Appendix D – Prototype Scope of Work: Rural Alaska Permafrost Vulnerability Assessment

PROTOTYPE SCOPE OF WORK[3]
RURAL ALASKA PERMAFROST VULNERABILITY ASSESSMENT

Prepared by
Donald Antrobus, PE
CAPT U.S. Public Health Service
Village Infrastructure Protection Program Manager
Denali Commission

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Background

Many communities throughout Alaska are experiencing significant impacts to infrastructure due to the thawing of permafrost. Impacts include failing structural foundations, damage to water and wastewater facilities, leaning storage tanks, and impassable roads. There are multiple factors driving changes to permafrost conditions including thermal impacts from heated infrastructure; human activities such as vehicular and pedestrian travel across delicate terrain; clearing and stockpiling of snow; warming climate and other natural phenomena such as flooding and erosion. Typically, there is insufficient data available to community decision makers that is needed both to understand community-wide vulnerability of infrastructure to permafrost thaw and to inform the development of long-term responses to these threats.

The goal of this assessment is to provide essential site-specific information needed to precisely quantify threats to community security from permafrost thaw and to inform near-term and long-term decision making regarding the development of effective mitigation measures. Specifically, this assessment has the following objectives:

- Characterize existing permafrost conditions throughout the community
- Define the primary factors driving changes to permafrost
- Identify current permafrost thaw impacts on infrastructure
- Project the potential magnitude of future impacts on infrastructure
- Define structural and behavioral measures to mitigate short-term impacts
- Develop long-term strategies to mitigate threats from permafrost thaw

Scope of Work

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

[3] 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.

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 funding agency requirements, 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: Desktop Assessment

A. Conduct a teleconference with community leadership to identify key community concerns; gather local knowledge about permafrost conditions, identify available technical reports and data, and obtain input on study methodology.

B. Complete interviews with key community contacts regarding the history of erosion and permafrost thaw in and around the community.

C. Identify and review existing information including but not limited to the following:

- Historical imagery, digital elevation or surface models, and terrain maps
- Current Local Hazard Mitigation Plan (LHMP) and other environmental hazard resources
- Geotechnical reports completed for major infrastructure development projects (school, sanitation facilities, clinic, airport, etc.)
- USACE Floodplain Management resources
- Alaska Water Level Watch (https://www.facebook.com/AlaskaWaterLevelWatch/ and https://aoos.org/alaska-water-level-watch/)
- Denali Commission threat assessment database
- Other relevant technical studies and data sources relating to historical shoreline change, wind, waves, tides, storm surge, sea ice, and sea level rise
- Collaborate with relevant State and Federal agencies (Alaska DGGS, UAF, ANTHC, VSW, NRCS, DOT&PF, NOAA, and NWS) to ensure that all available information is considered

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

E. Complete a preliminary permafrost characterization for the developed community and immediate surrounding areas identified or proposed for future development. Use site maps and charts to summarize and document the findings. To the extent possible based on existing data, the characterization shall capture general surface and subsurface conditions, soil classifications, depth of organics and depth to permafrost or of the active layer, ice and/or water content, occurrence of groundwater, potential occurrence of massive ice, and permafrost temperature. It is understood that the preliminary map may have significant data gaps.

F. Develop a plan for additional geotechnical or geophysical testing that may be required to supplement the preliminary permafrost characterization, with an emphasis on testing that is essential for determining geographical extent and ice content of permafrost in the community.

Task 3: Site Visit and Field Inspection

A team minimally consisting of a structural and geotechnical engineer shall travel to the community to conduct a field inspection. It is expected that the inspection will require a minimum of 3 full days in the field. The field inspection will consist of both structural and geotechnical assessments as follows:

A. Conduct a kick-off meeting with community stakeholders (including but not limited to the Tribe, City, and Corporation) to present the preliminary site characterization; discuss the project; and confirm community observations regarding current and future threats.

B. Visually inspect and photograph all public infrastructure to document impacts from melting permafrost, including roads, public buildings, sanitation facilities, bulk fuel tank farms, power plants, and other facilities identified by the community to be of concern. Include a minimum of 8 representative residential structures in the inspection.

C. Visually inspect and evaluate community drainage systems including ditches, culverts, and natural waterways.

D. Conduct a physical assessment of buildings including identification of foundation types, foundation cooling systems (e.g. active/passive freezing systems), environmental impacts (e.g. flowing water, ponding, snow drifting), and documentation of observed damage (e.g. detached/cracked foundations, uneven floors, cracked drywall, misaligned doors/windows, differential road or berm settlement, leaning tanks, separating utilidors, deformed/non-functioning culverts, etc.).

E. During the visual inspections, simultaneously document any observed impacts or imminent threats (expected impact in next 5 years) from flooding and erosion. For imminently threatened infrastructure, whether from permafrost thaw, flooding, or erosion, complete a preliminary structural assessment to determine whether the building is competent and able to be moved.

F. Conduct a visual inspection of site topography and terrain features to confirm and advance the preliminary permafrost characterization.

G. Conduct additional field investigation defined in task 2 in order to improve preliminary site permafrost characterization including aerial drone photography, and rod probing to determine depth to permafrost. If it is determined to be beneficial by the consultant and the community, use locally available equipment to pot hole shallow test pits to gain a better understanding of subsurface conditions in areas for which geotechnical information was not available during the desktop study.

H. Coordinate with community stakeholder to identify new sites within the existing community or on property immediately adjacent to the exiting community to which threatened infrastructure may be relocated. Include these sites in the inspection described above. Using similar techniques, develop an initial evaluation of the efficacy of the sites for new construction.

I. Observe and/or investigate daily practices which may have a negative impact on permafrost. These practices may include but are not limited to pedestrian and vehicular travel ways, river access, boat landing and parking, snow plowing and stockpiling, and greywater discharge.

Task 4: Analysis

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

A. Update the preliminary permafrost characterization based on field observations and additional data collection.

B. Utilizing existing publicly available climate data, model future behavior of permafrost across the community. Use modeling results to predict the magnitude of future impacts to infrastructure due to permafrost thaw.

C. Develop a list of recommended non-structural best practices that can be implemented by the community to mitigate impacts from permafrost thaw.

D. Develop a list of recommended structural solutions for specific infrastructure to mitigate damage due to permafrost thaw (drainage, active cooling, leveling, elevating, etc.). Prioritize the list based on community input. For each of the top three priorities, develop a detailed project scope, schedule, budget, and implementation plan sufficient to support an application for grant funding.

E. Develop a plan for permafrost monitoring that can be locally implemented in order to continually track permafrost change over the next several decades. The monitoring plan shall be based on the techniques established by the Circumpolar Active Layer Monitoring (CALM) program, adapted for community specific conditions and resources.

F. Develop a list of best practices and recommendations to guide future community growth.

G. Cross reference recommended mitigation measures with the community's existing Local Hazard Mitigation Plan (LHMP) in order to develop a list of recommended updates to the plan.

Task 5: Final 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. Baseline data: Describe available information, baseline data needs, and supplemental data that was collected as part of the study.

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

D. Existing Conditions: Present the results of the study related to current conditions and include a discussion of the following topics: 1) permafrost characterization for the community site; 2) summary of the structural assessments; and 3) delineation of the specific infrastructure elements found to be immediately threatened.

E. Projected Future Impacts: Summarize the results of permafrost modeling based on future climate projections, considering both rising temperatures and increased precipitation. Delineate community infrastructure that may be at risk over the next 50 years due to projected permafrost thaw.

F. 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 thaw. Define recommended structural solutions and report on the identified priority community projects. Delineate any recommendations for updates to the LHMP.

G. 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.

H. 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

A. 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 12 -18 months, depending on the magnitude of baseline data collection that is required, 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 preliminary assessment from March to May, field work from June to September, and modeling, analysis and reporting from October to December. This assumes that field investigations can be conducted during summer months that are free from snow and ice. If additional geotechnical testing must be conducted during the winter, then the schedule will be extended. The schedule and key milestones will be adjusted based on the date of the NTP and in order to accommodate field investigations.

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 (preliminary assessment): Months 1-5
Task 3 (site visit and field inspection): Month 6-9
Tasks 4 - 5 (analysis and reporting): Months 9-10
Task 6 (reporting): Months 11-12