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Coastal Engineering Design of the Oooguruk Project

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Abstract

This paper focuses on the coastal engineering aspects of the Oooguruk Project, which represents the third offshore production facility to be created in the Alaskan Beaufort Sea. The primary components of the project include a man-made island ("Offshore Drillsite") constructed during the first nine months of 2006 in a water depth of approximately 4.5 ft, and a 5.7-mile subsea flowline bundle installed between the Offshore Drillsite and the mainland shore during the following winter. Due primarily to its location in shallow water, the Oooguruk Project is exposed to less severe wave and ice conditions than the two offshore production facilities constructed previously in the Alaskan Beaufort Sea. Nevertheless, significant design challenges were presented by the financial constraints imposed by smaller field economics, and by the project's location in an active river delta subject to vigorous strudel scouring. The 4-cy gravel bag armor selected for use on the Offshore Drillsite represents a cost-effective means of protecting the side slopes against wave and ice attack, based on the experience acquired at previous exploration and production sites in the Alaskan Beaufort Sea as well as the island's performance during its first year in existence. The long-term rate of bluff recession at the site of the Oooguruk flowline shore crossing, 3.3 ft/yr, reflects two distinctly different oceanographic regimes: periods dominated by easterly storms, when erosion is modest or negligible due to reduced water levels during storm events, and periods dominated by westerly storms, when elevated water levels promote rapid erosion by permitting storm waves to impact the bluff face. The data acquired over the past three years indicate that ice gouging of the seabed is of negligible importance in the Oooguruk project area. Conversely, strudel scouring is widespread and sufficiently energetic to expose the flowline bundle. Of particular concern are man-made slots or holes in the winter ice sheet created to facilitate installation or maintenance of the flowline, in that they may promote preferential scouring on the flowline route.

Introduction

The Oooguruk Project represents the third offshore production facility to be constructed in the Alaskan Beaufort Sea. As illustrated in Figure 1, the development lies approximately 40 miles west of Prudhoe Bay in the shallow deltaic waters off the East Channel of the Colville River. A man-made island known as the "Offshore Drillsite" was constructed during the first nine months of 2006 in a water depth of approximately 4.5 ft (Plate 1), while a 5.7-mile subsea flowline bundle was installed between the Offshore Drillsite and the mainland shore during the following winter. The flowline bundle was buried in a trench excavated in the sea bottom to minimize the risk of damage from strudel scours and ice gouges.

An overview of the field development is provided by Hall (2008), while the design of the civil facilities and pipeline bundle are discussed by Lucas, *et al.* (2008) and Lanan, *et al.* (2008), respectively. This paper focuses on the coastal engineering aspects of the Oooguruk Project, with emphasis on four specific topics: (1) oceanographic design conditions, (2) slope protection for the offshore drillsite, (3) erosion of the mainland shore at the flowline shore crossing, and (4) potential disturbance of the flowline by ice gouges and strudel scours.