

# Coastal Erosion Hazard Map – LSN1W1P Implementation Project

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This Work Plan Template outlines tasks, budgets and schedules for the development of Lake Superior North Shore Coastal Erosion Hazard Map. ***This workplan is subject to change depending on funding availability and increased knowledge of the project as tasks progress.***

This Workplan has 4 Sections:

1. Background Information
2. Logistics – Coordination of Project and Key Objectives
3. Budget Summary
4. Tasks and Workplan in 4 Phases



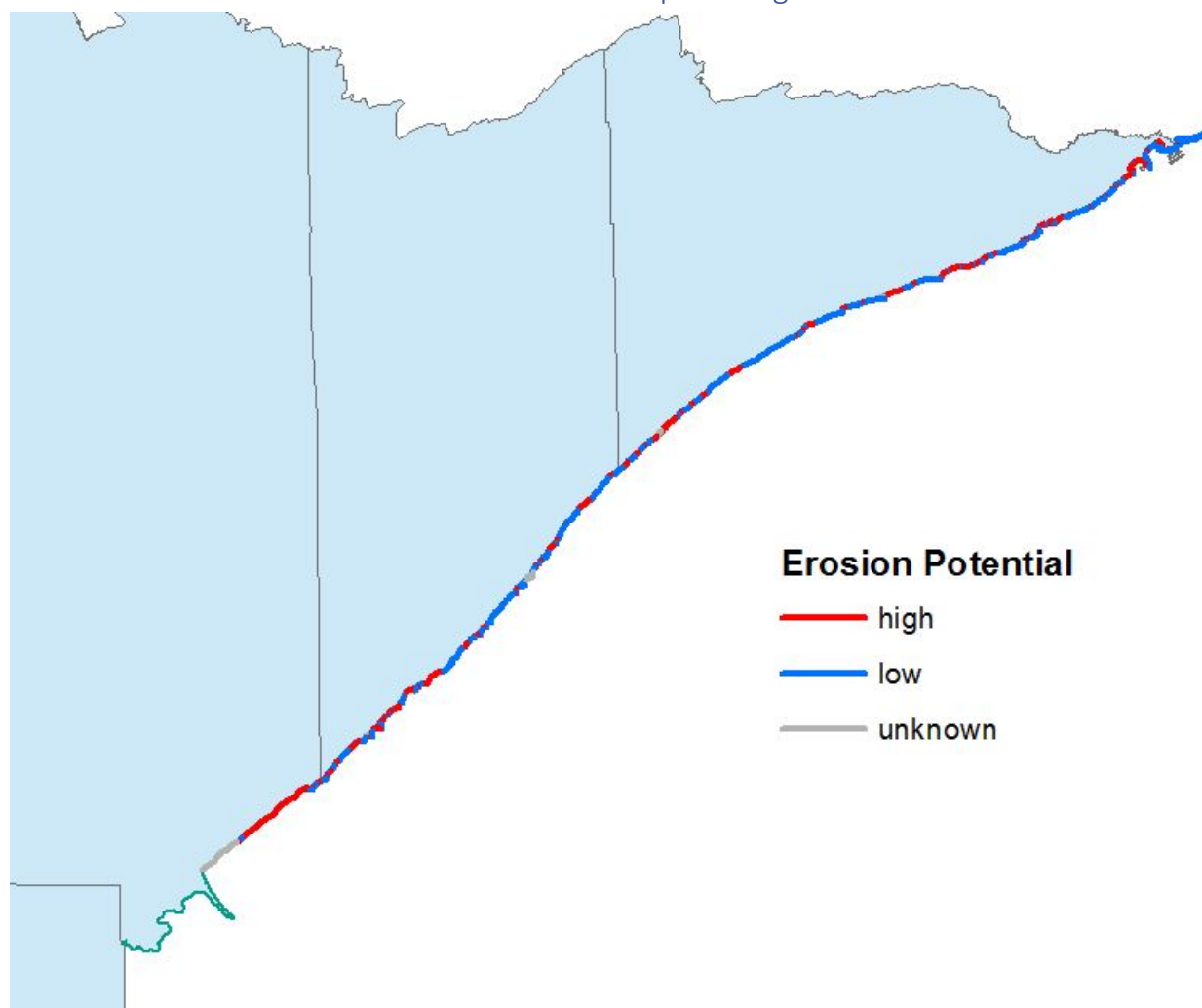
LAKE COUNTY  
**Soil & Water**  
CONSERVATION DISTRICT  
408 1<sup>st</sup> Avenue  
Two Harbors, MN 55616  
(218) 834-8370  
[www.co.lake.mn.us/swcd](http://www.co.lake.mn.us/swcd)



COOK COUNTY  
**Soil & Water**  
CONSERVATION DISTRICT  
411 W 2<sup>nd</sup> St.  
Grand Marais, MN 55604  
(218) 387-3647  
[www.cookswcd.org](http://www.cookswcd.org)



Work Plan Section 1: Coastal Erosion Hazard Map – Background Information



**2012 Coastal Erosion Hazard Study:** 204 miles of shoreline with 69 miles deemed “high risk” for erosion.

In 2012, a 100-year storm event caused part of a landowner’s sloughing clay bluff along the Northern Lake Superior Shoreline to fall into the lake, increasing sediment loading to Lake Superior, causing financial hardship, and threatening the landowner’s property infrastructure. Another landowner has seen a changing shoreline since ownership, altering area hydrology and recreation along their beach. As tourism and development has increased in the region, and water levels in an ever-changing Lake Superior have continued to rise, pressure on Lake Superior’s fragile shoreline areas has increased. Landowners are unaware of the erosion risk for their coastal properties, and LGUs have insufficient resources to provide well-informed assistance to inquiring entities.

Shoreline erosion affects landowner property values and structures, yet also impacts water quality and habitat for critical species. Erosion along the approximately 36-miles of unstable clay shoreline along the North Shore of Minnesota affects Lake Superior’s water quality, as evidenced in a 1995 study by C. Johnston and B. Johnston “Relationship of Lithology and Geomorphology to Erosion of the Western Lake Superior Coast.” Shoreline erosion was once estimated at 58% of total sediment load in Lake Superior, with 37% introduced from the western end of the lake. Erosion from the shoreline is caused by bank

sloughing or beach wash away, which deposits sediment into the near shore area and lead to higher total suspended solids (TSS) concentrations, increasing water temperatures and decreasing light penetration. Increased nearshore substrate concentrations and limited light availability could lead to habitat loss and a reduced reproductive capacity for near shore biological communities, which thrive and concentrate in the deep waters close to the Lake Superior shoreline.

Erosion is exacerbated during storm events. At an average increase of 2 degrees per decade, Lake Superior's rising water temperatures are leading to more storm events. Storm events further intensity with high water levels, which have also increased in recent years. Increased wave action due to high water levels are evidenced in the Great Lakes Coastal Flood Study 2018 draft findings for Lake Superior from the Federal Emergency Management Agency (FEMA) and partners. An increase in storms and storm intensity from higher and warmer water levels in coastal areas, such as the Lake Superior shoreline where most of the populations of Lake, Cook, and St. Louis Counties are located, cause infrastructure damage, economic impacts, and threats to human safety.

Coastal erosion impacts the Lake Superior North Shore community and environment by stressing:

- Lake Superior water quality and nearshore biological communities through increased erosion
- Coastal community infrastructure, economy, and resiliency considering increasing storm events

Current coastal erosion hazard mapping data does exist to mitigate and plan for stressors on the coastal community, but is not consistent, thorough, or readily available to the public. Coastal erosion hazard mapping data currently exists from a few sources:

- The NSMB defines Erosion Hazard Areas as “those areas of Lake Superior's North Shore where the long-term average annual rate of recession is one foot or greater per year.” To guide shoreland management, the NSMB has outlined specific areas based on a study by the technical committee in the original management plan creation in 1988.
- Additional erosion hazard mapping has been completed by the Natural Resources Research Institute (NRRI) in 1989 based on aerial photography from the 1930s, 1975, and 1988/89. ([http://nrri.d.umn.edu/coastalGIS/coastal\\_atlas/PDFS/sqbull44.pdf](http://nrri.d.umn.edu/coastalGIS/coastal_atlas/PDFS/sqbull44.pdf)). Lake County did conduct field studies of areas thought to be erosion prone at the time as well.
- FEMA completed a Coastal Flood Hazard Study and Flood Insurance Rate Map (FIRM) for the Lake Superior and Great Lakes Region which is currently in draft form (<https://www.fema.gov/coastal-flood-risk-study-process>).
- Minnesota State Hazard Mitigation Planning efforts have completed emergency and hazard mapping in select counties.
  - UMD-GAC is facilitating the update of the Cook County (2018), St Louis County (2019), and the MN State Hazard Mitigation Plans (2019) which, among other things, outline mitigation actions for each natural hazard. In addition to the HMP being a great planning tool, having an adopted HMP is what qualifies the jurisdiction to be eligible for certain FEMA and MN State Mitigation grant funds.
  - Grants are available through the State Hazard Mitigation Plan (and the FEMA and State Mitigation Grant Programs) with the Minnesota State Homeland Security and Emergency Management Office (HSEM). These plans look to subject matter experts and

stakeholder groups to identify the mitigation actions to include in each plan that reflect statewide priorities. Coastal hazards need to be greater expressed in statewide prioritization efforts.

Although data for Lake Superior's coastal region does exist, current mapping efforts do not directly address coastal erosion along the dynamic North Shore. As projects have occurred through a multitude of entities, data is not continuous. Most mapping efforts occurred 30 years ago, rendering them outdated considering increased water levels and storm cycles. These limitations make it difficult for LGUs or landowners to use existing coastal data and mapping tools in decision making.

A coastal erosion hazard map will address the risks and stressors placed on the Lake Superior coastal community. This map and data will be utilized upon completion by partners to this grant:

- For land use decision making or ordinance changes and more informed technical assistance
- By landowners, realtors, and interested parties before purchase or development, and
- By the North Shore Management Board (NSMB). After adoption of the Minnesota DNR's Shoreland Management Area zonation enforcement capacity for Lake Superior's North Shore through the 1988 North Shore Management Plan, the NSMB has including erosion hazard enforcement, planning, and mapping in the Joint Powers Board's specific scope of work. The NSMB defines erosion hazard areas as "those areas of Lake Superior's North Shore where the long-term average annual rate of recession is one foot or greater per year."
  - Developing an updated Erosion Hazard Area Map for the NSMB planning area was identified as one of 4 priority projects in the 2004 plan update, available at: <http://www.arrowheadplanning.org/documents/North%20Shore%20Management%20Plan%20Update/ErosionHazardAreaPlanningDefinitionProcess.pdf>
  - In the 2008 Plan updated, the NSMB included an "Erosion Hazard Area Planning Process Definition" Document which outlines steps to create an updated erosion hazard map: aerial photograph review, determining erosion rates, rate analysis and determining factors, soil and bedrock review, final identification of erosion hazard areas, map development, recommendation development, and long-term monitoring. <http://www.arrowheadplanning.org/documents/North%20Shore%20Management%20Plan%20Update/ErosionHazardAreaPlanningDefinitionProcess.pdf>

Local water planning through the state of Minnesota's comprehensive watershed management program, aligned with other state planning efforts, have further identified this project as key to coastal communities in the Lake Superior Watershed and their resource needs. Priority goals of the Lake Superior North One Watershed, One Plan (LSN1W1P) are addressed through this project ([http://www.co.lake.mn.us/departments/soil\\_and\\_water\\_conservation\\_district/water\\_plan.php](http://www.co.lake.mn.us/departments/soil_and_water_conservation_district/water_plan.php)) by:

- Incorporating climate change planning, a key component to the 10-year LSN1W1P implementation plan: "integrate climate change scenarios and vulnerability assessments into land use and resource management plans" (CC 1.1 Targeted Implementation Goal)
- Addressing "existing erosion problems by conducting targeted erosion control projects [...] to reduce sedimentation and nutrient loading into surface waters..." by prioritizing and targeting areas for erosion reduction in the coastal zone (SM 2.1 Targeted Implementation Goal, Page 20)

## Lake Superior's North Coastal Erosion Hazard Map – Work Plan

- Addressing sedimentation, a primary resource concern, in a Tier 1 Priority Area.
- Filling a gap in the planning process for LSN1W1P, which did not map and gather data for the coastal shoreline.
- Building upon an ongoing project started through the first round of LSN1W1P Implementation, an allocated and identified priority in the first round of implementation for the watershed plan.

The North Shore Management Board updated their Management Plan in 2015. Assistance with implementing the recently completed LSN1W1P was identified as a priority during that process. In 2016, the NSMB leveraged a STAR Coastal Program grant to assist the SWCD's with engaging potential partners and identifying projects which could be implemented through the 1W1P process. The erosion hazard overlay map, as well as other funded projects, were identified through that planning process. The NSMB submitted the Coastal Annual Grant for a coastal hazard mapping project (language from this background section is included in the grant).

## Work Plan Section 2: Logistics

The Coastal Erosion Hazard Map Task Force will oversee completion of this project under direction of the North Shore Management Board through a contract for fiscal management and staffing support with the Arrowhead Regional Development Council (ARDC). Lake Superior North One Watershed, One Plan (LSN1W1P) coordinators through Lake and Cook SWCDs will also oversee project coordination, especially as it relates to the LSN1W1P Implementation Funding.

Cook County Soil and Water Conservation District on behalf of the partners working on the coastal erosion mapping project, has begun the process of hazard mapping through a contract with the Arrowhead Regional Development Council (ARDC) to begin gathering data and organizing partners along the coastal area. By the summer of 2019, a data dictionary and geodatabase will have been developed for the North Shore through a Clean Water Fund grant. Key partners include Lake, Cook, and South St. Louis SWCDs, Cook and Lake Counties, ARDC, and the University of Minnesota Duluth's Geospatial Analysis Center. A complete list of partners is listed at the end of the workplan, but is subject to change.

To date, three meetings have been held:

1. August 31, 2018 – Two Harbors, MN - Initial meeting with all partners at the table.
2. October 10, 2018 – Two Harbors, MN – Coastal Erosion Hazard Task Force discussed the project.
3. October 17, 2018 – North Shore Management Board – A presentation and request for the NSMB to be fiscal agent for Objective 2 of the grant. A motion was passed for NSMB to be the fiscal agent.

At the August meeting, the following objectives were determined to guide the project to meet the stakeholders needs.

### **Key Objectives:**

- A tool that can be used to identify the suitability for development.
- A Lake Superior Guide to living in the coastal zone.
- Common recommendations for all St. Louis, Lake, and Cook property owners regarding conservation concerns/hazard erosion areas.
- A tool that is accessible to landowners/officials/decision makers/realtors.
- An accessible website map-based interface for erosion.
- A schedule, budget and plan for updated/ additional ground- truthed information to be added.

Work Plan Section 3: Budget Summary

Task	Lead	Funding Sources	Hours Estimate	Total	Secured
<b>Project Administration (ongoing)</b>	SWCDs, ARDC	BWSR CWF, MNDNR Coastal	360	\$35,000	\$10,500
<b>Meetings (ongoing)</b>	SWCD/ARDC/ Coastal Erosion Hazard Task Force	BWSR CWF, MNDNR Coastal, match	80	\$8,000	\$8,000
<b>1.1 Data Gathering</b>	ARDC	BWSR CWF	60	\$6,000	\$6,000
<b>1.2 Initial Assessment</b>	ARDC	BWSR CWF	60	\$6,000	\$6,000
<b>1.3 Sharing Data</b>	ARDC	BWSR CWF	140	\$14,500	\$14,500
<b>2.1 Research and Discuss Strategies</b>	ARDC	MNDNR Coastal	80	\$8,000	
<b>2.2 Methodology Consult and Development</b>	UMD-GAC	MNDNR Coastal	100	\$10,000	
<b>2.3 Run Pilot Area Study</b>	ARDC	MNDNR Coastal	200	\$20,000	
<b>2.4 Identify Workload</b>	ARDC	MNDNR Coastal	60	\$6,000	
<b>2.5 Develop Schedule/Action Plan</b>	ARDC	MNDNR Coastal	45	\$4,500	
<b>3.1 Fill Data “Gaps”</b>			240	\$24,000	
<b>3.2 Run Analysis</b>			400	\$80,000	
<b>3.3 Integrate with Other Data</b>			100	\$4,000	
<b>3.4 Ground Truthing</b>					
<b>3.5 Mapping modifications based on ground-truthed data</b>					
<b>4.1 Develop property owner’s resource guide</b>	MN SeaGrant, SWCDs			\$10,500	
<b>4.2 Print Guide</b>				\$4,000	
<b>4.3 Engage and educate landowners, realtors</b>	ALL			\$8,000	
<b>Total (estimated)</b>				<b>\$239,045</b>	<b>\$45,000</b>

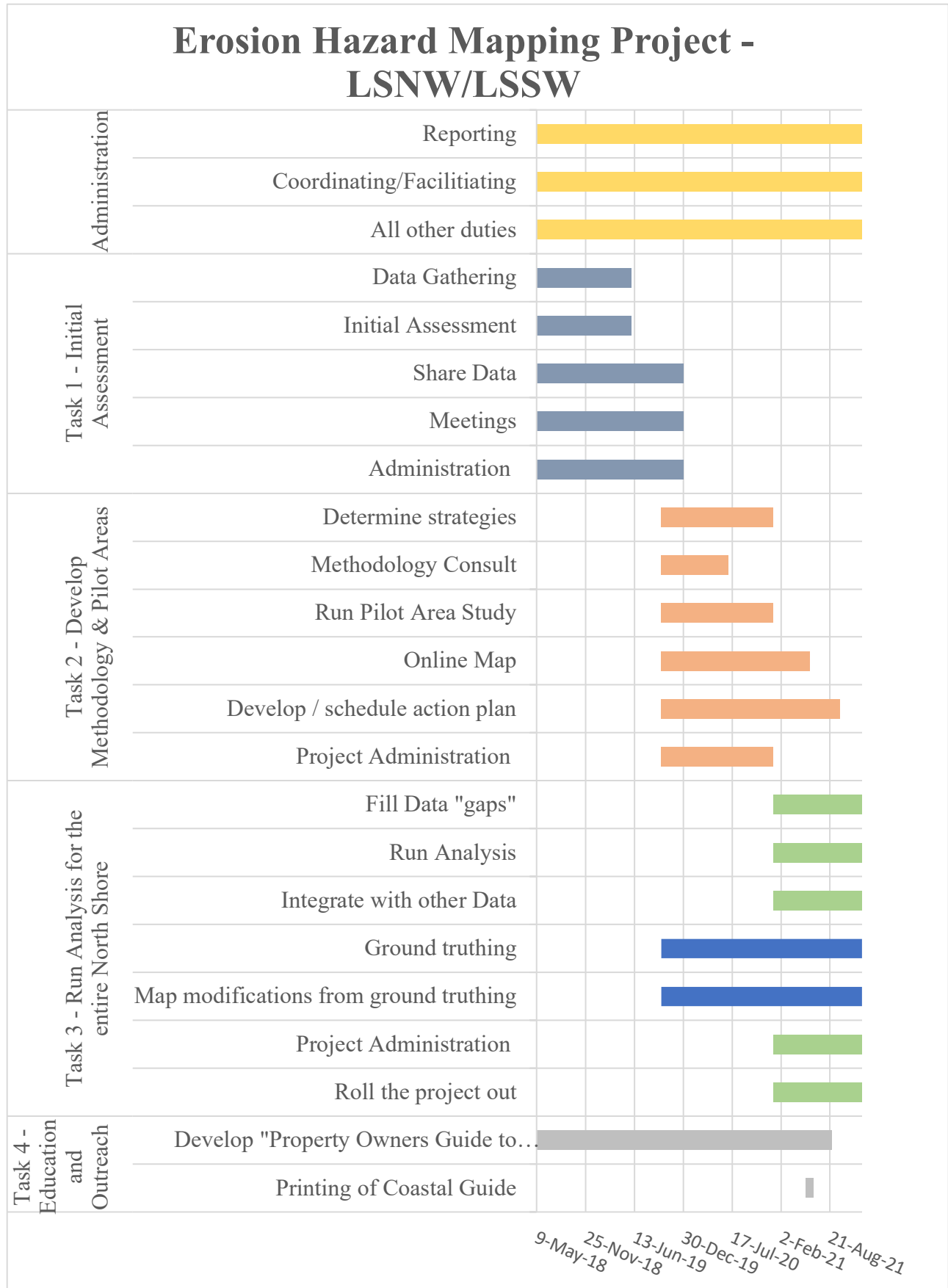
Work Plan Section 4: Project Development and Completion

To accomplish this project, it has been broken into four objectives. The objectives follow a GANTT chart for completion and an estimated budget. The first three objectives/tasks will be completed in phases with the first objective being the first phase. Phase 4 – Education and Outreach will be a continued effort to throughout the project. Additional funds and match will be sought for each stage of the project. Partners will be updated and collaborative efforts will continue to be fostered throughout the life of the project.

**Summary of Phased Tasks**

	<i>Task</i>	<i>Start Date</i>	<i>Duration (days)</i>	<i>End Date</i>
Administration	Reporting	9-May-18	1332	31-Dec-21
	Coordinating/Facilitating	9-May-18	1332	31-Dec-21
	All other duties	9-May-18	1332	31-Dec-21
Task 1 - Initial Assessment	Data Gathering	9-May-18	388	1-Jun-19
	Initial Assessment	9-May-18	388	1-Jun-19
	Share Data	9-May-18	601	31-Dec-19
	Meetings	9-May-18	601	31-Dec-19
	Administration	9-May-18	601	31-Dec-19
Task 2 - Develop Methodology & Pilot Areas	Determine strategies	1-Oct-19	457	31-Dec-20
	Methodology Consult	1-Oct-19	274	1-Jul-20
	Run Pilot Area Study	1-Oct-19	457	31-Dec-20
	Online Map	1-Oct-19	609	1-Jun-21
	Develop / schedule action plan	1-Oct-19	731	1-Oct-21
	Project Administration	1-Oct-19	457	31-Dec-20
Task 3 - Run Analysis for the entire North Shore	Fill Data "gaps"	1-Jan-21	363	30-Dec-21
	Run Analysis	1-Jan-21	363	30-Dec-21
	Integrate with other Data	1-Jan-21	363	30-Dec-21
	Ground truthing	1-Oct-19	821	30-Dec-21
	Map modifications from ground truthing	1-Oct-19	821	30-Dec-21
	Project Administration	1-Jan-21	363	30-Dec-21
	Roll the project out	1-Jan-21	363	30-Dec-21
Task 4 - Education and Outreach	Develop "Property Owners Guide to Coastal Living"	9-May-18	1209	30-Aug-21
	Printing of Coastal Guide	15-May-21	31	15-Jun-21
	Engage and educate landowners; realtors and other stakeholders	9-May-18	1332	31-Dec-21
	Project Administration	9-May-18	1332	31-Dec-21





### **Task 1: Initial Assessment**

During this phase first phase of the project, partners will meet, data will be identified and gathered, and a web application will be completed. The phase of this project is an important part of setting up the framework for the rest of the project.

*Budget: \$36,000*

<i>Task</i>	<i>Activity</i>	<i>Description</i>	<i>Lead Person</i>	<i>Deadline</i>
1.1	Data Gathering	Determine necessary data, gather it together	ARDC	1-June-2019
1.2	Initial Assessment	Process, clip, and merge all data for coastal area	ARDC	1-June-2019
1.3	Share Data	Develop web application where partners can access and use the application	ARDC	31-December-2019
1.4	Meetings	Meet with partners throughout the process	ARDC/SWCDs	31-December-2019
1.5	Administration	Coordinate, assist, and keep the project on track and moving along	SWCDs	31-December-2019

**Deliverables:**

- Informed partners through a series of meetings – 6 meetings
- ArcGIS Online Group, and we app where all coastal erosion data is stored

\*Existing LiDAR (2009, select 2011), oblique photography (Great Lakes Oblique, NOAA, county aerial or pictometry), soils data, precipitation and climate data, existing FEMA maps and associated runup calculations, and oblique photography will be included in the data compilation and analysis, among other existing data.

**More details on Task 1 project steps and meetings:**

**Step 1: Data Gathering**

- Gather and organize all relevant & available data within the study area and document source, resolution, scale, date, and datatype. Meet with CEHM Task Force GIS sub-committee partners to discuss data sources & availability. **(Meeting #1)**

*This step was discussed in further detail with Clint & Stacey during the first “GIS sub-committee” meeting*

1. Gather known datasets identified in first GIS sub-committee meeting
2. Reach out to partners to obtain any available additional data (Meeting 1)
3. Categorize datasets into spreadsheet that includes the following information
  - Spreadsheet has been started here:  
<https://docs.google.com/spreadsheets/d/19d2PSFmkUrkrFTFo6wlfJcJTwhlt41QgQpu56lz7Isc/edit?usp=sharing>
4. Follow-up with partners to make sure all available data has been gathered (share spreadsheet)

### **Step 2: Initial Assessment**

- Analyze gathered data and clip/merge datasets to Lake Superior's North Shore study area. Meet with CEHM GIS Sub-committee to discuss data gathered & initial analysis (**Meeting #2**) revise datasets based on feedback. Meet with all partners of the CEHM Task Force to share data and discuss potential strategies for analysis (**Meeting #3**).
  1. Identify GIS processes that should be run on datasets to generate additional base data (e.g. create slope layer from 1-meter digital elevation model, etc.). Note these processes in spreadsheet (consult with GIS partners to identify all additional base data processing – Meeting 2).
  2. Run processes to generate additional base data (the time it will take to complete these processes will vary based on resolution of data)
  3. Clip all datasets to study area (we won't need entire statewide datasets)
  4. Import all gathered data into one "Coastal Erosion" geodatabase for easy sharing and organization
  5. Organize datasets within the GIS so that navigating between base data will be easy for all users – consistent naming and thorough metadata will be generated for all data gathered
  6. Meet with all partners to show all data gathered and discuss any data gaps/strategies for analysis (Meeting 3)

### **Step 3: Share Data**

- Share data between partners – Develop a coastal erosion data "hub" web application and ArcGIS Online group where collaborators can view/access/download all data related to the coastal erosion study. Meet with CEHM GIS Sub-committee to review draft web application (**Meetings #4 & 5**) revise application based on feedback. Present web application to CEHM Task Force (**Meeting #6**).
  1. Host the Coastal Erosion geodatabase as a feature service through ArcGIS Online so that it can be easily shared with partners
  2. Configure a web app viewer through ArcGIS Online for viewing/interacting with data – this could be embedded in a website or shared with partners
  3. Meet with GIS sub-committee to discuss any potential edits/tools to include with web app for initial analysis (Meeting 4/5)
  4. Provide geodatabase with metadata to partners
  5. Present web application to CEHM task force for review, feedback, and to outline next steps for analysis (Meeting 6)

### **Deliverables**

During the process, ARDC will maintain a project website that contains all information about the project. At the end of the process ARDC will develop a shared database, web mapping application, and ArcGIS Online Group that will house the coastal erosion base data for future analysis. The shared database, mapping application, and Group information will be provided to all members of the CEHM Task Force.

**Task 2: Develop Methodology & Pilot Areas**

During this second phase of the project, pilot areas will be defined in Lake County. The process for the pilot areas, methodology defined, and pilot areas will be run for analysis. Following the analysis, the process will be reviewed and an action plan will be created to complete the analysis for the whole north shore of Lake Superior coastal area.

*Budget: \$63,500*

<i>Task</i>	<i>Activity</i>	<i>Description</i>	<i>Lead Person</i>	<i>Deadline</i>
2.1	Determine strategies	Review data gathered, discuss strategies, identify additional data needs	ARDC	31-December-2020
2.2	Methodology Consult	Define methodology, research existing methodologies and modify as needed, identify pilot areas (potential Little Sucker Bay, Silver Cliff)	UMD GAC	1-July-2020
2.3	Run Pilot Area Study	Run GIS analysis for identified pilot areas	ARDC	31-December-2020
2.4	Identify workload	Meet with partners about polite area findings and determine work for completion of project for the north shore	ARDC	1-June-2021
2.5	Develop/Schedule Action Plan	Partners will outline a schedule and project process, identify capacity of each partner, assign roles and tasks	ARDC	1-October-2021
2.6	Project Administration	Coordinate, assist, and keep the project on track and moving along	SWCDs	31-December-2020

*Deliverables:*

- Pilot Area Results
- Defined methodology for the project
- Action Plan for the completion of the north shore

\*It is anticipated existing LiDAR information and aerial photography will be utilizing to establish existing shore- and blufflines and calculate associated recession rates, but methodology still needs to be fully developed.

**Task 3: Run Analysis for the entire North Shore**

Following lessons learned and the developed action plan from the pilot areas, run the analysis for the north shore of Lake Superior. A contractor will be hired. Partners and efforts for the project will continue to be fostered to ensure the project is meeting identified objectives.

*Budget: \$128,000*

<i>Task</i>	<i>Activity</i>	<i>Description</i>	<i>Lead Person</i>	<i>Deadline</i>
3.1	Fill Data “gaps”	Any data gaps identified in Phase 2 will be addressed. Any additional data not previously generated will be generated.		30-December-2021
3.2	Run Analysis	Conduct the action plan for the north shore		30-December-2021
3.3	Integrate with other Data	Connect with partners to work towards integrating their data into a GIS format		30-December-2021
3.4	Ground truth data	Select site visits and review of photography		30-December-2021
3.5	Modify based on ground-truthed data feedback			30-December-2021
3.6	Project Administration	Coordinate, assist, and keep the project on track and moving along	SWCD	30-December-2021
3.7	Roll the project out along the shore	Provide opportunities	SWCD	30-December-2021

*Deliverables:*

- Mapping application for partners to use to determine erosion rates, regression rates, and make informed decisions

**Task 4: Education and Outreach**

Engaging landowners, contractors, realtors, and government units along the shore is an important part of the project. It will aid in the success of using the tool and the understanding of the tool. Continued effort for education and outreach for this project in relation to erosion taking place along the shore will be integrated throughout the project.

*Budget: \$25,000*

<i>Task</i>	<i>Activity</i>	<i>Description</i>	<i>Lead Person</i>	<i>Deadline</i>
4.1	Develop “Property Owners Guide to Coastal Living”	Partner with MNSeaGrant – format from existing property owner guides, but specific to the coastal zone.		30-August-2021
4.2	Printing of Coastal Guide			15-June-2021
4.3	Engage and educate landowners; realtors and other stakeholders	Workshops; presentations to associations.		31-December-2021
4.4	Project Administration	Coordinate, assist, and keep the project on track and moving along	SWCD	31-December-2021

*Deliverables:*

- Informed property owners
- Guide to Coastal Living