APPENDIX B

Hydraulic Modeling Results

Hydraulic Impact Analysis For Levee Raises Proposed By The Natomas Levee Improvement Program Landside Improvements Project

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Introduction

The Natomas Levee Improvement Program (NLIP) Landside Improvements Project (NLIP Landside Project) proposes raising and strengthening the Sacramento River east levee between the Natomas Cross Canal and the American River and the Natomas Cross Canal south levee to ensure that they could pass a "200-year" flood event[1] with a minimum of three feet of freeboard. The design top of levee elevation is based on adding three feet of freeboard to the water surface resulting from routing the 200-year flood event through the Sacramento and Feather Rivers with the assumption that levees comprising the Sacramento River Flood Control Project (SRFCP) overtop without levee failure. This report provides the results of an analysis to determine if the NLIP Landside Project would have any impacts on SRFCP design water surface elevations in adjacent river channels or on flows that exceed system design in these channels or in floodplain areas upstream and downstream of the Natomas Basin.

The NLIP Landside Project involves improvements to the landside of the Natomas Basin levees. These improvements would not alter the existing geometry or hydraulic characteristics (e.g., construction of a setback levee a significant distance away from the existing levee and removal of the existing levee) of the river and stream channels surrounding the basin and would therefore not affect SRFCP design flows or stages. Therefore, it can be concluded that the design capacity of the system as defined by USACE[2] would not be impacted by the Project. Accordingly, this document focuses on whether or not construction of the NLIP Landside Project facilities would affect river and floodplain water surface elevations in flood events that exceed the SRFCP design. To answer this question, a hydraulic computer model was used to compute water surface elevations for the 100-year and 200-year flood events with and without the NLIP Landside Project facilities in place. The NLIP also proposes to construct bank protection improvements at nine sites along the Sacramento River east levee and at two sites along the NCC south levee. The potential impacts to river stages that may result from these bank protection improvements are addressed in a separate report.

Hydraulic Model

The MBK version of the Sacramento River UNET hydraulic simulation model that was originally developed by the United States Army Corps of Engineers (USACE) for the Sacramento-San Joaquin River Basins Comprehensive Study (Comprehensive Study) was used to complete this analysis.

[1] The 200-year flood event is a flood event that has a 0.5% chance of occurring in any given year.
[2] USACE, Sacramento River Flood Control Project, California, Levee and Channel Profiles, 15 March 1957

Levee Performance

For the without project scenario the hydraulic model simulations assumed that all levees within the SRFCP outside the Natomas Basin would hold water to the top of their current profile and would fail when overtopped. Flow over the levees was allowed to surcharge 0.5 feet before the levee would begin to fail. If the levee failure criteria were met, a levee breach with a bottom width of 500 feet was assumed for levee failures on the major waterways (Sacramento River, American River, Feather River, Sutter Bypass and Yolo Bypass). For all other waterways a levee failure bottom width of 200 feet was assumed. Breaches were assumed to reach their final width in 2 hours. These levee failure assumptions are consistent with historical levee breaks.

Hydrology

The analysis was made using the following hydrologic centerings[3] that were developed by the USACE for the Comprehensive Study UNET model:

- Sacramento River at Sacramento
- Feather River at Shanghai Bend
- American River at Folsom Dam

The Folsom Dam releases in the Comprehensive Study hydrologic data sets were replaced with flood routings produced in August 2006 by the USACE[4] that are based on today's operating rules.

Results

As discussed, the analysis focused on changes in water surface elevations for the 100-year and 200-year flood events with and without the NLIP Landside Project facilities in place. The analysis showed that the existing Natomas Basin levees that would be raised as part of the NLIP Landside Project, would not fail due to overtopping in either of the modeled flood events (see Figures 1 and 2). Therefore, it follows that incorporation of the NLIP Landside Project improvements into the analysis would have no effect on water surface elevations for the modeled flood events. The peak flows in the Sacramento River downstream of the Natomas Cross Canal were 112,000 cfs and 141,000 cfs in the 100-year and 200-year simulations, respectively. For perspective, the SRFCP design discharge in this reach is 107,000 cfs and the peak flow reported for the Verona gage during the January 1997 flood event was 102,000 cfs.

Because of the determination that the existing Natomas Basin levees would not overtop even under a 200-year flood analysis, a second analysis was performed. This analysis assumed that levees throughout the SRFCP would fail when the river water surface elevation reached within

[3] The hydrologic centerings represents a system-wide storm that produces the n-year frequency discharge at the stated location. The studies performed herein used hydrologic input data from the HEC-DSS file SACINFLO.DSS, dated 5/14/2002, developed by USACE for use with the Sacramento River UNET model.

[4] The flood routings are from the following USACE spreadsheet files:
Current Conditions – "01 Folsom 2006-08-17 R000_800CF.xls"

three feet of the top of levee. The water surface profiles for this analysis are shown on Figures 3 and 4. This analysis also showed that the existing Natomas Basin levees would not fail. This means that under two very different levee failure scenarios, the Natomas Basin levees are currently superior to other levees in the SRFCP system.

Conclusion

The proposed landside improvements to the Natomas Basin levees would not adversely impact the SRFCP upstream, downstream or within the river and stream channels around the basin because the existing Natomas Basin levees are superior in height to the levees throughout the SRFCP system. Raising and strengthening the Natomas Basin levees, as proposed under the NLIP Landside Project, would not change this existing relationship. The NLIP Landside Project would provide greater assurance that the Natomas Basin levees could reliably protect a growing urban area without creating adverse hydraulic impacts elsewhere in the SRFCP.

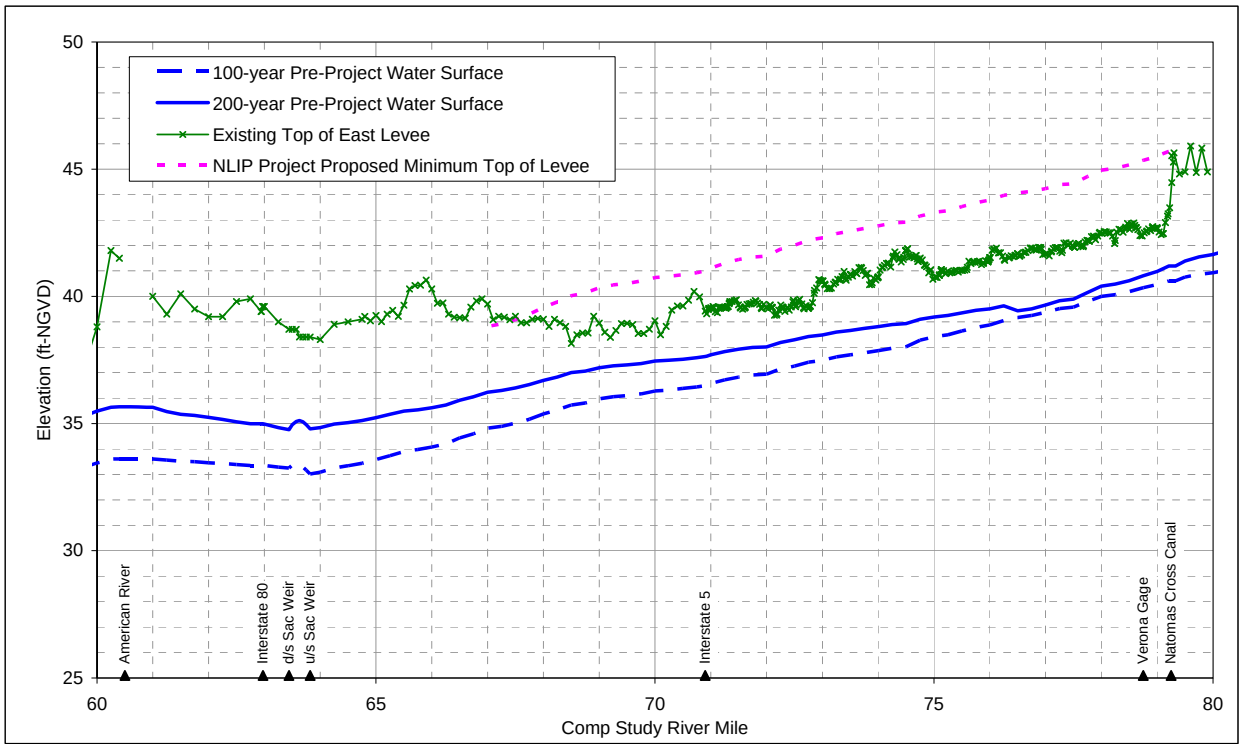

Figure 1. Overtopping Levee Failure Simulation Profiles – Sacramento River between Natomas Cross Canal and American River

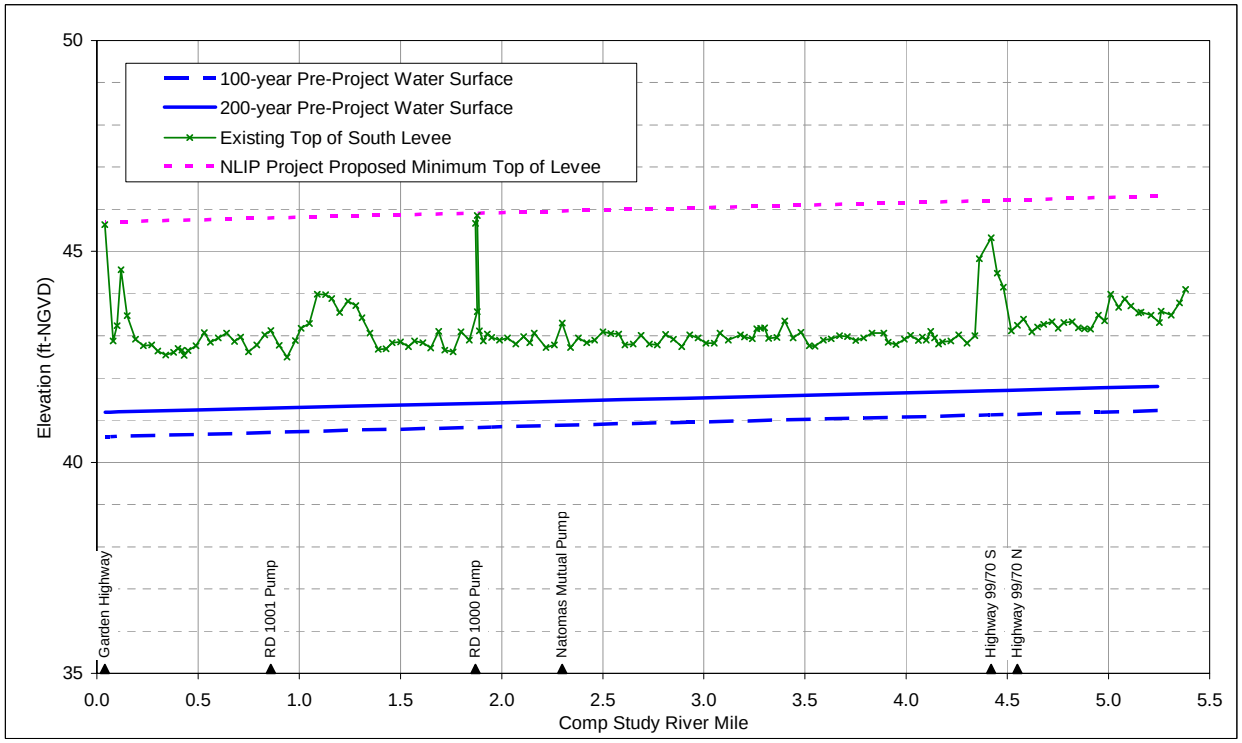

Figure 2. Overtopping Levee Failure Simulation Profiles – Natomas Cross Canal

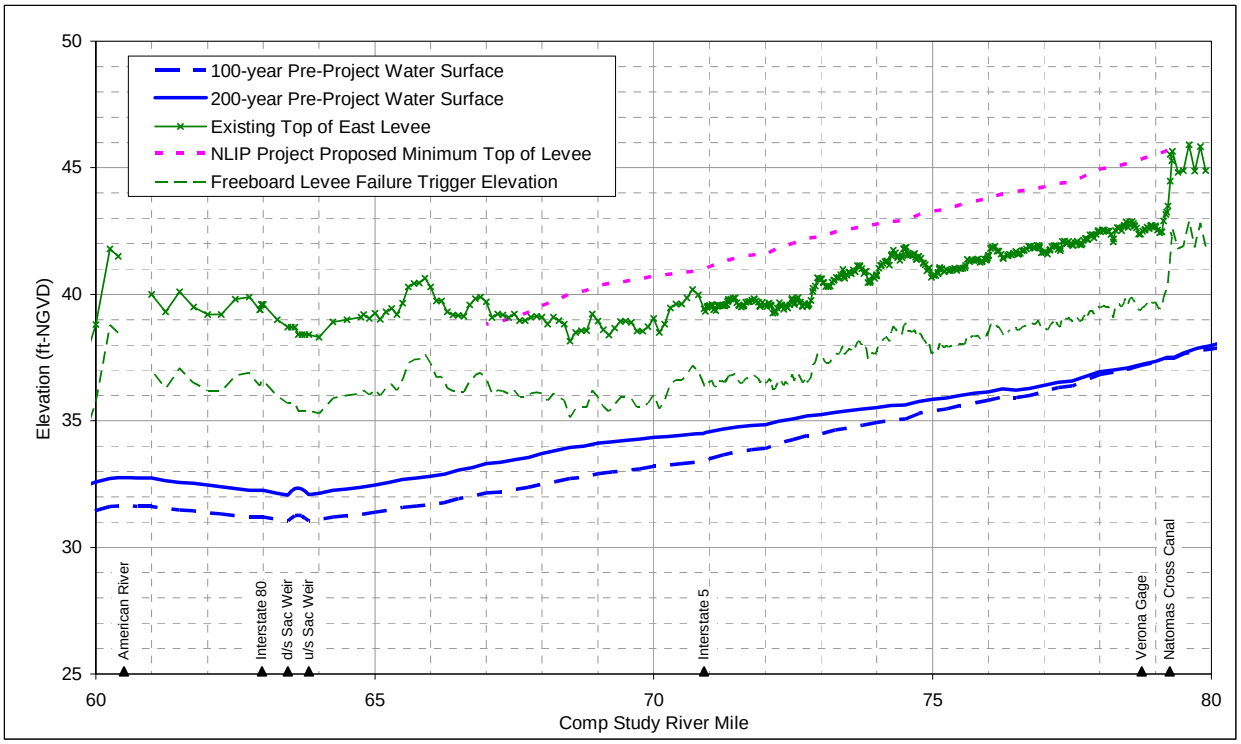

Figure 3. Freeboard Encroachment Levee Failure Simulation Profiles – Sacramento River between Natomas Cross Canal and American River

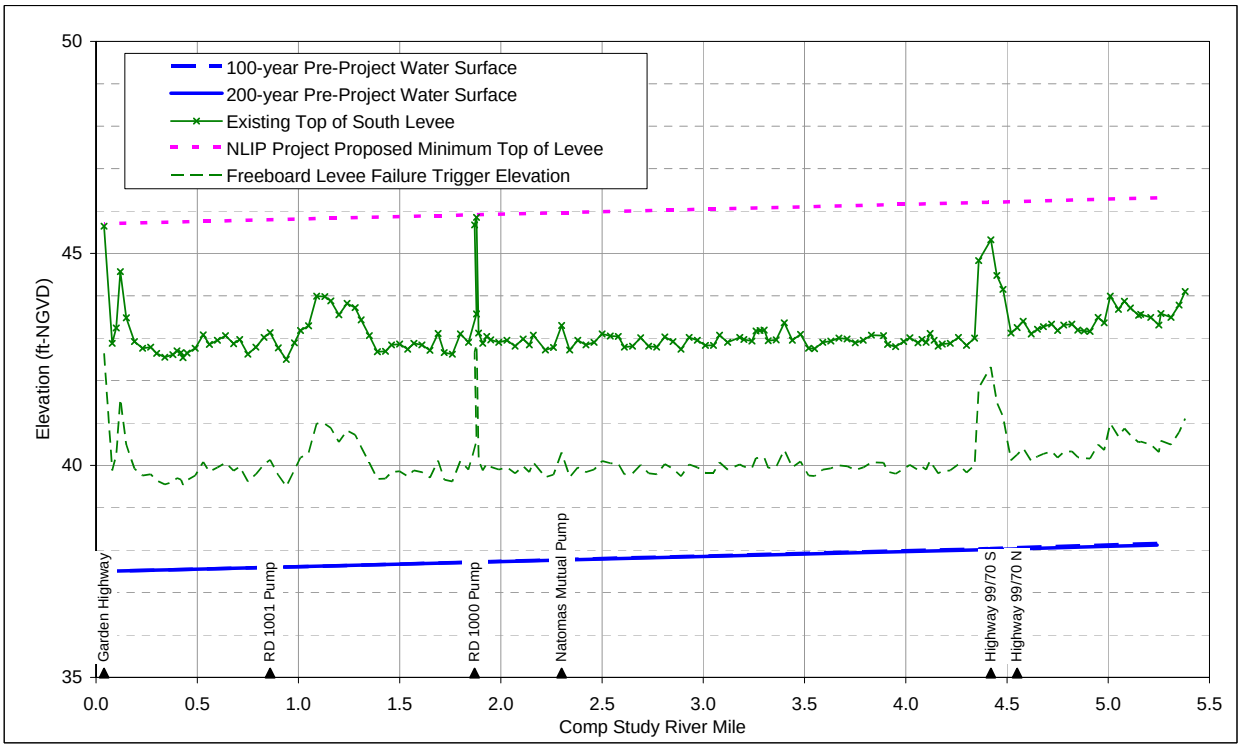

Figure 4. Freeboard Encroachment Levee Failure Simulation Profiles – Natomas Cross Canal