



**US Army Corps
of Engineers** ®
Los Angeles District



SANTA ANA RIVER 3 LEVEE SYSTEM (UPSTREAM REACH)

**ORANGE COUNTY, CALIFORNIA
NLD SYSTEM ID # 3805010015**

**PERIODIC INSPECTION REPORT NO. 1
GENERALIZED EXECUTIVE SUMMARY**

**FINAL SYSTEM RATING: MINIMALLY ACCEPTABLE
FINAL RATING DATE: 20 AUGUST 2015**

PERIODIC INSPECTION REPORT PREPARED BY TETRA TECH FOR THE
U.S. ARMY CORPS OF ENGINEERS, LOS ANGELES DISTRICT

SUBMITTED: JULY 2015
INSPECTED: NOVEMBER 3-5, 2014

EXECUTIVE SUMMARY

This Executive Summary provides an introduction to the Periodic Inspection, an overview of the upstream reach of the Santa Ana River 3 (SAR3) Levee System, which will be referred to as the SAR3 Levee System (Upstream Reach) from hereon, a summary of the major findings of the Periodic Inspection of the SAR3 Levee System (Upstream Reach), and the overall rating for the SAR3 Levee System.

1.1 Scope and Purpose of Periodic Inspections

The purpose of the SAR3 Levee System (Upstream Reach) Periodic Inspection is to identify deficiencies that pose hazards to human life or property. The inspection is intended to identify the issues in order to facilitate future studies and associated repairs as appropriate.

This assessment of the general condition of the SAR3 Levee System (Upstream Reach) is based on available data and visual inspections. Detailed investigation and analysis involving hydrologic design, topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of this levee system inspection.

1.2 System Summary

This report is Volume 2 of 2 of the Santa Ana River 3 (SAR3) Levee System Periodic Inspection Report No. 1. This volume includes the upstream reach of the SAR3 Levee System. The SAR3 Levee System (Upstream Reach) is located on the left/east bank of the Santa Ana River in the state of California, in Orange County, in the cities of Yorba Linda, Anaheim, Orange, and Santa Ana (Figure 1). The SAR3 Levee System (Upstream Reach) has a levee embankment with a riverward slope, which is lined with either grouted stone, riprap, reinforced concrete, or shotcrete reinforced with welded wire mesh. Other structures along the SAR3 Levee System (Upstream Reach) include reinforced-concrete wing walls, reinforced-concrete retaining walls, drop structures, grade stabilizers, 103 conduits associated with side-drainage structures, numerous utility crossings, 19 bridge crossings, and 28 access ramps.

The SAR3 Levee System (Upstream Reach) is composed of two levee segments. These segments are referred to as the Santa Ana River 3B (ST3B) Levee Segment and the upstream reach of the Santa Ana River 3A (ST3A) Levee Segment, which will be referred to as the ST3A Levee Segment (Upstream Reach) from hereon. The ST3B Levee Segment was constructed by the Orange County Environmental Management Agency (OCEMA) for the Santa Ana Valley Irrigation Company (SAVI). OCEMA is now referred to as the Orange County Flood Control District (OCFCD). The ST3B Levee Segment extends from upstream of Yorba Linda Boulevard/Weir Canyon Road at SAVI Station 43+89 (i.e., United States Army Corps of Engineers, Los Angeles District [USACE LAD] Station 1253+74) to SAVI Station 6+65 (i.e., USACE LAD Station 1216+50), a distance of 3,724 feet (0.70 miles). The ST3A Levee Segment (Upstream Reach) was constructed by the USACE LAD. It starts at USACE LAD Station 1216+50 (i.e., SAVI Station 6+65) and extends downstream to USACE LAD Station 571+38, a distance of 64,512 feet (12.22 miles). These stations are based on the stationing along the channel centerline shown on the construction drawings (OCEMA 1980 and 1987 and USACE LAD 1994, 1996a, and 1999). Construction of the ST3B Levee Segment was completed in 1980 (USACE LAD 1988b). Construction of the ST3A Levee Segment (Upstream Reach) was completed in 1999 (USACE LAD 1999). The SAR3 Levee System (Upstream Reach) is now entirely operated and maintained by OCFCD, which is administered by Orange County Public

Works (OCPW) staff. The SAR3 Levee System (Upstream Reach) is not included in the National Levee Database (NLD), but will share the same NLD Number as the SAR3 Levee System, which is 3805010015.

Volume 1 of 2 of this report is titled *Santa Ana River 3 Levee System Final Periodic Inspection No. 1* (USACE LAD 2014a). This volume included the downstream reach of the SAR3 Levee System, which extended from the confluence of the Santa Ana River with Santiago Creek to Victoria Avenue (Figure 1). The SAR3 Levee System (Downstream Reach) was composed of two levee segments: (1) the downstream reach of the ST3A Levee Segment, which will be referred to as the ST3A Levee Segment (Downstream Reach) from hereon, and (2) the Greenville-Banning Levee Segment (i.e., the GB Levee Segment). These levee segments were inspected on June 19, 2013 and December 16-18, 2013. The ST3A Levee Segment (Downstream Reach) consists of the left/east bank of the Santa Ana River and the right/west bank of the GB Channel. The portion of the ST3A Levee Segment (Downstream Reach) along the Santa Ana River extends from the confluence of the Santa Ana River with Santiago Creek (Station 571+38) to Victoria Street (Station 90+40), a distance of 48,098 feet (9.11 miles). The portion of the ST3A Levee Segment (Downstream Reach) that coincides with the GB Channel extends from where the GB Channel begins to parallel the Santa Ana River at GB Station 176+00 to Victoria Street (Greenville-Banning [GB] Station 24+10), a distance of 15,190 feet (2.88 miles). The GB Levee Segment forms the left/east bank of the GB Channel, and extends from where the leveed condition begins along the left/east bank of the GB Channel at GB Station 164+00 to Victoria Street (GB Station 24+10), a distance of 13,990 feet (2.63 miles).

During the next periodic inspection scheduled for November 2019, both the upstream and downstream reaches of the SAR3 Levee System will be inspected together. The two reaches were not inspected together for Periodic Inspection Report No. 1 because the upstream reach was not included in the National Levee Database, and it wasn't until the Periodic Inspection of the downstream reach it was noted there was levee along the upstream reach. The upstream and downstream reaches must be combined into one levee system and share the same NLD number for future Periodic Inspections because they both share the same leveed area.

1.3 Summary of Major Deficiencies Found

The Periodic Inspection of the SAR3 Levee System (Upstream Reach) was conducted on November 3-5, 2014, and OCPW staff was present. During the inspection of the levee system, deficiencies were noted for which remedial actions are required. The following main deficiencies of the project features were noted during the Periodic Inspection:

- ST3B Levee Segment:
 - Interior Drainage Systems:
 - Culverts/Discharge Pipes: The three side-drainage structures could not be visually inspected and have not been video inspected.
- ST3A Levee Segment (Upstream Reach):
 - Levee Embankment:
 - Non-Compliant Vegetation Growth: Significant vegetation growth including trees with trunks larger than 2-inches in diameter, shrubs, large rocks, and an irrigation system were present within the vegetation-free zone. The vegetation, large rocks, and irrigation were all added to the levee for esthetic purposes and are included on the

- landscape drawings (USACE LAD 2006 and 2007). The vegetation-free zone extends 15 feet outward from both the landward and riverward toes of the levee.
- Depressions/Rutting: A depression measuring 10 inches deep, 7 feet long, and 4 feet wide was observed on the landward slope. The depression is greater than 6 inches deep and may lead to ponding water.
 - Cracking: A crack in the levee embankment measuring 1.5 inches wide and up to 18 inches deep was observed along the landward slope from the top to the toe.
 - Riprap Revetments and Bank Protection: Erosion has displaced a 50-foot-wide by 6-foot-deep portion of the derrick stone apron at the downstream end of a drop structure; however, the cut-off wall associated with the drop structure was not undermined.
- Floodwalls:
 - Non-Compliant Vegetation Growth: Vines with diameters less than 2 inches were obstructing the inspection of a concrete wing wall.
 - Interior Drainage Systems:
 - Vegetation and Obstructions: The outlet or inlet of 12 of the side-drainage structures was obstructed by more than 10 percent.
 - Foundation of Concrete Structures: The cut-off wall at the outlet of the Fletcher Channel side-drainage structure was completely exposed and undermined for a width of 66 inches, a height of 6 inches, and 10 inches back into the structure.
 - Culverts/Discharge Pipes: The majority of the side-drainage structures could not be visually inspected and have not been video inspected.
 - Flap Gates/Flap Valves/Pinch Valves: The flap gate was missing at the outlet of a 24-inch-diameter side-drainage structure. The side-drainage structure was shown on the as-built drawings as having a flap gate.
 - Flood Damage Reduction Channels:
 - Flap Gates/Flap Valves/Pinch Valves: The flap gate was missing at the outlet of one of the side-drainage structures. In addition, a 36-inch-diameter RCP side-drainage structure and a 48-inch-diameter RCP side-drainage structure did not have flap gates and no documentation was available to show if a flap gate was or was not required.
 - Revetments other than Riprap: Along a channel reach, the shotcrete slope protection was missing from approximately a 5-foot to 10-foot wide portion of the riverward slope from top of the channel bank to the junction with riprap that provides toe and lower bank protection of the riverward slope.

1.4 Overall Rating

The Levee Safety Officer (LSO) Out-Brief Meeting was held on March 13, 2015. An engineering determination has concluded that the observed deficiencies would not prevent the system from performing as intended during the next significant runoff event. Therefore, the Dam and Levee Safety Section Chief, who was acting on the behalf of the LSO, Los Angeles District, has determined the overall rating of the SAR3 Levee System to be “Minimally Acceptable.”

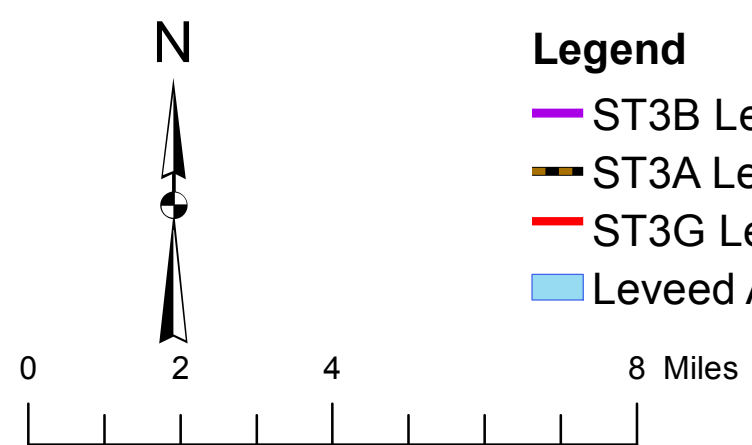
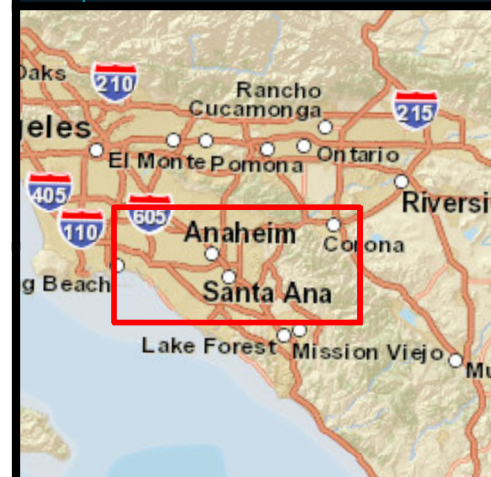
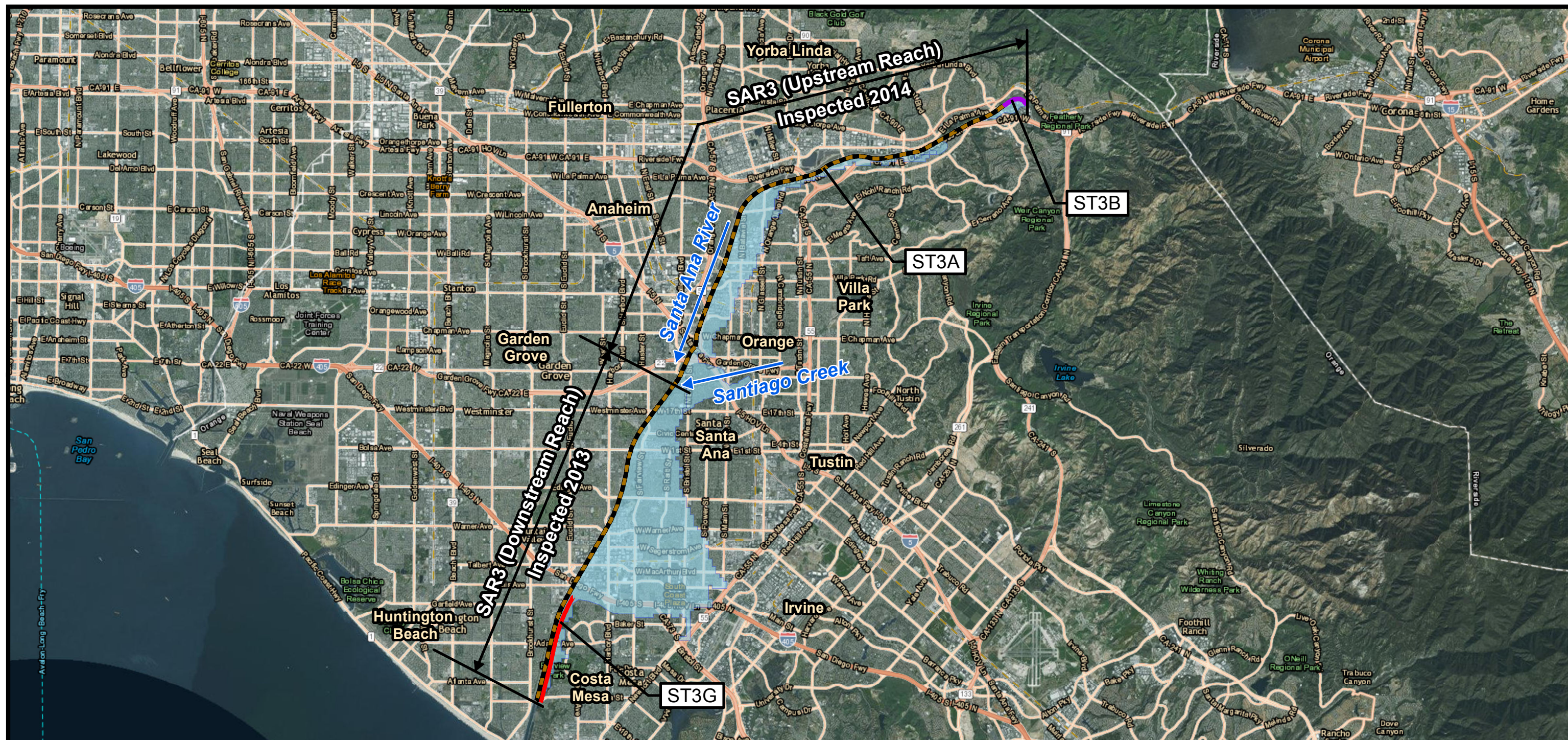
A “Minimally Acceptable” system rating is defined as, “One or more items are rated Minimally Acceptable or one or more items are rated Unacceptable and an

engineering determination concludes that the Unacceptable items would not prevent the segment/system from performing as intended during the next significant runoff event.”

The Local Sponsor will be notified of the overall rating of the levee system by letter with instructions to correct the Unacceptable rated items as soon as possible, and correct the Minimally Acceptable rated items within two years so that they do not deteriorate further and become Unacceptable.

It should be noted that the majority of the inspection observations observed during the Periodic Inspection and rated as Unacceptable were subsequently repaired by OCPW. The repairs are described and photo documented in the OCPW letter titled, “Various Repaired Deficiencies and Video Inspection along Santa Ana River Right Bank and Santa Ana River Left Bank Levee Systems” (OCPW 2015b). In addition, OCPW subsequently video inspected all but four of the side drains along the SAR3 Levee System (Upstream Reach). The pipe inspections are documented in the OCPW report (USACE LAD 2015a) titled, “Santa Ana River Laterals, Condition Assessment Report, Work Order No. 1, December 24, 2014 through February 27, 2015.” The two OCPW documents and the repairs were considered in the overall system rating. The repairs will be incorporated into a post-final Periodic Inspection (PI) Report Levee Inspection System (LIS) database to reflect the repairs made by OCPW.

The pipe video inspections (USACE LAD 2015a) along the ST3B Levee Segment showed that all of the pipes were in good condition. Along the leveed reaches of the ST3A Levee Segment (Upstream Reach), the pipe with the worst noted condition was an 18-inch-diameter Reinforced Concrete Pipe (RCP). The pipe serves to drain a portion of the 91 Freeway. The RCP had a crack at approximately 10 feet, a medium offset joint at 19 feet, another longitudinal crack at 27 feet, and spalling along a joint at 27 feet. The pipe inspector assigned the structural defects a Pipeline Assessment Certification Program (PACP) grade 5, but noted the structural risk was low, and that the structural defects should be monitored within 10 years.



- Legend**
- ST3B Levee Segment
 - ST3A Levee Segment
 - ST3G Levee Segment
 - Leveed Area (PI No. 1)

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LOCATION AND LEVEED AREA MAP



Aerial Source and Date: ESRI 2014