GLENNALLEN TO PALMER SPUR LINE
SOILS STUDIES

EXECUTIVE SUMMARY

The Alaska Natural Gas Development Authority (ANGDA) is currently conducting studies for a proposed natural gas spur pipeline. The soils studies information contained herein provide baseline geotechnical data concerning a pipeline corridor approximately two miles in width and extending for about 148 miles from Glennallen to Palmer, Alaska. Activities comprising the soils studies included literature search, terrain unit analysis of aerial photographs, a limited field reconnaissance and presentation of data into a final report. The purpose of this study was to provide ANGDA with a form of alignment terrain mapping sufficient to begin developing conceptual designs for expected soil conditions within and along the pipeline route. It further introduces potential locations for material sites, disposal sites, realignments, etc. As the study was intended to be preliminary in nature, final design will be based on soil investigations conducted during future project engineering and design phases.

This report is comprised of two volumes. Volume 1 summarizes the results of the field and office programs along with the methods and procedures used to complete the work. Volume 1 also presents conclusions and recommendations regarding alignment conditions and proposed construction. Volume 2, Appendices, contains the Route Soil Conditions sheets and Field Site Description sheets.

The route was divided into six different segments, based on the six physiographic provinces and subprovinces crossed by the proposed pipeline. The objective of the photo interpretation exercise was to delineate terrain units of various origins, noting the occurrence of evident geological features and geotechnical conditions (i.e. shallow bedrock, unstable slopes, construction materials, permafrost, etc.) that would affect the design and construction of the proposed spur line. The terrain units (i.e. landforms expected to occur from the ground surface to a depth of about 20 to 25 feet) were mapped on aerial photographs and then transferred to Route Soil Conditions sheets that are based on U.S. Geological Survey topographic maps. Physical characteristics and typical engineering properties are outlined for each terrain unit and are displayed separately in chart form.

Field reconnaissance investigations using ATVs and helicopter were carried out to verify and refine the landform data allowing a more complete development of the terrain unit properties. Additional field visits at stream crossings and observation of several landslide deposits and potential failure areas allowed a general assessment of slope stability problems within the corridor. Numerous photographs were obtained during the reconnaissance and Field Site Descriptions were prepared for proposed stream crossings.

Bedrock geology has been compiled from the geologic literature. This data has been generated to help determine the feasibility, geologic hazards, and construction conditions which will be

encountered along the spur line alignment. The practical applications of information from the bedrock studies are numerous. During construction, the less competent bedrock units (i.e. shales, coal, and highly weathered or sheared rocks) may be rippable, whereas the more competent bedrock (conglomerates, sandstones and igneous rocks) may require blasting. Bedrock best suited for use as general construction materials include the igneous units, but any of the more competent bedrock may be used. High quality riprap material could be derived from the igneous rocks and material which may produce high quality aggregate can be found within various fluvial or glacial fluvial deposits (eskers and kames).

Quaternary glacial events in southcentral Alaska have profoundly affected the landforms, soils, and terrain units occurring within the project corridor. To evaluate the impact of each terrain unit with respect to project features, an engineering interpretation chart was developed. A few factors on the chart which are of great importance in the determination of spur line route planning, geologic hazards study and construction techniques include slope stability, permafrost distribution, borrow materials availability, frost heave potential, bearing strength and drainage. The descriptions and data presented in the chart are based on information gained during field observations, and prior experience in similar areas.

The characteristics of the terrain units coupled with their distribution indicate, for example, that: limited high quality borrow material will be available east of Eureka Summit. Regarding permafrost conditions, the route is interpreted to be generally frozen from Glennallen to about Sheep Mountain and discontinuous to sporadically frozen from Sheep Mountain to Granite Creek. From Granite Creek to Palmer, permafrost is considered to be generally absent. Both thaw degradation/settlement of frozen soils and frost heave potential of unfrozen soils will need to be addressed during future project design phases. Numerous landslide deposits are shown on the Route Soil Conditions sheets. Most of the large failures occur in weak shales that underlie the area indicating that segments which cross slopes of this bedrock type should receive special design consideration.

Within the Glennallen to Palmer Spur Line Project Corridor a variety of potential geologic hazards exist. Possibly the greatest hazard is the high potential for landslides, which occur predominantly in over-steepened massive shales of the Matanuska formation. Existing landslides and potential slope failure sites have been mapped throughout the project corridor. Older landslide features may be stable but would require further evaluation. Recommended realignments include the Chitna Pass area, Chickaloon River Crossing and Moose Creek Crossing.

Conclusions and recommendations are provided regarding geologic hazards, possible realignments, stream crossings, material and disposal sites, and future design-level geotechnical investigations. For convenience, these recommendations have been summarized and presented in table form. Salient portions of the recommendations were also highlighted by italics within the text. These conclusions and recommendations are based on the terrain unit mapping data and limited route reconnaissance. It should be realized that the terrain unit mapping data is not considered to be of sufficient detail for final design analysis and preparation of construction documents. Therefore, detailed site-specific subsurface investigations should be performed and could include test borings, test pits, laboratory testing, geophysical surveys and geotechnical analysis. Site-specific soils investigation will be required before final pipeline stream crossing, valve site, fault zone, etc. location and design are fixed.

Additionally, the spur line alignment passes through significant segments of frozen ground having highly variable ice content. Thermal degradation of disturbed ground through these segments will result in some pipe subsidence that, combined with frost heave effects, will cause pipe movement and stress variation. These effects and potential mitigation measures for any adverse deformation will need to be addressed and accommodated during the pipeline design phase.

The soil and bedrock conditions are generally considered suitable for supporting the proposed spur line when designed and constructed using current cold regions pipeline techniques, subject to the thermal considerations previously discussed. No fatal flaws were encountered during these soils studies.