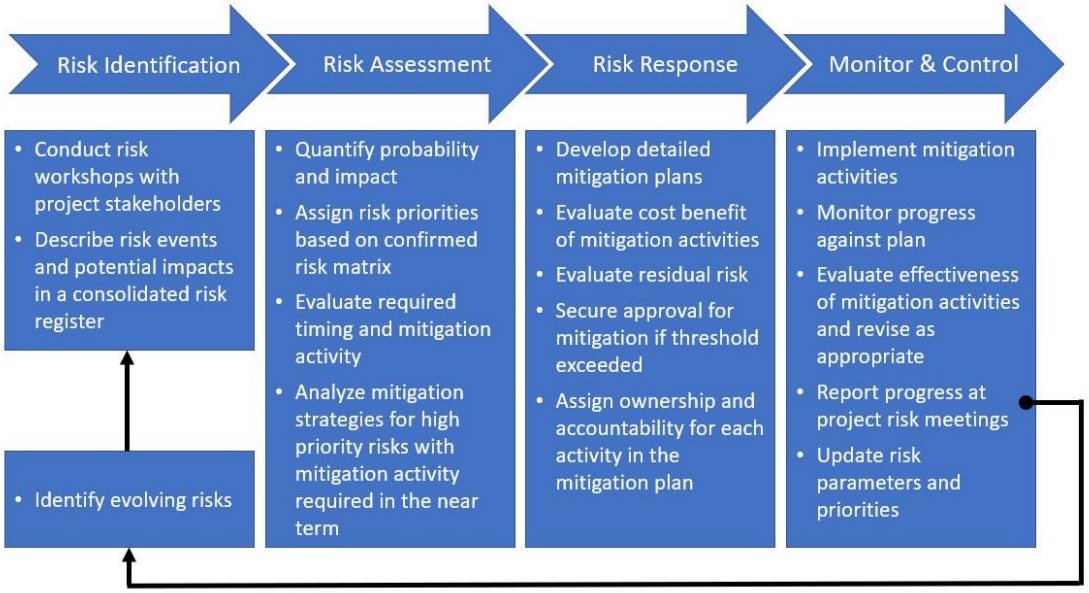


Figure 4.5: Overview of Risk Management Process

The risk assessment will be captured in a Project Risk Register, which is a collaborative, dynamic document. Project participants bring potentially relevant information to the development of the risk register, with stakeholder input being critical to capturing as many project risks as possible. In addition, collaboration among participants assists in mitigating risks and challenges.

Figure 4.6 provides an illustration of the risk assessment worksheet and risk reduction plan, as well as the inputs used to generate the risk score utilized at Baird.

RISK ASSESSMENT RECORD													RISK REDUCTION PLAN#						
Hazard	Unwanted event	Inherent Risk				Existing Controls*	Control Effectiveness (Ineffective) 1– 9 (Highly Effective)	Residual Risk				Recommended Action (Improve existing controls / implement new controls)	By Whom (person responsible for action)	By When (target completion date)	Final Risk			
		Consequence	Probability	Level (E,S,M,L)	Rank (1 to 25)			Consequence	Probability	Level (E,S,M,L)	Rank (1 to 25)				Consequence	Probability	Level (E,S,M,L)	Rank (1 to 25)

Step 1
Determine Consequences (Highest of the two)

	People Consequences		Plant, Property, Productivity Environmental Consequences
1 =	Fatality, Permanent Disability	1 =	More Than $500k Damage. Major Environmental Damage
2 =	Serious Lost Time Injury or Illness	2 =	$100 - $500k Damage. Serious Environmental Damage
3 =	Disabling Short Term Lost Time Injury	3 =	$50k - $100k Damage and/or Production Disruption, Reversible Environmental Damage
4 =	Medical Treatment Injury	4 =	$5k - $50k Damage and/or Slight Production Disruption, Minor Environmental Damage
5 =	First Aid Injury	5 =	Under $5k Damage and Minimal Productivity Disruption, No Environmental Damage

Step 2
Determine Probability

Probability	
A =	Common or Frequent Occurrence > once per day
B =	Is Known To Occur or "It Has Happened" > once per week
C =	Could Occur or Heard of It Happening > once per month
D =	Not Likely To Occur <once per year
E =	Practically Impossible < once per five years

Step 3
Calculate Risk

	A	B	C	D	E
1	1 Extreme	2 Extreme	4 Extreme	7 Extreme	11 Significant
2	3 Extreme	5 Extreme	8 Extreme	12 Significant	16 Moderate
3	6 Extreme	9 Significant	13 Significant	17 Moderate	20 Moderate
4	10 Significant	14 Significant	18 Moderate	21 Low	23 Low
5	15 Significant	19 Moderate	22 Low	24 Low	25 Low

Note: 1-15 Ranking Requires Risk Reduction Plan

Risk Score	Risk Score Response
1 - 15	**Extreme Risk** – Requires urgent attention for resolution. Must be rectified immediately. Task is not to proceed until risk reduced.
16 – 20	**Moderate Risk** – Must be rectified as soon as possible. Prompt planning and resolution required.
21 – 25	**Low Risk** – Consultation and monitoring required.

Figure 4.6: Risk Assessment Tools

The goal of Baird's internal risk reduction plan is to maximize cost-effectiveness through trade-off analysis and to help ensure that project participants understand residual risks and have contingency plans in place to address these risks. In addition to identifying who is best able to manage a particular risk, the risk reduction plan also considers alternative approaches to address the risk, including the following:

- Avoid the risk by changing project strategy or design;
- Mitigate the risk by taking action at additional cost/time to reduce the impact of a risk should it occur;
- Transfer the risk responsibility to another party, such as a contractor or insurer.

At Baird, the risk reduction plan is integral to every project and is a working tool maintained and updated in subsequent project phases in order to incorporate new information/events and to keep the project team aware of risks and opportunities as the project advances through detailed design, construction, and commissioning.

We have allowed for this process to unfold in the South Shore Breakwater project utilizing the Milwaukee County's risk management framework. We assume Milwaukee County's framework is very similar to that described above. A single joint risk meeting has been allowed with multiple stakeholders and the project team in attendance. The meeting will occur following submission of the draft BoD. Following the initial population of the risk register, reviews/updates will occur with the internal team members at the 50% and 90% deliverable levels.

Deliverable: Risk Registers coinciding with 50% and 90% deliverables

4.2.2.3 Task I-3 - Center Breakwater Condition Assessment

The results of the field investigations (visual reconnaissance, UAV topographic survey, and MBS bathymetric survey) will be used to assess the condition of the center section of the breakwater. Specifically, the high-resolution DTM derived from the surveys will be compared to the as-built profiles for the rehabilitation works (2008) in order to identify any significant changes to the structure since its completion in 2008. In addition, a review of available high-resolution imagery since 2008 will be completed to identify any specific areas where stone displacement has occurred. This information will provide an indication of how the rehabilitated structure has performed over the past 13 years, including exposure to severe storms during the recent period of high lake levels.

Deliverable: Center Breakwater Condition Assessment - Summary Memorandum

4.2.2.4 Task I-4 - Public Meeting

The Baird team has been involved in community-based shoreline protection design for resilience and adaptation around the Great Lakes on several recent projects. We understand the importance of generating public support to ensure a successful project outcome. For this project, Baird will coordinate with Milwaukee County to participate in a public workshop to present the design program and solicit feedback on schematic design alternatives and highlight risk and opportunities. The timing and logistics for the public meeting will be defined through consultation with the County. Baird will prepare basic presentation materials for review by the County prior to the presentation and will prepare minutes that provide a summary of key discussion points raised at the meeting.

The schematic design alternatives will subsequently be updated to develop community-supported consensus plans.

Deliverable: Public Meeting presentation and minutes

4.2.2.5 Task I-5 - Regulatory Approval Process

Baird will support the County through the regulatory approval process for the project, including coordination with the regulatory agencies (Wisconsin Department of Natural Resources (WDNR), U.S. Army Corps of Engineers (USACE), City of Milwaukee, and St. Francis, etc.), as required to secure the necessary permits and approvals for the project. The proposed scope of work includes the following tasks:

- Initial meetings with regulatory agencies (as listed above) to discuss the project, the regulatory approval process, key concerns and constraints, and potential requirements for mitigation efforts (assumes onsite mitigation only);
- Development of joint permit application (JPA), including project narrative and project drawings that document the project objectives/justifications, existing conditions, proposed works (plan view and typical sections), project scale (structure length, material volumes, encroachment onto lakebed), anticipated construction means, methods and schedule, and proposed mitigation efforts, if any;
- Two sets of follow-up meetings with regulatory agencies to discuss questions and concerns;
- Submission of revised JPA for review/approval.

It is noted that the regulatory approval process for breakwaters and shoreline protection structures is generally less involved for repair/rehabilitation works, particularly if the footprint of the proposed works is located within the footprint of the original structure. Minimizing the footprint of the proposed works will be a key objective of the design process.

Deliverable: JPA, revised JPA as well as meeting minutes documenting conversations with regulators.

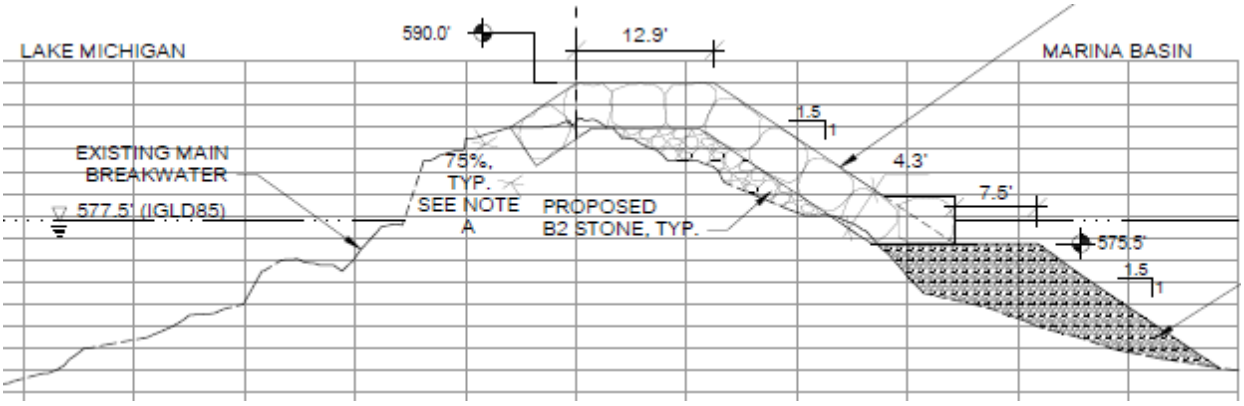
4.2.2.6 Task I-6 - Stormwater Management Plan

It is not anticipated that the Phase 1 project will require a disturbance of greater than 1 acre of upland area within the project boundaries. As such, a storm water management plan is not an anticipated requirement for Phase I.

4.2.2.7 Task I-7 - Design Development

The design and construction of rehabilitation works for a breakwater is significantly more complicated than that for a new structure, as it is very difficult to effectively integrate new works with existing work on such structures. In particular, recent project experience with breakwater rehabilitation projects have demonstrated the challenges and complexities of excavating rock from these structures to create a suitable foundation for the new works, with a full overlay of the structure being easier to build and potentially more cost effective in the long run. On the other hand, a full overlay will result in a larger structure footprint (i.e., encroachment on the lakebed) and may complicate the regulatory approval process. Baird has extensive experience with the planning, permitting, design, and construction of breakwater rehabilitation projects and will leverage this experience to identify the preferred alternative for the Milwaukee South Shore Breakwater project.

Design development for Phase I will advance progressively, with interim submissions at roughly 50% and 90% completion, and a final submission at 100% completion. Each design submission will include a design development report, project plans, technical specifications, an opinion of probable construction cost, and the anticipated construction schedule. A summary of key activities associated with the 50%, 90%, and 100% design effort is provided below.



50% Design (Preliminary Design)

The 50% (preliminary) design task includes the coastal engineering modeling and analyses required to develop/assess alternative design concepts for the proposed breakwater rehabilitation works, including different cross-section configurations and materials. The alternatives assessment will focus on structure stability, wave overtopping/transmission, constructability, geotechnical stability, and cost. Building on the results of the Phase 0 tasks and the requirements specified in the BOD, the 50% design task will include the application of desktop empirical design approaches, complemented by Baird's extensive practical experience with similar projects, to identify the recommended solution for this project. Specifically, the 50% design process will include the following activities:

- Review of BOD requirements with respect to design life, acceptable risk of damage, and level of protection required for existing marine and landside infrastructure;
- Input from regulatory agencies;
- Assessment of construction logistics, including availability of quarried stone, site access, and alternative construction means and methods;
- Development of schematic design drawings for at last two alternative rehabilitation concepts, including structure layout, typical cross-sections, and schematic renderings;
- Preliminary estimate of quantities and rough order of magnitude opinion of probable construction costs;
- Multi-criteria assessment (MCA) of the alternatives, including consideration of the following key factors:
    - Ability to provide effective long-term protection from waves to the infrastructure behind the breakwater;
    - Durability and resilience to extreme events;
    - Site aesthetics and viewsheds;
    - Sustainability and environmental uplift;
    - Ease of permitting (regulatory approval requirements);
    - Constructability and cost (comparative cost estimates);
    - Maintenance requirements;
    - Future adaptability to climate change.

Deliverable: Interim Design Report - The results of the 50% design effort will be summarized in an Interim Design Report. This report will include a discussion of the alternatives considered, the results of the MCA, preliminary design drawings (plan views and typical cross-sections), outline material specifications, quantities, and costs for each alternative. This report will be presented to/discussed with the County, leading to the selection of the preferred alternative for final design.

90% Design (Final Design)

The 90% (final) design task will include a series of activities to advance the 50% design, including the following:

- Refined coastal engineering analyses and additional empirical and/or numerical modeling to develop final structure layouts and cross-sections designs for the selected alternative;
- Refined geotechnical analysis assessing bearing capacity, long term settlement, and slip circle stability based upon available geotechnical information;
- Detailed design drawings, including an overall site plan, structure extents/layouts, typical cross-sections, transition and termination details, and updated schematic rendering;
- Design development for mitigation works (onsite only), if required by regulatory approval agencies (note: it is unlikely that regulatory review comments will have been received at the close of final design);
- Updated estimate of quantities, opinion of probable construction cost, and construction schedule. Engineer's Opinion of Probable Construction Costs (OPCC) will be detailed to an AACE Class II level having an accuracy of -15 to +20%. The OPCC will be developed utilized construction crew-based cost estimation software (MCACES MII) and pricing input from applicable material suppliers;
- Draft specifications for key elements of the proposed works, including general (Division 1) and technical specifications as per SpecsIntact organization and content (as used by the USACE, NAVFAC, and NASA), with refinements based on Baird's experience with similar projects;
- Discussion of construction contract types and procurement options with the County and identification of preferred approach for tendering the project;
- Draft of Front End documents (Instructions to Bidders, General Conditions, Particular Conditions, Bid Form, etc.);
- Preparation of supplemental information to be included with Bid Documents, such as summary of physical and environmental site conditions.

Deliverable: Final Design Report - The results of the 90% design effort will be summarized in a Final Design Report including the OPCC. Other deliverables will include 90% set of construction documents for the project including the Front End, design drawings, technical specifications, and supplementary information.

100% Design (Construction Documents)

Pending review/comment on the 90% design submission by the County, Baird will prepare the 100% design documents (Bid Documents), including the Front End, design drawings, technical specifications, and supplementary information and will structure these documents to provide best bidding value. These documents will be complete and ready for the County to proceed with bidding of Phase I – North Section Rehabilitation Works. As the regulatory review process may not be complete prior to closing out this study, some changes to the documents may be required in the future to reflect the results of this process.

Deliverable: Bid Documents

4.2.3 Phase II - South Section Alternatives Analysis + Planning/Design

In general, the approach and methodology to Phase II will follow that described above for Phase I. The following sub-sections provide a summary of the Phase II tasks and activities, highlighting those areas where there are significant differences between Phases I and II. Additional detail on each task and activity can be found in the Phase I descriptions.

4.2.3.1 Task II-1 - Basis of Design

Baird will coordinate with the County to establish functional requirements and design criteria for the south section of the project, including consideration of the specific requirements associated with protecting existing marine and landside infrastructure, including the south end of Bay View Park. This information will be incorporated into a draft Basis of Design (BOD), with the BOD to include the following information:

- Project goals/objectives, functional requirements, and design criteria;
- Physical and environmental site conditions;
- Applicable codes, design standards, and guidelines.

The BoD establishes the key objectives of the project and their justifications and serves as a record of what choices were made and why, including written documentation of key cost versus risk decisions. For example, the BoD will document the level of shoreline protection that is required along Bay View Park, with this information ultimately dictating the selection of breakwater rehabilitation works versus breakwater removal and the construction of a new shoreline revetment. The BoD is a living document that will be updated throughout design process.

Deliverable: Draft Basis of Design – South Section

4.2.3.2 Task II-2 - Risk Management

A single joint risk meeting has been allowed with multiple stakeholders and the project team in attendance. The meeting will occur following completion of the draft BoD. Following the initial population of the risk register, reviews/updates will occur with the internal team members at the 50% and 90% deliverable levels.

Deliverable: Risk Registers coinciding with 50% and 90% deliverables

4.2.3.3 Task II-3 – Feasibility Study/Alternatives Assessment

This task involves the development and assessment of alternative design concepts for the south section, including rehabilitation of the offshore breakwater, or removal of the breakwater and construction of a new shoreline revetment. Baird's extensive experience with similar projects will be of significant value in identifying, developing, and assessing alternative concepts, with the objective of this task being the selection of a preferred design concept that will provide a long-term, cost effective shoreline protection system.

Of note, Baird, completed a similar study for the center section of the Milwaukee South Shore Breakwater in 2003, the results of which are summarized in Figure 4.7. Notably, this study demonstrated a significant reduction in wave overtopping and transmission as the breakwater crest elevation is raised, but found that the extreme wave conditions at the shoreline are not significantly reduced as they are depth-limited. This study clearly demonstrated that the most cost-effective way to protect the shoreline is by building a revetment and not by raising the crest of the offshore breakwater. This analysis will be updated for the south section of the breakwater, as per the requirements in the RFP.

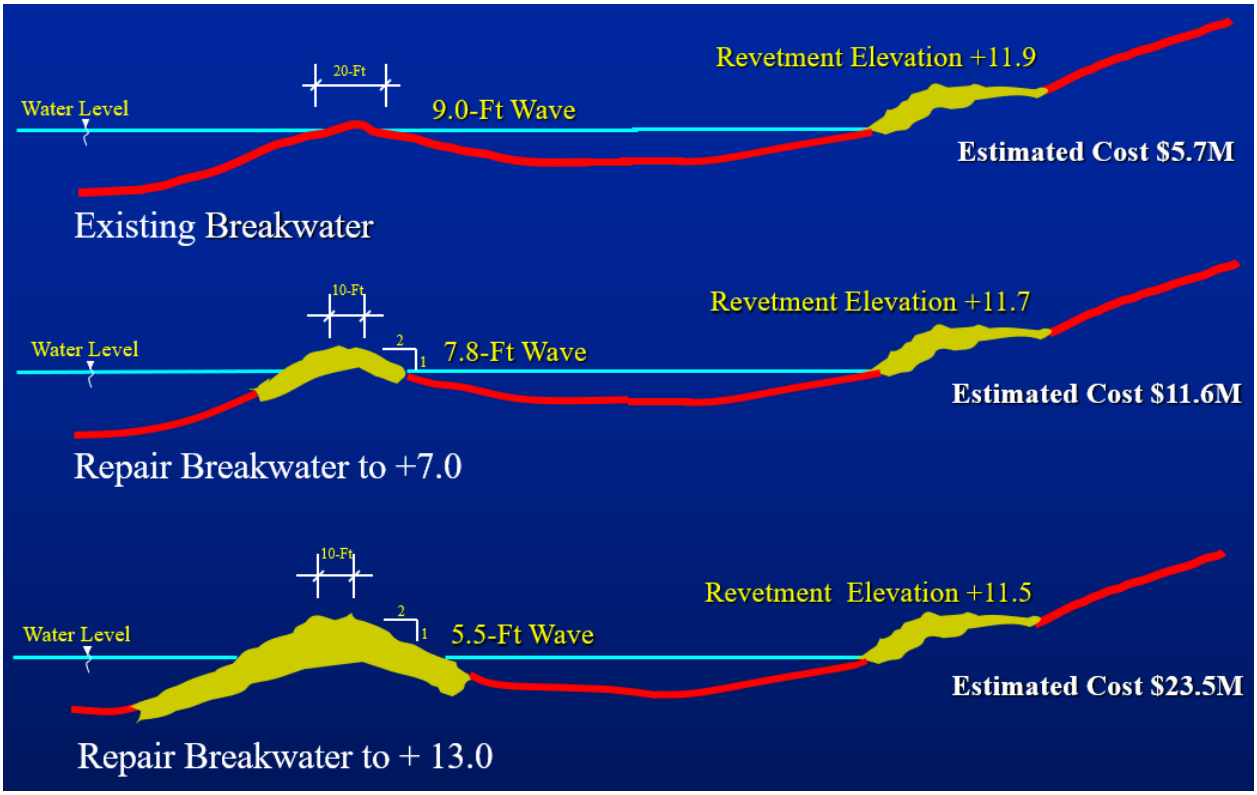


Figure 4.7: Summary of Baird (2003) Assessment of Alternatives for Center Section

The assessment of alternatives for the south section will consider the following:

- Functional requirements as per the BoD.
- Results of condition assessment for rehabilitation of center section of breakwater and experience gained with performance of South Shore Park revetment during recent period of high lake levels.
- Rehabilitation options for the existing breakwater, including consideration of the challenges associated with excavating/regarding the existing structure as well as the benefits of maximizing the reuse of materials in the structure. At this time, we anticipate that design concepts may include a new overlay of large armor stone (as done for the center breakwater) or encapsulation of the existing structure within an energy absorbing berm. The berm breakwater concept was pioneered by Baird in the early 1980s; it allows the use of smaller armor stone than a conventional design through the use of a wide, porous berm of stone to dissipate wave energy, and provides improve use of the quarry yield and simplified construction. While not suited to every project, the berm design can provide significant cost savings in some cases.
- Partial removal of the offshore breakwater, leaving a submerged reef as a habitat feature, or full removal (to the original lakebed) in combination with a new revetment to provide effective shoreline protection for Bay View Park (similar to the South Shore Park revetment designed by Baird).
- Develop at least two alternative concepts, including comparative cost estimate and multi-criteria assessment (MCA) of key issues, such as design certainty, risk of damage, environmental impacts, constructability, and cost (refer to example in Table 4.1).
- Comparative cost estimate to include preliminary estimate of quantities and rough order of magnitude opinion of probable construction costs.

Table 4.1: Example of Multi-Criteria Assessment of Alternatives for Rubble Mound Repair/Rehabilitation

Consideration	Alternative 1	Alternative 2	Alternative 3
Prior Experience with Similar Repair Works?	Yes	Yes	Yes
Design Uncertainty (Ice)	Moderate	Low	High
Risk of Damage if Design Event Exceeded	High	Low	High
Complexity of Transition to Existing Structure	Low	Moderate	Moderate
Difficulty to Repair in Future	High	Moderate	High
Material QC/QA Requirements	Average	High	Average
Placement QC/QA Requirements	Average	Low	High
Navigation Issues	Reduced Entrance Submerged Bench	Reduced Entrance	Reduced Entrance Submerged Bench
Estimated Construction Cost	$3.5 M	$4.4 M	$2.7 M
Potential for Design Refinement and Cost Savings	Low	High	Low

The results of the alternatives assessment will be documented in a summary memorandum and presented to/discussed with the County, leading to the selection of a preferred alternative for final design development. This task will close the feasibility portion of the work defined in the RFP.

Deliverable: Summary Memorandum – Alternatives Analysis for South Section

4.2.3.4 Task II-4 – Public Meeting

Similar to Task I-3, Senior representatives from Baird's team will attend a public meeting for Phase II. The objective of the public meeting will be to present an overview of the project, alternatives considered, schematics of the proposed design, and the anticipated execution program (schedule). The timing and logistics for the public meeting will be defined through consultation with the County. Baird will prepare presentation materials for review by the County prior to the presentation and will prepare minutes that provide a summary of key discussion points raised at the meeting.

Deliverable: Public Meeting presentation and minutes

4.2.3.5 Task II-5 – Regulatory Approval Process

Baird will support the County through the regulatory approval process for the project, including coordination with the regulatory agencies (WDNR, USACE, City of Milwaukee, and St. Francis, etc.), as required to secure the necessary permits and approvals for the project. The proposed scope of work associated with the regulatory approval process for the south section (Phase II) is generally similar to that described in Task I-4 for the north section (Phase I).

As noted in the RFP (Amendment 2), our proposal assumes that the Phase II works will include rehabilitation of the existing breakwater. Should the selected design for the south section include partial or full removal of the offshore breakwater and the construction of a new shoreline revetment, the scope of the regulatory approval process and associated fee may need to be reviewed and adjusted.

Deliverable: JPA, revised JPA as well as meeting minutes documenting conversations with regulators.

4.2.3.6 Task II-6 – Stormwater Management Plan

As noted in the RFP (Amendment 2), our proposal assumes that the Phase II works will include rehabilitation of the existing breakwater. It is not anticipated that the assumed Phase II project will require a disturbance of greater than 1 acre of upland area within the project boundaries. As such, a storm water management plan is not an anticipated requirement for Phase II.

4.2.3.7 Task II-7 – Design Development

Design development for Phase II will advance progressively, with interim submissions at roughly 50% and 90% completion, and a final submission at 100% completion. Each design submission will include a design development report, project plans, technical specifications, an opinion of probable construction cost, and the anticipated construction schedule. The design approach/methodology for Phase II will generally follow that described earlier for Phase I, as summarized below. More detailed information on the key activities associated with the 50%, 90%, and 100% design effort is presented under Task I-6.

50% Design (Preliminary Design)

The 50% (preliminary) design task includes the coastal engineering modeling and analyses required to develop/assess alternative design details for the proposed breakwater rehabilitation works, including different cross-section configurations and materials (also refer to Task II-2). The assessment of alternative design details will focus on structure stability wave overtopping/transmission, geotechnical stability, constructability, and cost. Building on the results of the Phase 0 tasks and the requirements specified in the BoD, the 50% design task will include the application of desktop empirical design approaches, complemented by Baird's extensive practical experience with similar projects, to identify the recommended details for this project.

Deliverable: Interim Design Report - The results of the 50% design effort will be summarized in an Interim Design Report. This report will include a discussion of the alternative design details considered, the results of the MCA, preliminary design drawings (plan views and typical cross-sections), material specifications, quantities, and costs for each alternative. This report will be presented to/discussed with the County, leading to the selection of the preferred alternative for final design.

90% Design (Final Design)

The 90% (final) design task will include a series of activities to advance the 50% design, including the following:

- Refined coastal engineering analyses and additional empirical and/or numerical modeling for the selected alternative;
- Detailed design drawings and updated schematic rendering;
- Design development for mitigation works (onsite only), if required by regulatory approval agencies (note: it is unlikely that regulatory review comments will have been received at the close of final design);
- Updated estimate of quantities, opinion of probable construction cost, and construction schedule;
- Draft specifications for key elements of the proposed works;

- Discussion of construction contract types and procurement options with the County and identification of preferred approach;
- Draft of Front End documents;
- Preparation of supplemental information to be included with Bid Documents.

Deliverable: Final Design Report - The results of the 90% design effort will be summarized in a Final Design Report. This report will include 90% complete set of construction documents for the project including the Front End, design drawings, technical specifications, and supplementary information.

100% Design (Construction Documents)

Pending review/comment on the 90% design submission by the County, Baird will prepare the 100% design documents (Bid Documents), including the Front End, design drawings, technical specifications, and supplementary information and will structure these documents to provide best bidding value. These documents will be complete and ready for the County to proceed with bidding of Phase II – South Section Rehabilitation Works. As the regulatory review process may not be complete prior to closing out this study, some changes to the documents may be required in the future to reflect the results of this process.

Deliverable: Bid Documents

5. Project Management and Quality Control

5.1 Project Management

Baird will implement a robust project management plan approach for the project. This section provides an overview of the proposed approach to be implemented by the project management team. It is noted that the approach has been successfully applied by Baird to many similar coastal planning projects, and also to much larger and more complex coastal and marine infrastructure projects.

Baird's project management process is geared towards consistently producing high quality deliverables that are a strong reflection of the habits of good organization, clear communication, and concise documentation. At the core of our management process is the Project Management Plan (PMP). The PMP is a written document that contains all items necessary for the team to commence, execute, monitor, quality control, and close-out the project. The PMP is created at the beginning of a project and is presented to the project team prior to the project kick-off meeting. It typically includes the following information:

- *Project and Team Description* – Define project and the role of the team member firms and named individuals who will be doing the work, including contact details.
- *Project Tasks and Milestone Schedule* – Indicates task leader and task budget, broken down to an appropriate level as well as all deliverables and due dates.
- *Work Plan* – Detailed schedule showing major tasks, sub tasks, durations, and due dates (Gantt chart), tying in to the major project tasks and deliverable dates listed above.
- *Communication* – Describe how external communication with the client will be handled, internal communication, FTP, and SharePoint sites.
- *Quality Assurance/Quality Control* – Summarizes the requirements of the project specific Quality Control Plan (QCP) and lists the reviewers for each deliverable in the main body of the PMP.
- *Safety* – Reference the company Safety Manual and any salient issues pertinent to the project.
- *Accounting* – Specifics related to invoicing or payment.
- *Risk Register* - Potential risks are listed on a risk register and analyzed in terms of probability and impact, and appropriate mitigation and ownership are identified. Where a risk cannot be fully eliminated, it will only be accepted on the basis that it has been mitigated to the fullest practical extent.
- *Confidentiality* – Explains the basis of confidentiality, the associated requirements, and how it will be maintained (e.g., emails, network folder accessibility, communication, reference for other proposals).
- *Important Information* – This section is optional and would contain project specific information that would not normally be contained in the above sections, such as site accessibility and notable contract requirements.

5.2 Quality Control

Baird is committed to quality and have a Quality Management System that has been certified by Bureau Veritas against the requirements of ISO 9001:2015.

In addition, as part of the PMP, Baird develops Quality Control Plan (QCP) that is tailored to the specific requirements of each project. The QCP format is similar to that used by the US Army Corps of Engineers, which undertakes thousands of projects across the globe on an annual basis. Additionally, our quality control process has been audited by various Clients and has met or exceeded expectations.

The QCP is prepared by the Project Manager (Mr. Brent Sumner) and is reviewed and approved by the Project Quality Assurance Manager (Mr. Dave Anglin), who will check for compliance against company practice. The QCP will also tie in the requirements of all sub-consultants working on the project. The document will cover the following key items:

- *Project Team* – Project Manager, task leaders, subordinates, and type of work – this is the staff that will be doing project work on a daily basis. It can consist of anyone on the Baird team, including sub-consultants. Individual team members are required to check their own work and then have a supervisor perform a subsequent check to ensure the task is complete, and results are realistic.
- *Quality Control Reviewers* – These individuals are not involved with the project on a daily basis, but are brought into review the project approach and key deliverables. QCRs will attend the internal project kick-off meeting to understand the scope and purpose of the work, and to meet the project team, and will also participate in project meetings at key milestones. The QCRs are selected based on their technical background, experience, and knowledge of their specialty.
- *Review Schedule and Documentation Process* – These comprise a milestone list of when the QCRs will provide input into methodology or review of draft deliverables. Notes are prepared by the QCRs and provided to the task leaders when reviewing methodology, and formal comments are prepared and submitted to the PM and task leader when reviewing draft deliverables. All comments are discussed in detail and an approach to resolve them is determined among the project team and QCR.

It this case, Dave Anglin will act as the QCR and will be responsible for completing an independent technical review (ITR) of the project as it progresses, with the ITR to include intermittent reviews of the progress/results of the project as it advances.

6. Project Schedule and Workplan

6.1 Project Schedule

Figure 6.1 presents the anticipated schedule for the proposed study and illustrates the progression of tasks for Phases 0, I and II. The total estimated duration of the study is approximately 6.5 months. Assuming we receive an executed contract and notice to proceed by September 17th (as noted in the RFP), we anticipate that the Phase I study (100% design documents for north section, and feasibility study/alternatives analysis for south section) can be completed by Dec. 31, 2021, with the Phase II study (100% design documents for south section) to be completed by March 31, 2022.

Schedule Notes

- Task 0-1 - Project Management/Quality Control – task is intermittent throughout the study
- Task 0-4 – Field Investigations – task duration includes planning, field data collection, and data processing
- Tasks I-2 and II-2 – Risk Management – task is intermittent throughout the study, with updated risk registers at key milestones
- Tasks I-5 and II-5 – Regulatory Approval Processes – task duration extends through joint permit application submittal; we anticipate additional six months to receive permits
- Assumes 1 week client review periods for major deliverables

ID	Task Name	Duration	Start	Finish
1	**South Shore Breakwater**	**140 days**	**9/17/2021**	**3/31/2022**
2	**Notice to Proceed**	**0 days**	**9/17/2021**	**9/17/2021**
3	Task 0-1 - Project Management and Quality Control	140 days	9/17/2021	3/31/2022
4	**Phase 0 - Preliminary Studies**	**40 days**	**9/17/2021**	**11/11/2021**
5	Task 0-2 - Kickoff Meeting	1 day	9/17/2021	9/17/2021
6	Task 0-3 - Review Available Information	2 wks	9/17/2021	9/30/2021
7	Task 0-4 - Field Investigations	4 wks	10/8/2021	11/4/2021
8	Task 0-5 - Coastal Modeling and Analysis	4 wks	10/15/2021	11/11/2021
9	Task 0-6 - Sustainability	1 wk	11/5/2021	11/11/2021
10	Task 0-7 - Phase 0 Report	2 wks	10/29/2021	11/11/2021
11	**Phase I - N. Breakwater Planning & Design**	**45 days**	**10/29/2021**	**12/30/2021**
12	Task I-1 - Basis of Design	2 wks	11/5/2021	11/18/2021
13	Task I-2 - Risk Management	5 wks	11/22/2021	12/24/2021
17	Task I-3 - Center Breakwater Condition Assessment	3 wks	11/5/2021	11/25/2021
18	Task I-4 - Public Meeting	1 day	11/19/2021	11/19/2021
19	Task I-5 - Regulatory Approval Process	7 wks	11/12/2021	12/30/2021
23	Task I-6 - Stormwater Management Plan	0.1 days	12/30/2021	12/30/2021
24	**Task I-7 Design Development**	**45 days**	**10/29/2021**	**12/30/2021**
25	50% Design Deliverables	4 wks	10/29/2021	11/25/2021
26	50% Design Deliverables Client Review	1 wk	11/26/2021	12/2/2021
27	90% Design Deliverables	2 wks	12/3/2021	12/16/2021
28	90% Design Deliverables Client Review	1 wk	12/17/2021	12/23/2021
29	Final Design Deliverables	1 wk	12/24/2021	12/30/2021
30	**Phase II - S. Breakwater Planning & Design**	**95 days**	**11/19/2021**	**3/31/2022**
31	Task II-1 - Basis of Design	2 wks	11/19/2021	12/2/2021
32	Task II-2 - Risk Management	16 wks	12/6/2021	3/25/2022
36	Task II-3 - Feasibility Study / Alternatives Analysis	4 wks	12/3/2021	12/30/2021
37	Task II-4 - Public Meeting	1 day	1/28/2022	1/28/2022
38	Task I-5 - Regulatory Approval Process	10 wks	1/21/2022	3/31/2022
42	Task II-6 Stormwater Management Plan	0.1 days	3/31/2022	3/31/2022
43	**Task II-7 - Design Development**	**60 days**	**1/7/2022**	**3/31/2022**
44	50% Design Deliverables	6 wks	1/7/2022	2/17/2022
45	50% Design Deliverables Client Review	1 wk	2/18/2022	2/24/2022
46	90% Design Deliverables	3 wks	2/25/2022	3/17/2022
47	90% Design Deliverables Client Review	1 wk	3/18/2022	3/24/2022
48	Final Design Deliverables	1 wk	3/25/2022	3/31/2022

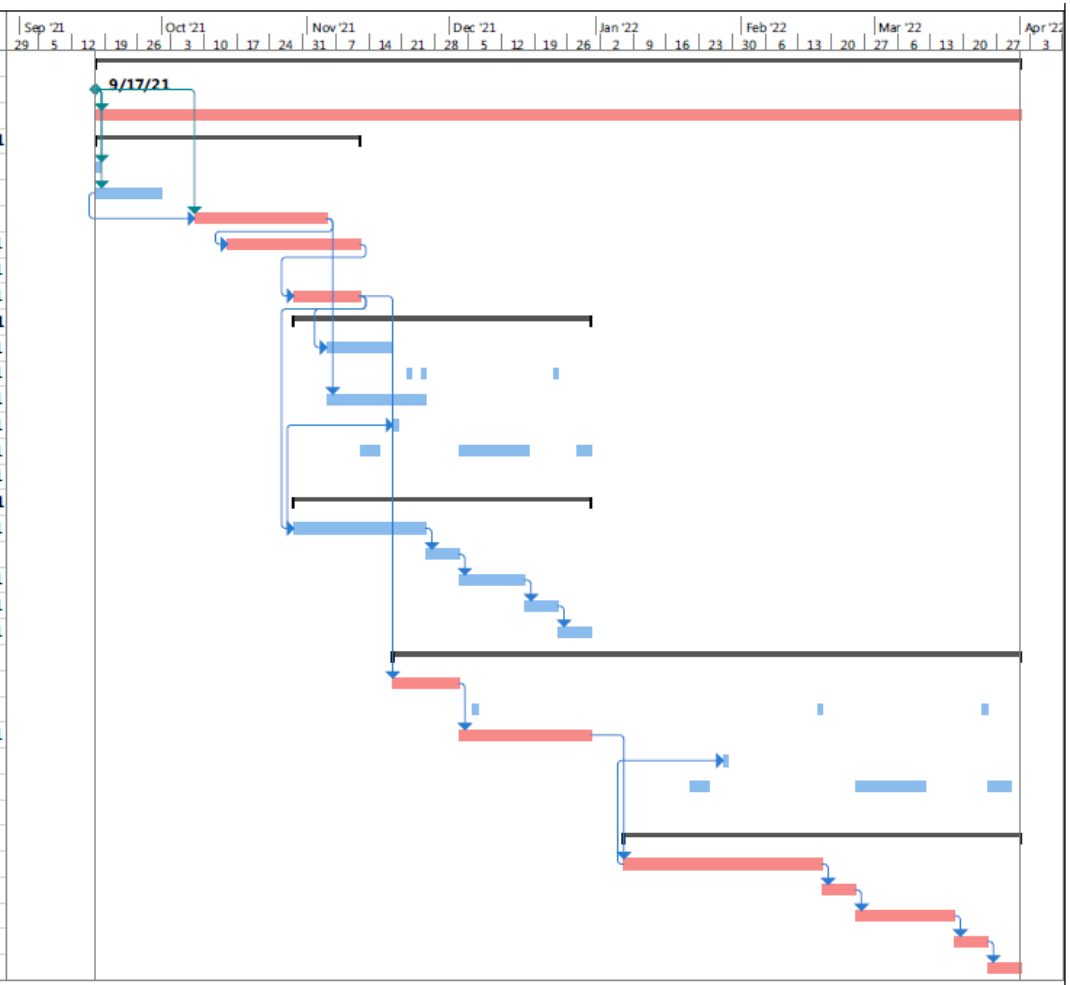


Figure 6.1: Anticipated Project Schedule

6.2 Project Workplan

Table 6.1 presents a detailed breakdown of the level of effort and cost associated with the proposed project. As noted earlier, the Phase 0 costs, which include tasks that are relevant to both Phases I and II, have been split 60/40 for the purpose of defining the total lump sum costs for Phases I and II, as required in the RFP. The total estimated costs for Phases I and II are $351,361 and $347,838 respectively. The total estimated project cost is $699,199, including $69,920 (10%) for our TBE sub-consultant, Resolution Studio, LLC.

Table 6.1: Study Work Plan – Estimated Level of Effort and Cost

Task	Anglin $260	Clark $241	Sumner $225	Barth $196	Woods $225	Sikdar $225	Dibajnia $241	Agnew $196	Rusek/ Dorvinen $132	CAD Tech. $120	Admin. Staff $94	Expenses	TBE Sub	Non-TBE Sub	Task Cost
Phase 0															
0-1. Project Management and Quality Control	46	16	96	44				44	32	4		$1,650			$61,018
0-2. Kickoff Meeting	2		8	8								$275			$4,163
0-3. Review Available Information	12	2	4	8	4	8	16	8	24	8					$18,322
0-4. Field Investigations	10	2		16				16	128			$16,500	$15,400	$30,030	$88,180
0-5. Coastal Modeling and Analysis	22			4			2		96			$1,351			$21,009
0-6. Sustainability					40										$9,000
0-7. Report	4	2	24					24			24				$13,882
Phase I															
I-1. Basis of Design	24	2	48	24				24	8		44				$32,122
I-2. Risk Management	8	2	8	8		4	4								$7,794
I-3. Center Breakwater Existing Condition Assessment	4		8	8						40					$9,208
I-4. Public Meeting	2	2	8	8				24			8	$275			$10,101
I-5. Regulatory Approval Process	18	12	4	40				40	32		8				$29,128
I-6. Stormwater Management Plan															
I-7. Design Development	49.1		205.6	80.4				80.4	16.5	184			$18,876		$133,664
Phase II															
II-1. Basis of Design	21.6	1.8	43.2	21.6				21.6	7.2	7.2	39.6				$29,774
II-2. Risk Management	8	2	8	8		4	4								$7,794
II-3. Alternatives Assessment	48	16.5	21	22		11	49.5	22	30	16	1	$1,260	$17,164		$68,608
II-4. Public Meeting	2	2	8					24			8	$275			$8,533
II-5. Regulatory Approval Process	18	12	4	40				40	32		8				$29,128
II-6. Stormwater Management Plan															
II-7. Design Development	44.2		179.0	69.4				69.4	3.5	165.6			$18,480		$117,771
Total Hours	342.8266667	74.3	676.84	409.36	44	27	75.5	437.36	409.1866667	424.8	140.6				
Total Cost	$89,135	$17,906	$152,289	$80,235	$9,900	$6,075	$18,196	$85,723	$54,013	$50,976	$13,216	$21,586	$69,920	$30,030	$699,199
% of time	11.20%	2.43%	22.11%	13.37%	1.44%	0.88%	2.47%	14.28%	13.36%	13.87%	4.59%				

Initial Contract:	
0-1 PM	$5,000
0-2 Kickoff	$4,163
0-4 Field Investigation	$88,180
Total	$97,343

Fee Inc 1:	
Remainder of Fee	$601,856
Initial Contract	$97,343
Fee Inc 1	$601,856
Revised Contract Total	$699,119

7. Fee Proposal

The total estimated project cost is $699,199, including $69,920 (10%) for our TBE sub-consultant, Resolution Studio, LLC. The total estimated costs for Phases I and II are $351,361 and $347,838 respectively, as summarized below:

Phase I – North Section

- Baird fees $293,086 (1,575 hours of staff labor)
- Direct expenses $12,141 (travel costs and numerical modeling fees)
- TBE sub-consultant $28,116
- Other sub-consultants $18,018
- **Total Phase I Cost $351,361**

Phase II – South Section

- Baird fees $284,577 (1,487 hours of staff labor)
- Direct expenses $9,445 (travel costs and numerical modeling fees)
- TBE sub-consultant $41,804
- Other sub-consultants $12,012
- **Total Phase II Cost $347,838**

Baird is prepared to undertake this project for a lump sum fee of $699,199 and is prepared to start work immediately upon the execution of a mutually acceptable professional services agreement with Milwaukee County.

For the purposes of this proposal, we have assumed that a rubble mound rehabilitation approach is viable for the north section of the breakwater, generally consisting of an overlay of new armor stone on the existing breakwater. If it is determined that the existing timber cribs cannot support the increased loading associated with the armor stone overlay, an alternative solution may be required. This may have implications on the project approach and cost, potentially requiring the following additional work to support design development:

- More detailed assessment of existing structure (timber cribs);
- Geotechnical investigation;
- Structural modeling and analyses.

Also, as noted in the RFP (Amendment 2), our proposal assumes that the Phase II works will include rehabilitation of the existing breakwater. In the event another alternative is selected, such as removal of the breakwater and construction of a new shoreline revetment, the following additional work may be required to support design development:

- Shoreline topographic survey, geotechnical investigation, and utility locates;
- Wetland delineation;
- Storm water management plan;
- Additional geotechnical and coastal design analysis.

It is anticipated that the requirement for significant changes in the assumed design concept, such as those discussed above, would be identified during Phase I (field work for north and south sections and feasibility

study for south section). Should Baird identify the potential need for such changes, we will notify the County immediately and work with them to develop an updated approach and cost to complete the project. This may influence the overall schedule for the project, particularly given that field data is not easily gathered during the winter months.