# 30. GEOTECHNICAL STUDIES, SEISMICITY, AND VOLCANISM

## 30.1 Introduction

The geotechnical, seismic, and volcanism characteristics of the Cook Inlet drainages study area were investigated through desktop studies and reviews of published information. No geotechnical site investigations were completed in the study area for the baseline study. The study area is defined by the drainage boundaries of Iliamna and Iniskin Bays, two fjords with a common mouth on the west side of Cook Inlet (Figure 1-4 in Chapter 1).

## 30.2 Results and Discussion

### 30.2.1 Local Geotechnical Conditions

The discussion on the geotechnical conditions of the study area is limited to the estuarine deposits in northern Iliamna Bay in the vicinity of Williamsport. A 1995 preliminary evaluation of the geotechnical conditions for a dredged channel in the estuarine deposits in northern Iliamna Bay at Williamsport was based on a review of the USACE report, *Navigation Channel Feasibility Report and Environmental Assessment, Williamsport, Alaska* (USACE, 1995).

The USACE drilled five holes in the northwest arm of Iliamna Bay. The holes ranged from 11 to 23 feet deep. The USACE also collected geophysical measurements near Williamsport and in Iliamna Bay.

The seismic-refraction survey data indicated that there are approximately 100 to 130 feet of unconsolidated sediments in Iliamna Bay within approximately 3,000 feet of the existing landing at Williamsport.

The tidal flats in northern Iliamna Bay consist primarily of clays, silts, and fine sands, and are dark brown to black in color, indicating the presence of organic matter. These tidal deposits also contain angular gravel and occasional cobbles and boulders. The existing tidelands have scattered large boulders protruding from the tidal flats. A gravelly subgrade is exposed along the natural tidal drainage channels. The gravel content of the sediments is higher closer to the existing landing at Williamsport. The soils range from nonplastic to plastic (with liquid limits and plasticity indices to about 50 and 20, respectively). Moisture contents range from about 20 to 50 percent.

An estimate of the in situ soil density and index properties was obtained using standard penetration tests (SPTs). This process involves driving a split-spoon sampler into the soil at the base of the hole using a hammer of standard energy. The standard penetration test “N value” is the number of blows required to advance the sampler from 6 to 18 inches. In the tidal flat area the N value ranged from two to 10 in the upper 10 feet of the deposits and up to 30 below a

depth of 10 feet. The N values ranged from 24 to 48 in the area of the existing landing at Williamsport; however, a loose sand zone (N value less than 10) was encountered at a depth of about 15 feet in this area. Details of the site investigation in Iliamna Bay near Williamsport can be found in the USACE, 1995.

The data indicate that the existing marine and glaciofluvial sediments include localized zones with low N values and are potentially subject to liquefaction during seismic events.

### 30.2.2 Regional Seismicity and Faulting

Alaska is the most seismically active state in the United States, with the level of seismic activity being highest along the south coast, where earthquakes are generated by the Pacific plate subducting under the North American plate. A regional overview of seismicity in southern Alaska, including Cook Inlet, is presented in Chapter 6 and is not repeated in this chapter.

### 30.2.3 Regional Volcanism

Four active volcanoes along the west shore of Cook Inlet are associated with the convergence of the North American and Pacific plates: Mount Spurr, Mount Redoubt, Mount Iliamna, and Augustine Volcano (also called Mount Augustine or Mount St. Augustine). These four Quaternary volcanoes are aligned in a relatively straight line, trending north-northeast to south-southwest. Mount Iliamna and Augustine Volcano are the closest volcanoes to the Cook Inlet drainages study area. The Cook Inlet volcanoes represent the eastern limit of the 1,616-mile-long Aleutian volcanic arc formed by tectonic plate collision and subduction (Miller and Chouet, 1994).

Evaluation of lake cores indicate that volcanic eruptions occurred in the Cook Inlet area every 10 to 35 years during the 20th century, with Mount Redoubt, Mount Spurr, and Augustine Volcano being the most important sources of tephra (i.e., airborne volcanic debris; Begét et al., 1994). In contrast, the last confirmed eruption of Mount Iliamna was in 1876. Begét and Kienle (1992) provided evidence that the summit edifice of Augustine Volcano has repeatedly collapsed and regenerated every 150 to 200 years over the last 2,000 years because of sustained lava effusion rates 10 times those normally seen in plate-margin volcanoes.

The major effects of volcanoes include the burial of old substrate by lava, debris, or ash and creation of new substrate; rapid release of meltwater; corrosive rains; noxious gas and dust clouds; and tsunamis (Peterson, 1979). The 1883 eruption of Augustine Volcano produced a debris avalanche that covered at least 8 square miles on the north side of the mountain and extended the coastline by more than 1.2 miles. The avalanche created a tsunami that registered 33 feet in height more than 62 miles from the volcano. Given its history of eruption, Augustine Volcano is likely to repeat this behavior at any time, and it entered a new active phase in January 2006. Collapse of the summit could be brought on by earthquakes (Begét and Kienle, 1992). The hazard from a tsunami generated by the eruption of Augustine Volcano is considered to be minor, unless a very large debris avalanche occurred at high tide (Waythomas, 2000), as occurred in 1883. A tsunami also could occur as a result of an earthquake in the area or elsewhere around the Pacific Rim.

## 30.3 References

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