Appendix C – Prototype Scope of Work: Rural Alaska Riverine Erosion Assessment

PROTOTYPE SCOPE OF WORK[2]
RURAL ALASKA RIVERINE EROSION ASSESSMENT

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Background

In 2009, the U.S. Army Corps of Engineers (USACE) completed the *Alaska Baseline Erosion Assessment* (BEA). The report found that most Alaskan communities are facing some level of infrastructure threat due to erosion. Drivers of erosion are variable and include naturally occurring changes in river channels, diminishing winter ice, storm surge, relative sea level rise, flooding, and human activities which impact shoreline ecosystems. The impacts of erosion on Alaskan communities range from minor damage to landscapes, to damage to transportation and utility infrastructure, to loss of individual or multiple structures, up to and including wholescale threats to community viability.

In the BEA, USACE identified 27 Priority Action communities, concluding that additional site-specific data and information was required for these communities in order to develop informed responses to the identified threats. Since 2009, little additional progress has been made to address the information gap identified by USACE. Too often, community decision-makers lack the scientific data and assessments required to fully forecast the magnitude and timing of erosion threats.

The goal of this assessment is to provide essential information needed to precisely quantify erosion threats to community security and to inform near-term and long-term decision making and mitigation measure development. Specifically, this assessment has the following objectives:

- Delineate near term (5-10 years) threats to community infrastructure based on an assessment of historical linear erosion rates
- Identify primary factors driving active erosion (geomorphic and anthropogenic)
- Establish long-term erosion projections based on hydrologic and hydraulic river modeling
- Evaluate effectiveness and feasibility of structural mitigation measures (barriers and bank stabilization) based on design criteria established through river modeling
- Evaluate the relative efficacy of non-structural mitigation measures (e.g. managed retreat away from erosion threat) in comparison to structural measures
- Determine long term viability of the current community site based on model projections

[2] This is a generic scope of work intended as a reference document that can be used to guide the development of a detailed community specific scope of work.

- Develop recommendations for both near-term and long-term mitigation measures
- Build local capacity to address harmful environmental trends

Scope of Work

The following tasks will be implemented in order to accomplish the objectives of this project. Professional engineers, geologists, and community planners shall be engaged to complete Tasks 2 - 6 in direct consultation with the community.

Task 1: Project Management (Provided by Community)

A. Develop and implement a solicitation process to contract for the professional services required to carry out the project. In the event that the community already has access to professional engineering services procured in accordance with the requirements of 2 CFR 200, then this task will not be required.

B. Conduct all general project management activities including award management, contract management, scheduling, meeting coordination, and other project activities.

Task 2: Preliminary Assessment

A. Conduct a teleconference with community leadership to identify key community contacts and concerns; gather local knowledge about erosion, identify available technical reports and data, and obtain input on the assessment methodology.

B. Complete interviews with key community stakeholders regarding the history of erosion in and around the community.

C. Identify and review existing information including but not limited to the following:
   - Historical aerial imagery datasets.
   - Bathymetric and topographic data sets for the study area.
   - Geotechnical reports for major infrastructure development projects (school, sanitation facilities, clinic, airport, etc.).
   - The current hazard mitigation plan and other reports related to environmental hazard analysis.
   - Denali Commission threat assessment database.
   - Other relevant technical studies and data sources relating to historical shoreline change, wind, waves, tides, storm surge, sea level rise, and river hydrology.

D. Collaborate with relevant agencies and entities to ensure that all available information is considered (Alaska DGGS, Alaska DOT&PF, NOAA, USACE, NWS, VSW and ANTHC).

E. Summarize historical climate data and projected climate scenarios for the community using Scenarios Network for Alaska/Arctic Planning (SNAP).

F. Summarize projected changes to frozen ground and resulting implications for long-term erosion rates using public resources from SNAP, CRREL and UAF.

G. Create a preliminary decadal erosion projection map for the developed community and any surrounding areas proposed for future development. Overlay linear erosion projections on a map of community infrastructure to estimate the timing of the erosion impact on specific community

infrastructure. Convert annual rate of change to anticipated time of impact. Use site maps and charts to summarize and communicate the findings.

Task 3: Site Visit / Field Investigation

A team minimally consisting of a structural engineer, a hydrologist or geologist, and surveyors shall travel to the community to conduct a field assessment. It is expected that the assessment will require a minimum of 3 full days in the field. The field assessment will consist of the following:

A. Kick-off meeting with community stakeholders (including but not limited to the Tribe, City, and Corporation) to present the preliminary erosion projections; discuss the project; and discuss community observations regarding current and future erosion threats.

B. Visually survey the reach of river above, below, and through the community.

C. Conduct a visual inspection of site topography and terrain features to confirm and/or update the preliminary erosion projections. Employ additional field investigation techniques, including aerial drone photography, to improve the erosion projections and further document the current shoreline.

D. Complete topographic, bathymetric, and river flow surveys to gather baseline data necessary to conduct hydrologic and hydraulic modeling of the river system.
   - Topographic surveys will be conducted using an Unmanned Aerial Vehicle (UAV) with an on-board survey-grade global positioning system (GPS) technology. Horizontal and vertical accuracy of point cloud data on bare earth surfaces will average 0.1 feet.
   - Bathymetric surveys will be conducted utilizing dual frequency eco-sounder technology to identify soft surface layers and the hard bottom. Horizontal and vertical accuracy of bathymetry data points will average 0.1 feet.
   - Topographic and bathymetric data will be merged and complemented with available LiDAR data to extend the range of upstream and downstream river analysis.

E. Observe and/or investigate daily practices in the community that may contribute to erosion. These practices may include but are not limited to pedestrian and vehicular travel ways, river access, and boat landing and parking.

F. Photograph all infrastructure along the shoreline expected to be impacted within ten years based on the preliminary results and knowledge from the community.

G. Conduct a structural engineering assessment of all infrastructure expected to be impacted within five years in order to determine if structures can be relocated to a new site. If relocation is feasible, provide recommendations on relocation methodology.

H. Coordinate with community stakeholders to identify and evaluate least two new sites within the community or on property immediately adjacent to the exiting community, to which imminently threatened infrastructure may be relocated. Site analysis will include the following considerations:
   - Determination of minimum acreage required based on a review of threatened structures
   - Surface and subsurface characterization with respect to constructability
   - Evaluation of flood, erosion, and permafrost degradation risk
   - Delineation of site control issues
   - Site access
   - Utility service potential

- Environmental permitting
- Development costs
- Cultural considerations and/or other factors identified by the community

Task 4: Hydrologic and Hydraulic Modeling and Analysis

Upon completion of the field study, the following tasks will be completed prior to proceeding to the final report.

A. Complete a hydrologic analysis using USGS regression equations for Alaska to estimate river flows.

B. Develop a finite element hydro-dynamic model (RiverFlow2D or equivalent) to analyze river hydraulics. Utilize the model to estimate natural erosion and deposition processes along the river.
   - Consider the intersection of other threats (flooding, inundation, permafrost degradation, wave energy) with historical and projected erosion patterns. The overlay of historical erosion rates, geomorphology, and model-derived data will be used to interpret hot spots and areas of concern under expected future climate conditions.
   - Model future shoreline change across the community to predict infrastructure mortality.

C. Develop a list of recommended structural solutions to mitigate damage from erosion. Utilize the hydraulic model to analyze in-place mitigation measures.

D. Compare the efficacy of structural solutions with a managed retreat response.

E. Make a determination whether the community can stay and defend at its current site (including managed retreat), or whether complete relocation will be required. The determination shall be primarily based on viability of the site based on modeled erosion projections and the ability to mitigate erosion risk in both a feasible and socially acceptable manner.

F. Develop a prioritized list of mitigation measures based on community input. For each of the top three priorities, develop a detailed project scope, schedule, and budget sufficient to support an application for grant funding.

G. Develop a list of recommended non-structural best practices that can be immediately implemented by the community to mitigate erosion impacts.

Task 5: Reporting

Develop a final report documenting the entire evaluation. The report shall be supported by maps, images, figures, conceptual drawings, etc. to maximize the usage of the report as a tool for community planning and decision-making. Upon completion of the report, the consultant will schedule a final meeting in the community to present the results.

The final report shall incorporate the following sections:

A. Introduction and Background: Describe the purpose and scope of the vulnerability assessment.

B. Investigation Methodology: Describe the methodology used to develop the erosion assessment. Include a description of the desktop evaluation, community meetings and interviews, and field investigations, and modeling.

C. Existing Conditions: Present the results of the study related to current conditions and include a discussion of the following topics: 1) historical erosion rates and map; 2) summary of the structural assessments; 3) identification of the specific infrastructure found to be imminently threatened.

D. Projected Future Impacts: Summarize expected erosion impacts based on modeling projections. Delineate community infrastructure that may be at risk over the next 50 years due to projected erosion rates. Utilize both maps and tables to present the results.

E. Best Practices and Solutions: Provide a narrative description of the non-structural practices that can be locally implemented to limit and/or slow destructive permafrost degradation. Define recommended structural solutions and present the scope, schedule, and estimated cost for the identified priority community projects.

F. Next Steps and Long-term Recommendations: Discuss additional data collection recommendations and provide concluding recommendations that may be used by the community to develop long-term responses to environmental hazards.

G. Appendices (Documentation): The report will include appendices as required to capture project records including trip reports, photographs, relevant survey and field notes. The section will include a bibliography of all previous plans, studies, designs, geotechnical reports, and other technical documents identified and used in the evaluation.

Task 6: Records Management

B. All data collected and/or generated by this effort will be archived for public access. Data will be provided both to Alaska Division of Geological and Geophysical Surveys and will be added to the Denali Commission Statewide Threat Assessment geodatabase in ArcGIS.

Project Schedule

Ideally, this assessment can be completed in approximately 12 months, depending on the availability of funding and the date of the Notice to Proceed (NTP). Under the ideal scenario, the solicitation would be completed in January and February, the desktop assessment March to May, field work from June to September, and final reporting from October to December. The field investigation must take place during summer months free from snow and ice. The schedule and key milestones will be adjusted based on the NTP date to accommodate the field investigation.

A general schedule is presented below.

Task 1A (project management by the community): Months 1-12
Task 1B (engineering consultant solicitation): Months 1-2
Task 2 (desktop assessment): Months 1-5
Task 3 (site visit): Month 6-9
Task 4 (analysis and reporting): Months 9-10
Task 5 (reporting): Months 11-12
Task 6 (records management): Months 11-12