San Diego County

Interstate 5 Bridge at San Elijo Lagoon Sedimentation Study Report

San Diego County, California

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November 19, 2006

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Executive Summary

San Elijo Lagoon is one of the six lagoons that interrupt the coastal bluffs and marine terraces of Northern San Diego County. It extends inland northeast from the coast for about 2.5 miles, and its width varies from 0.25 to 0.75 miles. Its watershed extends for 24.6 miles inland and has an area of approximately 77 square miles. Flow enters the lagoon mainly at the eastern end of the lagoon from two streams, Escondido Creek and La Orilla Creek. The location map, Figure 1, and the vicinity map Figure 2, show the approximate location of the study area.

Three bridges cross the lagoon. These are, from east to west, the I-5 Bridge, NCTD Railroad Bridge, and Coast Highway 101 Bridge. Currently, the channels beneath these bridges constrict flow during high flow events. Consequently, floodwater may overtop these bridges and flood the roadway and nearby commercial areas during peak-flow events.

To avoid or reduce the frequency of flooding, two alternatives were proposed to improve the current conditions. Alternative 1 proposes to extend the bridge decks and widen the channels beneath all three bridges. The Alternative 1 proposed channel widths are 80 meters at the I-5 Bridge, 150 meters at the North County Transit District (NCTD) Railroad Bridge, and 40 meters for the Coast Highway 101 Bridge. Alternative 2 proposes the same improvement at the I-5 Bridge as Alternative 1. In addition, Alternative 2 proposes to replace the existing Railroad Bridge with a new bridge 400 meters south of the location of the existing bridge and to replace the existing 101 Bridge with a new bridge 800 meters south of the location of the existing 101 Bridge. The proposed channel widths are 180 meters for the Railroad Bridge, and 60 meters for the 101 Bridge under Alternative 2 condition.

This study analyzed on the sediment transport behavior in the lagoon under the existing condition and under the two alternatives under high flow conditions. Specifically, WRECO developed a HEC-6 model in order to predict the sediment transport behavior in terms of scour and deposition after a 100-year flood event. Table ES-1 summarizes the model results.

Table ES-1: Summary of Scour

Scenarios	I-5 Bridge	Railroad Bridge	101 Bridge
Existing Condition	17.2 meters	7.4 meters	7.7 meters
Alternative 1	10.6 meters	2.3 meters	6.5 meters
Alternative 2	10.0 meters	0.2 meters	4.8 meters

The model results predict significant scour at all three bridges in the event of a 100-year storm and particularly extensive scour at the I-5 Bridge. The Alternative 1 scenario results predict that Alternative 1 would result in less scour at all three bridges relative to the existing condition. The Alternative 2 scenario results predict that Alternative 2 would result in relatively similar conditions to Alternative 1 at the I-5 Bridge and less scour than Alternative 1 at the Railroad Bridge and the Coast Highway 101 Bridge.

The model results may over-predict scour because the bed material in San Elijo Lagoon is predominantly clay and silt to a depth of over 100 feet. As of the current state of the art, sediment transport simulation is limited where cohesive materials (i.e, clays and silts) are present and sediment models may not sufficiently account for the capability of cohesive material to resist scour.

1 INTRODUCTION

1.1 Background

Three bridges, the Interstate 5 (I-5), North County Transit District (NCTD) Railroad and Coast Highway 101 bridges, cross San Elijo Lagoon on embankments, and these bridge embankments allow no more than narrow apertures for flow to pass through during high flow events. These apertures are not sufficiently wide enough to convey water during such events thus causing flooding on the roadway that extends into the adjacent commercial area.

The proposed improvement project (Project) consists of widening the bridges and the channels beneath the bridges and, possibly, relocating where certain of the bridges cross the lagoon. Two alternatives are under consideration, and both are expected to increase channel capacity. The purpose of this sedimentation study was to anticipate potential scour and deposition due to the 100-year flood event by performing sediment transport analysis using the numerical model, HEC-6. WRECO prepared this study at the request of Dokken Engineering, and it is part of the planning studies for the Project

1.2 Study Area

San Elijo Lagoon is one of the six lagoons that interrupt the coastal bluffs and marine terraces of Northern San Diego County. They are, from south to north respectively, Los Penasquitos, San Dieguito, San Elijo, Bataquitos, Aqua Hedionda, and Buena Vista. San Elijo Lagoon is located about 20 miles north of the City of San Diego, between the cities of Solana Beach and Cardiff-by-the-Sea. It extends inland northeast for about 2.5 miles, and its width varies from 0.25 to 0.75 miles. Its watershed extends for 24.6 miles inland and has an area of approximately 77 square miles. Flow enters the lagoon mainly at the eastern end of the lagoon from two streams, Escondido Creek and La Orilla Creek. The location map, Figure 1, and the vicinity map, Figure 2, show the approximate location of the study area.

1.3 Climate

San Elijo Lagoon experiences a mild climate that is typical of coastal Southern California. The nearest climate station with a long period of record is the Oceanside Marina station (COOP ID 046377-6), which is 25.4 km (15.8 mi) northwest of the lagoon. Average monthly maximum temperatures at the Oceanside Marina station range from 17.7°C (63.8°F) in February to 23.5°C (74.3°F) in August and average monthly minimum temperatures range from 6.9°C (44.5°F) in December to 17.4° (63.4°F) in August. Mean monthly precipitation at the station ranges from 0.4 mm (0.03 in) in July to 26 mm (2.1 in) in February[1] and all precipitation falls as rain.

1.4 Bed Material

Bed material characteristics are one of the parameters necessary to study sedimentation in a given channel. When using HEC-6, the sediment grain size distribution of the channel in question represents the bed material characteristics of the channel. The grain size distribution used in this study was based on soil borings collected from the western part of the lagoon, where stream flow experiences abrupt decreases and increases in velocity at the bridges. Table 1 shows grain size distributions for several sediment sampling locations and shows their corresponding locations along the lagoon. The data does not indicate a specific pattern of sediment grain size distribution along the lagoon, but it does have some general characteristics: fine sand generally constitutes a large fraction of the sediment within the lagoon ranging from 43% to 93% of the total

[1] All climate summary data retrieved from Western Regional Climate Center web pages.(*http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6377*)