

Technical Notebook

30% Submittal

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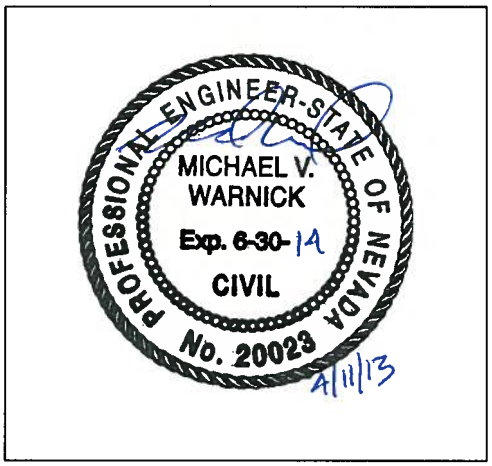
Clark County Public Works
Clark County Parks and Recreation
City of Las Vegas
Clark County Regional Flood Control District

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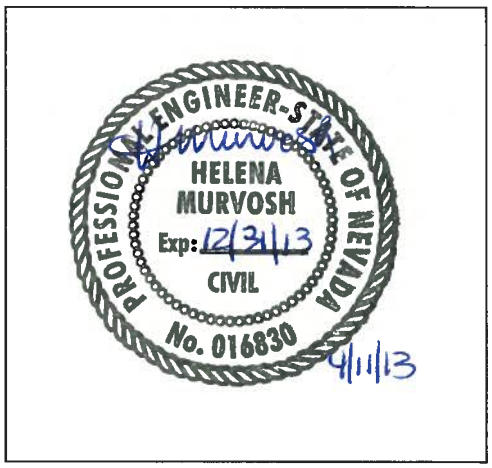
Prepared by:

CH2MHILL
Stanley Consultants INC.

The following design professionals certify that the Calculations contained in this Technical Notebook were prepared by them or under their direct supervision. Initials of each registered engineer appear in the Table of Contents following the title of each technical section for which each professional was responsible.



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1 INTRODUCTION

1.1 STUDY OVERVIEW AND PURPOSE

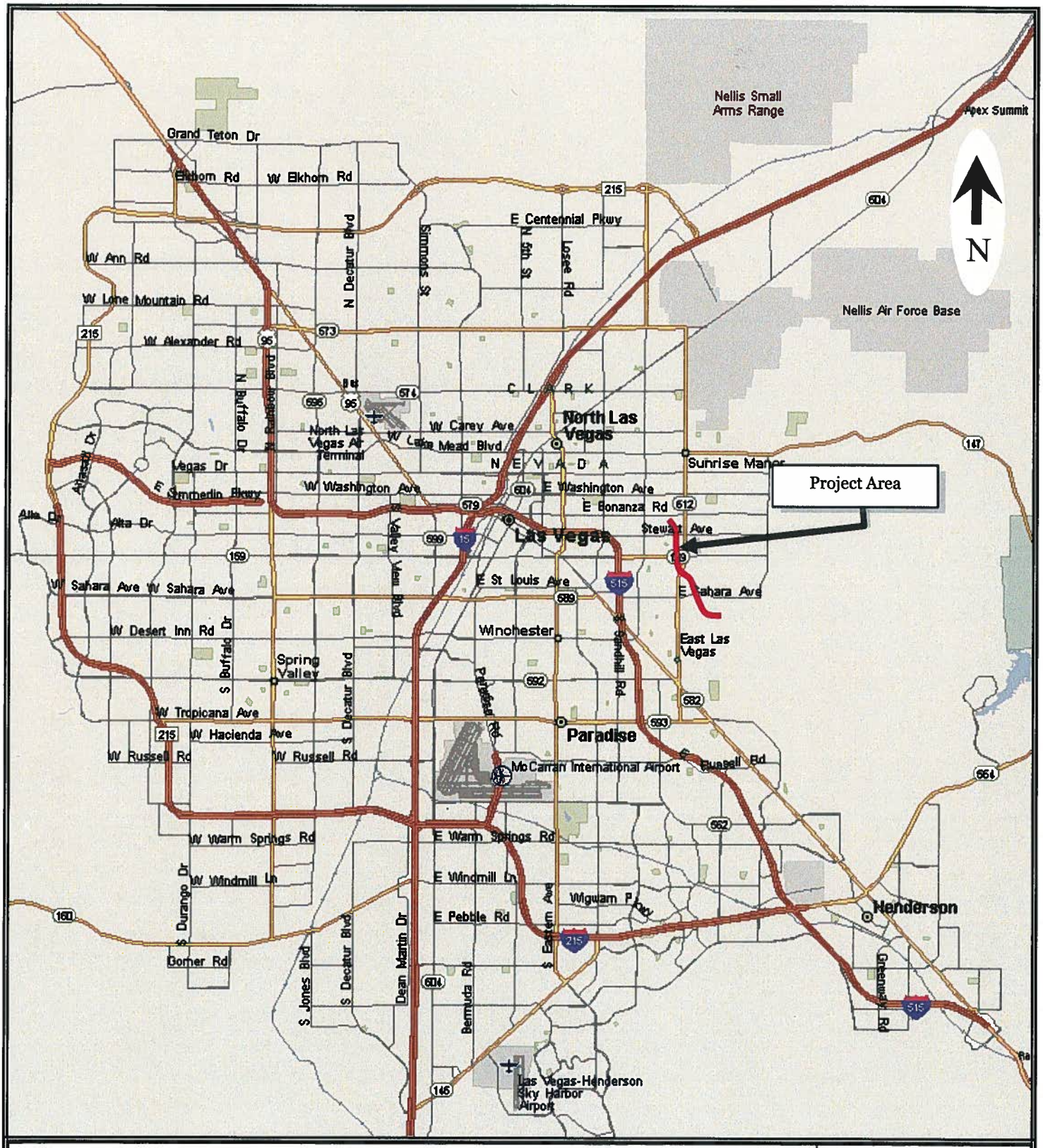
On November 7, 2012, Clark County, Nevada entered into a professional engineering services contract with CH2M HILL Engineers, Inc. for the *Las Vegas Wash – Sloan Channel to Cedar Avenue*. The scope of services to be provided with this project is for the design and preparation of contract drawings for the Flood Control improvements on the Las Vegas Wash from the Sloan Channel to Cedar Avenue. The project improvements include rectangular and trapezoidal reinforced concrete channel lining, regrading and redesign of the Desert Rose Golf Course, public outreach, CMAR support, hydraulic analysis of the Las Vegas Wash from Sloan Channel to Cedar Avenue and confluence analysis and design for the Flamingo Wash, Nellis Wyoming Channel, Colorado Storm Drain, Charleston MPU Channel, Cedar Channel, local storm drainage facilities, Sahara roadway and bridge design, utility modifications and relocations, and other necessary appurtenances required to design and prepare contract drawings for the Project.

1.2 SITE LOCATION

The project area is located in Section 32 of Township 20 South, Range 62 East, M.D.M., Clark County, Nevada, and Sections 4, 9, and 10 of Township 21 South, Range 62 East, M.D.M., Clark County, Nevada. The northern end of the project is located 1000 feet south of Bonanza Drive. The southern end of the project is located 1,100 feet east of Sloan Lane. See *Figure 1, Vicinity Map* for location of project in the Las Vegas Valley.

1.3 SITE DESCRIPTION

The improvements included with this project consist of approximately 14,800 feet (2.8 miles) of flood control upgrades within the existing right-of-way along the reach. The existing right-of-way varies from 140 feet to almost 870 feet (at the confluence with the Flamingo Wash) and is designated as either Flood Channel, Public, or Clark County Parks and Community Service. The existing right-of-way is confined on both sides by existing residential and commercial development. The improvements will include reinforced concrete lining, confluence structures, transition structures, bridge construction, roadway reconstruction, golf course reconstruction, storm drain inlets, accommodation for existing large diameter sewer, trail, and overhead utility facilities. There are four



Vicinity Map

Las Vegas Wash

Sloan Channel to Cedar Avenue

Figure 1

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major roadway bridge crossings of the Las Vegas Wash within the Project: Stewart Avenue, Charleston Boulevard, Nellis Boulevard, and Sahara Avenue. The existing bridge structures are at varying stages of design life and have dissimilar conveyance capacities. Major tributary facilities include a trapezoidal concrete channel at Cedar Avenue, an RCB at Colorado Avenue, the Flamingo Wash, and the Sloan Channel. Cedar Avenue to the center of Charleston Boulevard is within the jurisdiction of the City of Las Vegas. From the centerline of Charleston Boulevard to the Sloan Channel Confluence is within unincorporated Clark County (Sunrise Manor). See *Figure 2, Project Area Map.*

The upstream portion of the project, between Cedar Avenue and Nellis Boulevard, is approximately 5,400 feet long. This reach consists of an existing partially improved channel section within an approximately 150ft wide right-of-way that includes some sections of rip rap or concrete slope lining and articulated concrete block on the invert. There is an existing 66" sanitary sewer facility along the west side of the right-of-way that will be accommodated with the channel improvements. The capacity of the Charleston Bridge will be increased by lowering the existing invert and protecting the existing 51" sanitary sewer that is attached to the underside of the bridge structure. The Stewart Avenue and Nellis Boulevard bridge structures will be protected in place with channel lining under the structures.

The middle portion of the project, between Nellis Boulevard and the confluence with the Flamingo Wash, is approximately 7,800 feet long. This reach of the project is located within the existing Desert Rose Golf Course. The Golf Course reach consists of an approximately 450 foot to 575 foot wide grass-lined channel section with a varying cross-section to accommodate the golf course layout for hole #1 and holes #10 through #18. The golf course will be regraded/reconfigured to contain the 100-year design storm event flow within the right-of-way. The capacity of the Sahara Bridge will be increased with this project by removing the existing bridge and construction a new larger bridge. There are three existing golf cart bridge locations within the golf course that will be modified or replaced. An existing concrete low-flow valley gutter conveys the constant nuisance flow from the north end of the golf course to the just downstream of the second golf cart bridge, where a drop inlet collects the nuisance flow and conveys it in an RCP to the confluence with the Flamingo Wash.

The downstream portion of the project, between the confluence with the Flamingo Wash and the Sloan Channel confluence, is approximately 1,600 feet long. This reach consists of a partially improved channel section within an approximately 300 foot right-of-way that includes reinforced concrete slope lining on the north side of the channel. The south wall and the invert of the existing section are both natural. There is a sheet pile weir located in the channel at the Sloan Lane alignment to protect the sewer siphons located under the Wash at this location. The existing reinforced concrete trapezoidal channel section begins approximately 350ft upstream of the Sloan Channel Confluence, and it is proposed that the channel improvements will tie into this section.

2 MPU FLOWRATES

The project flow rates are based off the 2008 MPU. A complete summary of the flows at major design point along the wash has been included in Appendix A-1. Because the majority of tributary area to the project is within the McCarran Airport rainfall area, a scaling factor was determined for the 2-year, 5-year, 10-year, 25-year and 50year. These flow rates were used to determine the level of storm water protection in the golf course. The range of design storms also was ran to test the sensitivity of the hydraulic models. Additional design points and information was needed at certain points along the project for analysis of laterals. The HEC-1 output for these laterals is included on the Data CD. This information is also summarized in Appendix A-1.

3 GOLF COURSE DESIGN

The golf course routing has been shown in Appendix A-3. The main changes in the routing occur at Holes 10 and 18, they have been swapped along the west and east sides of the wash. This change of routing has eliminated the crossing pattern that existed at the Sahara Bridge. Currently, golfers had to travel under the bridge then around and over the bridge adjacent to traffic to get from Hole #10 to Hole #11a and from Hole #17 to Hole #18. The two-way traffic under the bridge created a conflict for carts. The proposed routing change of Holes #10 and #18 eliminate this movement and provides for a path to cross under Sahara Avenue along each side of the Las Vegas Wash. Additionally, the cart path was relocated to left side of every hole, by doing this it was possible to raise the elevations of the cart path to be above the 100-year water surface elevation. This will create a safe zone for golfers to access along Holes #1, and #10 - #18. Because the crossings under the Sahara Bridge are below the 100-year water surface, at-grade access to Sahara Avenue has been placed at each quadrant of the bridge, within existing right-of-way. A gate will be placed at each location with a sidewalk ramp and a notch in the median to drive carts across the roadway, back to the clubhouse.

Summarized in Appendix A-2 are the design elevations for tees, landing areas, and greens for each hole. These elevations were compared with the hydraulic models to determine the level of protection for each facility.

4 SAHARA AVENUE BRIDGE

The existing Sahara Bridge does not have the capacity to convey the 100-year flow. It also cannot be structurally modified to adjust the invert through the bridge. A new bridge has been proposed to the east of the current location. Included in Appendix A-4 is a memorandum discussing the bridge type selection and the alternatives that were also considered. The Sahara Avenue profile was adjusted slightly to improve the roadway conditions and to provide the necessary two feet of freeboard above the 100-year water surface elevation to the soffit of the bridge.

5 UTILITY CONFLICTS

There are several utilities, including, trail improvements, overhead electrical, and sanitary sewer, that follow the alignment of the wash. In addition, at each bridge crossing are multiple utility crossings, including, water, gas, cable TV, fiber optic, overhead electric and transmission, underground telephone and electric, and sanitary sewer siphons. The proposed improvements were designed to avoid most of these existing utilities. A Utility Conflict Schedule for the 30% design has been included in Appendix A-5. Utilities that are known to be relocated or adjusted with the project include sanitary sewer manholes, a portion of the 66-inch sanitary sewer, and existing golf course irrigation appurtenances. Utilities that will be relocated by others and are being coordinated include an overhead electrical distribution pole and underground electric at Sloan Lane, a 4-inch PE/Steel gas line at the Sahara Avenue bridge, and a cable TV box along Sahara Avenue.

6 DRAFT GEOTECHNICAL REPORT

A geotechnical analysis was performed for the project and the results have been compiled and presented in the Draft Geotechnical Report that has been included on the Data CD. The filed exploration, lab testing, and analyses concluded that the proposed facilities are suitable for construction. The recommendations contained in the report will be used as design progresses and develops. Groundwater was found throughout the project and an under-drain system will be required for the channel lining. Soils

near the limits of concrete structures will need to be overexcavated to remove loose, soft, firm or wet soils.

7 LAS VEGAS WASH HYDRAULIC ANALYSIS

7.1 HEC-RAS ANALYSIS

A hydraulic analysis for the proposed Las Vegas Wash channel was performed from the Sloan channel to Cedar Avenue using HEC-RAS. The upstream end of the model is approximately 1150 feet upstream of the Cedar Avenue Channel. The downstream end of the model is at Vegas Valley Drive. The HEC-RAS model features the concrete lined channel upstream of the golf course, the proposed grading surface through the golf course, including the proposed Sahara Avenue Bridge, Confluence with the Flamingo Wash, and the concrete lined trapezoidal channel to the tie-in point near the Sloan Confluence. Even though the concrete channel upstream of Nellis is included in the HEC-RAS model the channel has been designed using the WSPG analysis, see section 7.2. The HEC-RAS model shows similar characteristics to the WSPG model, the transition from the concrete lined channel to the golf course channel creates a choke point to the flow. This area remains hydraulically stable, but creates a backwater effect that drives the hydraulic jump upstream of Nellis Boulevard. The HEC-RAS water surface at the end of the rectangular channel was used as the system outlet for the WSPG model. The HGL plotted on the 30% plans downstream of the rectangular concrete channel is from the HEC-RAS analysis. The high point plotted on the 30% plans is the bank station, left or right, along the HEC-RAS cross section.

Small variations between the modeling techniques of HEC-RAS and WSPG, as well as a cross slope from the flowline are input into the HEC-RAS model that lead to slight variations in the water surface elevations. The HEC-RAS model through the golf course to Sloan Channel has been summarized on the table below. The grading in the golf course was adjusted to lower velocities to less than 12 feet per second; in areas with higher velocities a Pyramat turf reinforcement mat will be utilized to armor the banks of the channel. In areas that the water surface elevation was higher than the adjacent houses to the golf course, additional mounding has been placed to create additional freeboard and to decrease the amount of material that will be required to be exported from the project. This occurs between 45+55 and 47+00, 59+00 and 60+00, on the right bank (west side). It also occurs between 53+00 to 57+00, 60+25 to 85+50 on the left bank (east side).

The confluence with the Flamingo Wash was modeled as a separate reach and junction located just downstream of the driving range. With the lower driving range the flows from the two washes come

together over a 1,000 foot reach and reach equilibrium before the low flow channels come together. Downstream of the confluence is a 120 foot wide trapezoidal channel with 4:1 side slopes that will be grass-lined and maintained as part of the golf course facilities.

To check the sensitivity of the Sahara Bridge a pier bulking model was run with the piers bulked by three feet. The analysis showed that the change in water surface through the bridge structure increased by 0.13 feet. The minimal disruption to the water surface is an acceptable amount of lost freeboard. The results of this analysis are in Appendix D.

Table 7.1.1 – HEC-RAS Summary Table

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP BANK ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 73+32.16 = "LF" 13+38.42	15,156	1716.81	1732.59	15.78	11.61	85.00	0.52	1736.16	1735.18	3.57
"LV" 18+80.50	15,156	1716.05	1732.42	16.37	11.18	85.00	0.49	1735.40	1734.86	2.98
"LV" 19+35.00	15,156	1715.97	1732.95	16.98	8.49	178.63	0.47	1736.85	1734.57	3.90
"LV" 19+53.64	15,156	1715.94	1732.92	16.98	8.49	181.82	0.48	1736.84	1734.54	3.92
"LV" 20+00.00	15,156	1715.88	1732.90	17.02	8.25	202.92	0.48	1736.57	1734.46	3.67
"LV" 20+44.07	15,156	1715.82	1732.83	17.01	8.24	234.29	0.52	1736.10	1734.38	3.27
"LV" 21+00.00	15,156	1715.74	1732.68	16.94	8.40	231.37	0.53	1735.78	1734.28	3.10
"LV" 21+66.63	15,156	1715.65	1732.56	16.91	8.37	237.06	0.53	1735.65	1734.15	3.09
"LV" 22+00.00	15,156	1715.57	1732.52	16.95	8.20	243.11	0.52	1737.00	1734.06	4.48
"LV" 22+27.02	15,156	1715.50	1732.51	17.01	7.98	250.83	0.51	1735.98	1734.00	3.47
"LV" 22+50.00	15,156	1715.44	1732.49	17.05	7.88	258.93	0.51	1737.00	1733.95	4.51
"LV" 22+97.33	15,156	1715.33	1732.45	17.12	7.62	284.05	0.51	1737.00	1733.85	4.55
"LV" 23+31.65	15,156	1715.24	1732.31	17.07	7.92	253.44	0.51	1737.00	1733.78	4.69
"LV" 23+65.98	15,156	1715.16	1732.11	16.95	8.40	237.58	0.54	1737.00	1733.71	4.89
"LV" 24+00.00	15,156	1715.07	1731.95	16.88	8.71	237.62	0.57	1737.00	1733.63	5.05
"LV" 24+26.00	15,156	1715.01	1731.90	16.89	8.63	255.89	0.58	1737.00	1733.56	5.10
"LV" 24+50.00	15,156	1714.95	1731.83	16.88	8.66	270.18	0.60	1737.00	1733.49	5.17
"LV" 25+00.00	15,156	1714.82	1731.69	16.87	8.68	281.07	0.61	1735.36	1733.36	3.67
"LV" 25+50.00	15,156	1714.70	1731.45	16.75	9.02	270.80	0.64	1735.00	1733.21	3.55
"LV" 26+00.00	15,156	1714.58	1731.19	16.61	9.33	278.46	0.68	1734.00	1733.04	2.81
"LV" 26+21.93	15,156	1714.52	1731.04	16.52	9.56	275.96	0.70	1734.00	1732.96	2.96
"LV" 26+50.00	15,156	1714.45	1730.91	16.46	9.65	272.51	0.71	1733.32	1732.86	2.41
"LV" 27+00.00	15,156	1714.33	1730.80	16.47	9.31	281.90	0.68	1733.51	1732.65	2.71
"LV" 27+21.29	15,156	1714.28	1730.82	16.54	8.81	320.47	0.67	1733.59	1732.53	2.77
"LV" 27+60.57	15,156	1714.18	1730.71	16.53	8.76	292.74	0.63	1733.67	1732.40	2.96
"LV" 28+00.00	15,156	1714.08	1730.33	16.25	9.59	238.74	0.66	1733.62	1732.26	3.29
"LV" 28+50.00	15,156	1713.96	1730.26	16.30	9.30	201.76	0.58	1733.27	1732.10	3.01
"LV" 29+00.00	15,156	1713.83	1730.23	16.40	8.92	189.21	0.52	1733.66	1731.97	3.43
"LV" 29+50.00	15,156	1713.71	1730.21	16.50	8.51	243.62	0.56	1733.40	1731.83	3.19

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP BANK ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 30+00.00	15,156	1713.58	1730.14	16.56	8.36	245.94	0.54	1733.63	1731.73	3.49
"LV" 30+43.11	15,156	1713.48	1729.86	16.38	8.99	191.87	0.53	1733.13	1731.61	3.27
"LV" 31+00.00	15,156	1713.34	1729.78	16.44	8.93	180.29	0.51	1732.59	1731.52	2.81
"LV" 31+50.00	15,156	1713.22	1729.71	16.49	8.82	197.15	0.53	1732.60	1731.42	2.89
"LV" 32+00.00	15,156	1713.09	1729.63	16.54	8.81	184.52	0.51	1732.00	1731.34	2.37
"LV" 32+50.00	15,156	1712.97	1729.50	16.53	8.97	176.82	0.51	1732.00	1731.25	2.50
"LV" 33+12.37	15,156	1712.81	1729.60	16.79	7.86	225.33	0.47	1731.15	1731.06	1.55
"LV" 33+63.25	15,156	1712.68	1729.60	16.92	7.41	271.87	0.48	1730.99	1730.95	1.39
"LV" 34+14.13	15,156	1712.56	1729.50	16.94	7.47	288.73	0.50	1730.95	1730.87	1.45
"LV" 34+60.73	15,156	1712.44	1729.33	16.89	7.80	299.30	0.54	1730.90	1730.77	1.57
"LV" 34+97.30	15,156	1712.34	1728.47	16.13	10.26	206.07	0.67	1730.80	1730.60	2.33
"LV" 35+00.00	**Inl Struct**									
"LV" 36+00.00	15,156	1713.94	1726.26	12.32	14.29	136.75	0.90	1730.00	1729.93	3.74
"LV" 36+50.00	15,156	1713.00	1726.94	13.94	10.95	204.66	0.74	1729.56	1729.30	2.62
"LV" 37+17.28	15,156	1711.81	1726.78	14.97	10.70	162.05	0.64	1729.89	1729.06	3.11
"LV" 37+65.90	15,156	1711.69	1727.00	15.31	9.16	213.94	0.58	1729.78	1728.80	2.78
"LV" 38+14.51	15,156	1711.57	1727.17	15.60	7.77	221.73	0.46	1729.67	1728.61	2.50
"LV" 38+50.00	15,156	1711.47	1727.24	15.77	7.04	244.88	0.42	1729.42	1728.51	2.18
"LV" 39+00.00	15,156	1711.35	1727.21	15.86	6.91	244.61	0.41	1729.00	1728.45	1.79
"LV" 39+50.00	15,156	1711.23	1727.16	15.93	6.85	272.22	0.42	1730.00	1728.39	2.84
"LV" 40+00.00	15,156	1711.10	1727.05	15.95	7.04	281.02	0.45	1730.00	1728.32	2.95
"LV" 40+44.66	15,156	1711.00	1726.91	15.91	7.32	291.87	0.48	1730.00	1728.24	3.09
"LV" 41+00.00	15,156	1710.86	1726.65	15.79	7.93	301.93	0.56	1730.00	1728.13	3.35
"LV" 41+50.00	15,156	1710.74	1726.35	15.61	8.60	260.95	0.58	1731.00	1728.00	4.65
"LV" 41+76.51	15,156	1710.67	1726.34	15.67	8.30	277.34	0.57	1731.00	1727.91	4.66
"LV" 42+03.02	15,156	1710.62	1726.32	15.70	8.07	292.91	0.56	1729.82	1727.83	3.50
"LV" 42+37.46	15,156	1710.52	1726.41	15.89	7.07	343.91	0.50	1728.47	1727.69	2.06
"LV" 42+71.91	15,156	1710.43	1726.26	15.83	7.44	324.28	0.52	1727.67	1727.62	1.41
"LV" 43+25.00	**Inl Struct**									
"LV" 45+06.50	15,156	1709.86	1725.51	15.65	9.08	308.90	0.69	1727.69	1727.29	2.18
"LV" 45+55.96	15,156	1709.73	1725.61	15.88	7.79	316.25	0.55	1727.86	1727.05	2.25
"LV" 45+91.64	15,156	1709.64	1725.56	15.92	7.59	333.39	0.55	1728.48	1726.95	2.92
"LV" 46+27.56	15,156	1709.55	1725.47	15.92	7.61	359.23	0.57	1727.00	1726.87	1.53
"LV" 46+50.00	15,156	1709.50	1725.40	15.90	7.68	359.10	0.58	1727.82	1726.82	2.42
"LV" 47+00.00	15,156	1709.37	1725.24	15.87	7.84	314.23	0.56	1728.10	1726.69	2.86
"LV" 47+63.19	15,156	1709.21	1724.99	15.78	8.24	264.93	0.55	1727.99	1726.54	3.00
"LV" 48+00.00	15,156	1709.12	1724.95	15.83	8.00	296.74	0.56	1727.91	1726.44	2.96
"LV" 48+50.00	15,156	1709.00	1724.93	15.93	7.47	352.20	0.55	1726.88	1726.30	1.95
"LV" 48+76.97	15,156	1708.93	1724.70	15.77	8.10	314.24	0.59	1726.70	1726.22	2.00
"LV" 49+00.00	15,156	1708.87	1724.43	15.56	8.82	286.56	0.63	1726.98	1726.14	2.55
"LV" 49+50.00	15,156	1708.75	1723.82	15.07	10.20	222.48	0.70	1726.85	1725.94	3.03
"LV" 50+00.00	15,156	1708.63	1723.55	14.92	10.51	169.06	0.63	1726.00	1725.77	2.45
"LV" 50+50.00	15,156	1708.51	1723.46	14.95	10.37	168.14	0.62	1726.00	1725.63	2.54

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP BANK ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 50+86.63	15,156	1708.45	1723.45	15.00	9.88	277.00	0.74	1726.00	1725.47	2.55
"LV" 51+50.00	15,156	1708.26	1723.51	15.25	8.50	308.54	0.62	1726.00	1725.13	2.49
"LV" 51+95.07	15,156	1708.15	1723.44	15.29	8.16	335.56	0.61	1726.00	1724.97	2.56
"LV" 52+50.00	15,156	1708.01	1723.42	15.41	7.47	354.28	0.55	1726.00	1724.79	2.58
"LV" 53+00.00	15,156	1707.88	1723.45	15.57	6.65	399.92	0.49	1725.00	1724.64	1.55
"LV" 53+23.31	15,156	1707.83	1723.31	15.48	7.05	375.61	0.52	1725.96	1724.58	2.65
"LV" 53+50.00	15,156	1707.76	1723.17	15.41	7.37	392.01	0.57	1726.00	1724.51	2.83
"LV" 54+00.32	15,156	1707.63	1722.90	15.27	7.89	366.91	0.61	1725.07	1724.37	2.17
"LV" 54+50.00	15,156	1707.51	1722.57	15.06	8.54	336.46	0.65	1724.67	1724.20	2.10
"LV" 55+00.00	15,156	1707.39	1722.24	14.85	9.03	336.80	0.71	1724.05	1724.01	1.81
"LV" 55+24.59	15,156	1707.33	1722.15	14.82	8.97	344.77	0.71	1724.00	1723.90	1.85
"LV" 55+50.00	15,438	1707.27	1722.08	14.81	8.84	355.98	0.70	1724.70	1723.79	2.62
"LV" 55+79.17	15,438	1707.20	1721.88	14.68	9.10	341.12	0.72	1725.00	1723.67	3.12
"LV" 56+00.00	15,438	1707.14	1721.80	14.66	9.12	319.12	0.70	1724.44	1723.59	2.64
"LV" 56+50.00	15,438	1707.02	1721.73	14.71	8.61	321.36	0.64	1724.00	1723.38	2.27
"LV" 56+69.52	15,438	1706.99	1721.57	14.58	8.96	293.47	0.65	1724.90	1723.32	3.33
"LV" 57+00.00	15,438	1706.89	1721.12	14.23	9.98	272.69	0.74	1724.09	1723.17	2.97
"LV" 57+50.00	15,438	1706.77	1720.97	14.20	9.83	239.43	0.68	1724.04	1722.97	3.07
"LV" 58+00.00	15,438	1706.64	1720.93	14.29	9.28	255.15	0.64	1725.00	1722.77	4.07
"LV" 58+27.45	15,438	1706.58	1720.84	14.26	9.33	268.20	0.66	1724.02	1722.69	3.18
"LV" 58+50.00	15,438	1706.52	1720.75	14.23	9.39	279.57	0.68	1724.00	1722.62	3.25
"LV" 58+86.01	15,438	1706.43	1720.54	14.11	9.63	289.15	0.72	1724.00	1722.48	3.46
"LV" 59+50.00	15,438	1706.27	1720.46	14.19	8.93	287.68	0.64	1724.00	1722.20	3.54
"LV" 59+95.45	15,438	1706.16	1720.29	14.13	9.11	221.99	0.58	1724.00	1722.08	3.71
"LV" 60+25.88	15,438	1706.09	1720.55	14.46	7.53	256.93	0.42	1724.27	1721.93	3.72
"LV" 61+00.00	**Bridge**	**Sahara**								
"LV" 61+50.00	15,438	1705.78	1720.32	14.54	8.00	255.27	0.42	1724.00	1721.81	3.68
"LV" 62+00.00	15,438	1705.65	1720.33	14.68	7.64	218.83	0.41	1723.41	1721.74	3.08
"LV" 62+50.00	15,438	1705.50	1720.11	14.61	8.18	272.42	0.55	1723.00	1721.65	2.89
"LV" 63+00.00	15,438	1705.35	1719.84	14.49	8.72	282.03	0.61	1721.97	1721.52	2.13
"LV" 63+50.00	15,438	1705.20	1719.77	14.57	8.40	293.13	0.59	1722.69	1721.37	2.92
"LV" 64+00.00	15,438	1705.05	1719.75	14.70	7.85	302.89	0.54	1722.00	1721.21	2.25
"LV" 64+50.00	15,438	1704.90	1719.73	14.83	7.38	294.03	0.49	1722.00	1721.08	2.27
"LV" 65+00.00	15,438	1704.75	1719.68	14.93	7.22	288.54	0.47	1722.00	1720.99	2.32
"LV" 65+36.85	15,438	1704.64	1719.69	15.05	6.85	302.04	0.44	1722.00	1720.92	2.31
"LV" 66+00.00	15,438	1704.45	1719.39	14.94	7.64	307.66	0.53	1722.00	1720.80	2.61
"LV" 66+50.00	15,438	1704.27	1719.03	14.76	8.53	293.58	0.61	1723.00	1720.66	3.97
"LV" 66+89.17	15,438	1704.11	1719.02	14.91	8.06	307.63	0.57	1722.00	1720.53	2.98
"LV" 67+50.00	15,460	1703.87	1718.82	14.95	8.22	329.61	0.61	1722.00	1720.37	3.18
"LV" 68+00.00	15,460	1703.67	1718.28	14.61	9.47	280.21	0.69	1720.67	1720.17	2.39
"LV" 68+41.19	15,460	1703.51	1718.46	14.95	7.88	341.44	0.58	1720.40	1719.92	1.94
"LV" 69+00.00	15,460	1703.27	1718.39	15.12	7.54	336.21	0.54	1720.56	1719.77	2.17
"LV" 69+50.00	15,460	1703.07	1718.22	15.15	7.73	350.20	0.57	1720.51	1719.65	2.29
"LV" 70+00.00	15,460	1702.87	1717.63	14.76	9.24	341.98	0.74	1720.02	1719.46	2.39

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP BANK ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 70+50.00	15,460	1702.67	1717.12	14.45	10.19	217.78	0.68	1722.00	1719.23	4.88
"LV" 70+99.52	15,460	1702.47	1716.86	14.39	10.48	211.95	0.70	1722.00	1719.07	5.14
"LV" 71+49.64	15,460	1702.27	1716.27	14.00	11.58	163.57	0.71	1718.90	1718.85	2.63
"LV" 71+80.12	15,460	1702.15	1716.20	14.05	11.48	158.07	0.69	1720.15	1718.75	3.95
"LV" 72+00.00	15,460	1702.07	1716.31	14.24	10.78	152.88	0.62	1720.19	1718.61	3.88
"LV" 72+32.90	15,460	1701.94	1715.93	13.99	11.55	137.98	0.65	1719.23	1718.50	3.30
"LV" 72+50.00	15,460	1701.87	1716.03	14.16	10.96	139.33	0.61	1719.91	1718.40	3.88
"LV" 73+00.00	15,460	1701.67	1714.62	12.95	13.91	124.55	0.82	1718.20	1718.12	3.58
"LV" 73+60.59	15,460	1701.43	1714.59	13.16	13.14	132.53	0.78	1718.09	1717.77	3.50
"LV" 74+00.00	15,460	1701.27	1715.11	13.84	10.59	184.82	0.66	1717.40	1717.35	2.29
"LV" 74+50.00	15,460	1701.11	1715.24	14.13	9.35	218.07	0.60	1718.00	1717.10	2.76
"LV" 75+00.00	15,460	1700.95	1715.48	14.53	7.51	286.82	0.49	1717.31	1716.86	1.83
"LV" 75+50.00	15,460	1700.80	1715.71	14.91	5.41	410.57	0.36	1717.00	1716.66	1.29
"LV" 76+00.00	15,460	1700.65	1715.48	14.83	6.31	306.97	0.39	1717.00	1716.60	1.52
"LV" 76+50.00	15,460	1700.50	1715.53	15.03	5.64	338.82	0.35	1717.00	1716.52	1.47
"LV" 76+80.80	15,460	1700.41	1715.12	14.71	7.35	257.58	0.45	1717.00	1716.46	1.88
"LV" 77+00.00	**Inl Struct**									
"LV" 77+50.00	15,460	1704.98	1714.32	9.34	8.19	321.77	0.60	1716.00	1715.86	1.68
"LV" 78+00.00	15,460	1704.94	1714.27	9.33	7.73	354.56	0.57	1716.00	1715.70	1.73
"LV" 78+50.00	15,460	1704.91	1714.19	9.28	7.53	351.12	0.55	1716.00	1715.57	1.81
"LV" 79+00.00	15,460	1704.87	1714.32	9.45	6.10	394.88	0.42	1716.00	1715.40	1.68
"LV" 80+00.00	15,460	1699.45	1713.87	14.42	7.34	335.66	0.52	1716.00	1715.21	2.13
"LV" 80+50.00	15,460	1699.05	1713.88	14.83	6.76	308.93	0.44	1716.00	1715.09	2.12
"LV" 83+00.00	21,656	1698.67	1713.69	15.02	5.82	590.43	0.41	1715.50	1714.72	1.81
"LV" 83+50.00	21,656	1698.56	1713.52	14.96	6.34	511.13	0.43	1715.50	1714.64	1.98
"LV" 84+00.00	21,656	1698.52	1713.08	14.56	7.82	435.75	0.55	1715.50	1714.53	2.42
"LV" 84+50.00	21,656	1698.42	1712.63	14.21	9.04	276.88	0.54	1715.50	1714.40	2.87
"LV" 85+00.00	21,656	1698.37	1712.27	13.90	9.86	242.11	0.58	1715.00	1714.28	2.73
"LV" 85+50.00	21,656	1698.28	1712.06	13.78	10.11	252.66	0.61	1715.00	1714.15	2.94
"LV" 86+00.00	21,656	1698.22	1711.96	13.74	9.99	260.99	0.61	1715.00	1714.01	3.04
"LV" 86+50.00	21,656	1698.14	1711.49	13.35	10.96	207.39	0.63	1714.00	1713.86	2.51
"LV" 87+00.00	21,656	1698.07	1708.96	10.89	16.04	169.33	1.00	1714.00	1710.85	5.04
"LV" 87+20.00	**21,656**	**1698.04**	**1707.40**	**9.36**	**18.39**	**152.64**	**1.17**	**1714.04**	**1709.37**	**6.64**
"LV" 87+50.00	21,656	1698.00	1707.29	9.29	18.57	152.33	1.18	1714.00	1709.27	6.71
"LV" 88+00.00	21,656	1697.98	1707.17	9.19	18.63	152.20	1.19	1713.00	1709.15	5.83
"LV" 88+42.58	21,656	1697.97	1707.11	9.14	18.59	152.20	1.18	1713.00	1709.08	5.89
"LV" 88+50.00	21,656	1697.96	1707.10	9.14	18.58	152.22	1.18	1712.99	1709.07	5.89
"LV" 89+00.00	21,656	1697.94	1707.00	9.06	18.65	152.12	1.19	1712.00	1708.97	5.00
"LV" 89+50.00	21,656	1697.93	1706.91	8.98	18.76	152.05	1.20	1712.00	1708.88	5.09
"LV" 90+00.00	21,656	1697.00	1705.49	8.49	20.66	149.22	1.37	1712.00	1707.54	6.51
"LV" 90+50.00	21,656	1695.88	1703.64	7.76	22.88	146.43	1.59	1708.70	1705.77	5.06
"LV" 91+00.00	21,656	1695.00	1702.55	7.55	23.93	149.18	1.71	1707.00	1704.72	4.45
"LV" 91+50.00	21,656	1695.00	1702.21	7.21	24.02	148.91	1.72	1707.00	1704.37	4.79

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP BANK ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 92+00.00	21,656	1695.00	1702.41	7.41	23.14	147.87	1.62	1706.00	1704.54	3.59
"LV" 92+50.00	21,656	1695.00	1702.38	7.38	22.73	147.76	1.58	1706.00	1704.49	3.62
"LV" 93+00.00	21,656	1695.00	1702.62	7.62	21.82	147.74	1.48	1705.72	1704.69	3.10
"LV" 93+50.00	21,656	1695.00	1702.67	7.67	21.30	149.33	1.44	1705.47	1704.72	2.80
"LV" 94+00.00	21,656	1694.83	1702.76	7.93	20.72	150.95	1.39	1705.71	1704.79	2.95
"LV" 94+50.00	21,656	1694.46	1702.43	7.97	20.94	150.09	1.41	1705.14	1704.48	2.71
"LV" 95+00.00	21,656	1694.08	1702.15	8.07	21.07	149.57	1.42	1705.23	1704.21	3.08
"LV" 95+50.00	21,656	1694.00	1702.07	8.07	20.85	149.80	1.40	1705.02	1704.12	2.95
"LV" 96+00.00	21,656	1694.00	1702.02	8.02	20.60	150.25	1.37	1704.81	1704.05	2.79
"LV" 96+50.00	21,656	1693.94	1702.15	8.21	19.97	151.65	1.32	1704.72	1704.16	2.57
"LV" 97+00.00	21,656	1693.58	1701.82	8.24	20.24	151.37	1.34	1704.48	1703.84	2.66
"LV" 97+50.00	21,656	1693.22	1701.40	8.18	20.60	150.72	1.37	1703.99	1703.44	2.59
"LV" 98+00.00	21,656	1692.99	1701.12	8.13	20.75	150.43	1.39	1703.67	1703.16	2.55
"LV" 98+50.00	21,656	1692.98	1700.97	7.99	20.69	150.71	1.38	1703.75	1703.00	2.78
"LV" 99+00.00	21,656	1692.89	1701.07	8.18	20.10	151.82	1.33	1703.66	1703.08	2.59
"LV" 99+50.00	21,656	1692.51	1700.71	8.20	20.39	151.06	1.35	1703.58	1702.74	2.87
"LV" 100+00.00	21,656	1692.13	1700.28	8.15	20.75	150.28	1.39	1703.40	1702.32	3.12
"LV" 100+50.00	21,656	1691.99	1700.00	8.01	20.91	150.06	1.40	1703.20	1702.05	3.20
"LV" 101+00.00	21,656	1691.98	1699.99	8.01	20.54	150.78	1.37	1702.95	1702.02	2.96
"LV" 101+50.00	21,656	1691.93	1700.07	8.14	20.01	151.97	1.32	1702.72	1702.08	2.65
"LV" 102+00.00	21,656	1691.49	1699.61	8.12	20.44	151.11	1.36	1702.55	1701.64	2.94
"LV" 102+50.00	21,656	1691.05	1699.10	8.05	20.93	150.13	1.40	1702.25	1701.15	3.15
"LV" 103+00.00	21,656	1689.19	1698.42	9.23	21.61	149.21	1.47	1701.88	1700.55	3.46
"LV" 103+50.00	21,656	1689.39	1698.15	8.76	21.71	148.37	1.48	1701.66	1700.27	3.51
"LV" 104+00.00	21,656	1689.58	1697.95	8.37	21.70	150.97	1.49	1701.16	1700.05	3.21
"LV" 104+68.80	**21,656**	**1689.66**	**1697.53**	**7.87**	**21.88**	**153.89**	**1.52**	**1700.41**	**1699.62**	**2.88**
"LV" 105+00.00	21,656	1689.54	1696.76	7.22	22.72	159.30	1.64	1700.17	1698.86	3.41

7.2 WSPG ANALYSIS

A hydraulic analysis was performed for the proposed Las Vegas Wash channel from Cedar to the Nellis Bridge using WSPG. The extents of this analysis are from a point roughly 1150 ft upstream of the Cedar Channel to a point roughly 900 ft downstream of Nellis Boulevard Bridge. The results for two WSPG models are provided: 1) an interim condition model, with the riprap and concrete transitions that are proposed at the upstream end of project (upstream of the Cedar Channel) and 2) an ultimate condition model that assumes the proposed 90-ft wide rectangular concrete channel continues upstream. The HGL for the ultimate condition analysis is plotted on the 30% plans.

The channel cross sections in the WSPG model assume the channel has a flat bottom. The area created by the low flow cross slope is neglected, and the toe of the wall elevation is used as the invert elevation in the analysis. For reference, the summary tables in Appendix B of the WSPG hydraulic output list the elevations of both the centerline invert, or flowline, and the invert at the toe of the wall. Through the transitions, where the channel bottom width varies, the slope along the toe of the wall will differ from the slope of the flowline. The WSPG analysis shows this slope along the toe of channel wall.

The analysis was performed with pier bulking at all bridge locations to take into consideration the effects of debris build-up on the piers. The average width of the bridge piers, 1.5-ft diameter, was increased to 3.0-ft to model the bulking. With the additional bulking, the WSPG results indicate that the water surface is more than 2-ft below the bottom bridge cord at Nellis Boulevard and Stewart Avenue and more than 2-ft below the 51-inch sanitary sewer attached to the bridge at Charleston Boulevard.

Super-elevation calculations were performed and are included in the summary table. The HGL plotted on the 30% plans includes the increase in water surface due to super-elevation along curves in the channel. Equations for these calculations were referenced from Section 706.2.5 of the CCRFCD's Hydrologic Criteria and Drainage Design Manual (HC&DDM).

Freeboard calculations were also performed and are included in the summary table. Freeboard for sub-critical flow was calculated using the equation referenced from Section 706.1.3 of the CCRFCD's HC&DDM; freeboard for super-critical flow was calculated using the equation from Section 706.2.4 of the CCRFCD's HC&DDM. The wall heights proposed on the plans are based on the freeboard. Three locations exist where freeboard is not met due to existing conditions:

1. "LV" 4+50 to 5+60, this section of the wash is upstream of the project improvements. This location is shown in the LOMR as having flow breaking out of the channel to the east, which is confirmed by this analysis.

2. "LV" 18+50 to 19+00, there is a 5-ft wide notch proposed on the east side of the channel wall where a low point exists in the existing adjacent trail. The water surface elevation is more than 1-ft below the trail elevation, but the required freeboard is 2.3 ft.
3. "LV" Station 61+49 to 61+70, there is a 20-ft wide notch proposed on the west channel wall where an existing drainage easement conveys flow to the wash. Although the freeboard requirement is not satisfied, the water surface elevation is approximately 1-ft below the notch.

The minimum proposed transition lengths were determined using criteria in the CCRFCD HC&DDM. These calculations are included. The lengths for expanding and contracting transitions for sub-critical flow were calculated using the equation referenced from Section 706.1.1. The lengths for expanding transitions in super-critical flow were calculated using the equation in Section 706.2.4.

Table 7.2.1 – WSPG Analysis Results – Proposed Condition

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP WALL ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 4+50.00	13,944	1746.12	1756.54	15.40	14.22	90.00	0.84	1760.54	1760.53	4.00
Begin Riprap Transition										
"LV" 5+60.00	13,944	1745.87	1755.06	14.26	16.24	90.00	1.02	1760.10	1760.09	5.04
Begin Concrete Transition										
"LV" 7+00.00	13,944	1743.69	1752.72	7.98	19.42	90.00	1.21	1759.15	1754.69	6.43
Begin Concrete Rectangular Channel										
"LV" 9+55.05	13,944	1744.00	1754.26	6.22	24.91	90.00	1.76	1759.00	1758.37	4.74
"LV" 10+01.99	13,944	1743.90	1754.46	6.32	24.53	90.00	1.72	1758.90	1758.47	4.44
"LV" 13+08.12	13,944	1743.19	1754.35	6.92	22.39	90.00	1.50	1757.19	1757.84	2.84
"LV" 13+72.54	13,944	1743.05	1754.37	7.04	22.00	90.00	1.46	1758.05	1757.78	3.68
"LV" 15+99.90	13,944	1742.52	1754.52	11.92	10.90	90.00	0.56	1757.52	1756.87	3.00
Confluence with Realigned CCRFCD Facility CACH 0000										
"LV" 16+00.00	14,354	1742.52	1754.24	11.63	11.50	107.33	0.59	1757.52	1756.79	3.28
"LV" 18+15.00	14,354	1742.03	1754.28	12.16	11.00	107.33	0.56	1757.24	1756.65	2.96
"LV" 19+15.00	14,354	1741.80	1751.22	9.25	17.25	90.00	1.00	1756.83	1756.34	5.61
"LV" 24+55.12	14,354	1740.56	1749.60	8.85	18.02	90.00	1.07	1751.56	1751.53	1.96
"LV" 27+55.20	14,354	1737.56	1744.53	6.64	24.02	90.00	1.64	1748.56	1746.66	4.03
Existing Stewart Avenue Bridge Low Chord = 1750.00										
"LV" 28+28.43	14,354	1735.92	1745.28	8.46	20.21	90.00	1.23	1747.83	1747.31	2.55
"LV" 29+23.73	14,438	1734.97	1742.86	6.99	22.96	90.00	1.53	1746.87	1744.95	4.01
"LV" 29+38.65	14,438	1734.82	1742.65	6.93	23.14	90.00	1.55	1746.72	1744.76	4.07
"LV" 32+27.86	14,438	1734.04	1742.32	7.38	21.73	90.00	1.41	1745.97	1744.38	3.65
"LV" 47+36.32	14,438	1729.99	1739.34	8.45	18.99	90.00	1.15	1745.05	1741.30	5.71
"LV" 52+42.08	14,438	1728.63	1737.98	8.45	18.99	90.00	1.15	1740.73	1739.94	2.75
"LV" 53+65.38	14,438	1726.17	1733.57	6.51	24.66	110.00	1.70	1739.50	1735.72	5.93

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP WALL ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 54+14.80	14,438	1725.18	1731.15	4.87	26.96	110.00	2.15	1737.28	1733.29	6.13
"LV" 54+41.66	14,438	1724.64	1730.54	4.80	27.35	110.00	2.20	1736.75	1732.69	6.21
Existing Charleston Boulevard Bridge with Ex. 51" SS Low Chord of 51" SS = 1733.00										
"LV" 55+53.35	14,438	1723.60	1731.48	6.78	21.73	110.00	1.47	1739.00	1733.51	7.52
"LV" 56+50.67	14,438	1722.69	1729.36	5.56	23.59	110.00	1.76	1739.00	1731.40	9.64
"LV" 56+85.45	14,438	1722.37	1729.85	5.52	23.77	110.00	1.78	1739.46	1731.90	9.61
Junction with Future CCRFCD Facility LVCA 0000										
"LV" 57+09.73	14,811	1722.14	1729.96	5.93	22.72	110.00	1.64	1739.27	1731.99	9.31
"LV" 57+78.65	14,811	1721.50	1734.14	11.33	11.89	110.00	0.62	1738.76	1736.84	4.62
"LV" 58+59.22	14,811	1720.75	1734.38	12.38	10.87	110.00	0.55	1739.86	1736.71	5.48
"LV" 60+59.36	14,811	1718.89	1734.78	14.69	9.16	110.00	0.42	1737.99	1736.59	3.21
"LV" 61+70.40	14,811	1718.70	1734.78	14.88	9.05	110.00	0.41	1737.79	1736.55	3.01
Junction with Existing CCRFCD Facility LVCO 0000										
"LV" 65+36.64	15,083	1718.10	1734.66	15.36	8.93	110.00	0.40	1737.20	1736.40	2.54
"LV" 66+60.18	15,083	1717.91	1734.69	15.55	8.82	110.00	0.39	1737.01	1736.39	2.32
"LV" 67+20.09	15,083	1717.81	1733.56	14.71	12.06	85.00	0.55	1736.66	1736.32	3.10
"LV" 68+49.29	15,083	1717.60	1733.35	14.90	11.91	85.00	0.54	1736.45	1736.05	3.10
Junction with Existing CCRFCD Facility NLWY 0000										
"LV" 68+69.18	15,156	1717.56	1733.29	14.87	11.99	85.00	0.55	1736.40	1736.02	3.11
Existing Nellis Boulevard Bridge Low Chord = 1735.30										
"LV" 68+71.18	15,156	1717.56	1732.08	13.66	14.04	85.00	0.67	1736.41	1735.64	4.33
"LV" 69+73.72	15,156	1717.37	1732.62	14.40	12.38	85.00	0.58	1736.22	1735.50	3.60
"LV" 70+91.17	15,156	1717.20	1732.92	14.53	12.27	85.00	0.57	1736.05	1735.75	3.13
"LV" 73+32.16 = "LF" 13+38.42	15,156	1716.81	1732.86	14.89	11.98	85.00	0.55	1735.66	1735.59	2.80
"LV" 78+74.24 = "LF" 18+80.5	15,156	1716.05	1732.42	15.52	11.49	85.00	0.55	1736.47	1735.59	4.05
End Rectangular Concrete Channel - Begin Golf Course Channel										

Table 7.2.2 – WSPG Analysis Results – Proposed Condition

PROJECT STATIONING	FLOW (cfs)	CHAN. INVERT (ft)	W.S. ELEV (ft)	DEPTH (ft)	VEL. (ft/s)	TOP WIDTH (ft)	FR #	TOP WALL ELEV. (ft)	REQ. FB ELEV. (ft)	TOTAL FB (ft)
"LV" 4+50.00	13,944	1746.12	1761.58	15.40	14.22	136.00	0.84	1756.00	N/A	-5.58
Begin Riprap Transition										
"LV" 5+60.00	13,944	1745.87	1760.22	14.26	16.24	136.00	1.02	1756.00	N/A	-4.22
Begin Concrete Transition										
"LV" 7+00.00	13,944	1743.79	1751.28	6.44	26.37	136.00	1.86	1759.15	1753.51	7.87
Begin Concrete Rectangular Channel										
"LV" 9+55.05	13,944	1743.10	1750.48	6.22	24.91	90.00	1.76	1759.00	1752.62	8.52

"LV" 10+01.99	13,944	1743.00	1750.91	6.32	24.53	90.00	1.72	1758.90	1753.05	7.99
"LV" 13+08.12	13,944	1742.29	1750.12	6.92	22.39	90.00	1.50	1757.19	1752.18	7.08
"LV" 13+72.54	13,944	1742.15	1750.09	7.04	22.00	90.00	1.46	1758.05	1752.14	7.96
"LV" 13+97.03	13,944	1742.09	1754.49	11.39	13.60	90.00	0.71	1757.99	1757.86	3.50
"LV" 15+99.90	13,944	1741.62	1754.52	11.92	10.90	90.00	0.56	1757.52	1756.87	3.00
Confluence with Realigned CCRFCD Facility CACH 0000										
"LV" 16+00.00	14,354	1741.62	1754.24	11.63	11.50	107.33	0.59	1757.52	1756.79	3.28
"LV" 18+15.00	14,354	1741.13	1754.28	12.16	11.00	107.33	0.56	1757.24	1756.65	2.96
"LV" 19+15.00	14,354	1740.90	1751.22	9.25	17.25	90.00	1.00	1756.83	1756.34	5.61
"LV" 24+55.12	14,354	1739.66	1749.60	8.85	18.02	90.00	1.07	1751.56	1751.53	1.96
"LV" 27+55.20	14,354	1736.66	1744.53	6.64	24.02	90.00	1.64	1748.56	1746.66	4.03
Existing Stewart Avenue Bridge Low Chord = 1750.00										
"LV" 28+28.43	14,354	1735.92	1745.28	8.46	20.21	90.00	1.23	1747.83	1747.31	2.55
"LV" 29+23.73	14,438	1734.97	1742.86	6.99	22.96	90.00	1.53	1746.87	1744.95	4.01
"LV" 29+38.65	14,438	1734.82	1742.65	6.93	23.14	90.00	1.55	1746.72	1744.76	4.07
"LV" 32+27.86	14,438	1734.04	1742.32	7.38	21.73	90.00	1.41	1745.97	1744.38	3.65
"LV" 47+36.32	14,438	1729.99	1739.34	8.45	18.99	90.00	1.15	1745.05	1741.30	5.71
"LV" 52+42.08	14,438	1728.63	1737.98	8.45	18.99	90.00	1.15	1740.73	1739.94	2.75
"LV" 53+65.38	14,438	1726.17	1733.57	6.51	24.66	110.00	1.70	1739.50	1735.72	5.93
"LV" 54+14.80	14,438	1725.18	1731.15	4.87	26.96	110.00	2.15	1737.28	1733.29	6.13
"LV" 54+41.66	14,438	1724.64	1730.54	4.80	27.35	110.00	2.20	1736.75	1732.69	6.21
Existing Charleston Boulevard Bridge with Ex. 51" SS Low Chord of 51" SS = 1733.00										
"LV" 55+53.35	14,438	1723.60	1731.48	6.78	21.73	110.00	1.47	1739.00	1733.51	7.52
"LV" 56+50.67	14,438	1722.69	1729.36	5.56	23.59	110.00	1.76	1739.00	1731.40	9.64
"LV" 56+85.45	14,438	1722.37	1729.85	5.52	23.77	110.00	1.78	1739.46	1731.90	9.61
Junction with Future CCRFCD Facility LVCA 0000										
"LV" 57+09.73	14,811	1722.14	1729.96	5.93	22.72	110.00	1.64	1739.27	1731.99	9.31
"LV" 57+78.65	14,811	1721.50	1734.14	11.33	11.89	110.00	0.62	1738.76	1736.84	4.62
"LV" 58+59.22	14,811	1720.75	1734.38	12.38	10.87	110.00	0.55	1739.86	1736.71	5.48
"LV" 60+59.36	14,811	1718.89	1734.78	14.69	9.16	110.00	0.42	1737.99	1736.59	3.21
"LV" 61+70.40	14,811	1718.70	1734.78	14.88	9.05	110.00	0.41	1737.79	1736.55	3.01
Junction with Existing CCRFCD Facility LVCO 0000										
"LV" 65+36.64	15,083	1718.10	1734.66	15.36	8.93	110.00	0.40	1737.20	1736.40	2.54
"LV" 66+60.18	15,083	1717.91	1734.69	15.55	8.82	110.00	0.39	1737.01	1736.39	2.32
"LV" 67+20.09	15,083	1717.81	1733.56	14.71	12.06	85.00	0.55	1736.66	1736.32	3.10
"LV" 68+49.29	15,083	1717.60	1733.35	14.90	11.91	85.00	0.54	1736.45	1736.05	3.10
Junction with Existing CCRFCD Facility NLWY 0000										
"LV" 68+69.18	15,156	1717.56	1733.29	14.87	11.99	85.00	0.55	1736.40	1736.02	3.11
Existing Nellis Boulevard Bridge Low Chord = 1735.30										
"LV" 68+71.18	15,156	1717.56	1732.08	13.66	14.04	85.00	0.67	1736.41	1735.64	4.33
"LV" 69+73.72	15,156	1717.37	1732.62	14.40	12.38	85.00	0.58	1736.22	1735.50	3.60
"LV" 70+91.17	15,156	1717.20	1732.92	14.53	12.27	85.00	0.57	1736.05	1735.75	3.13
"LV" 73+32.16 = "LF" 13+38.42	15,156	1716.81	1732.86	14.89	11.98	85.00	0.55	1735.66	1735.59	2.80
"LV" 78+74.24 = "LF" 18+80.5	15,156	1716.05	1732.42	15.52	11.49	85.00	0.55	1736.47	1735.59	4.05
End Concrete Lining - Begin Golf Course Channel										



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix A

GENERAL DOCUMENTATION



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix A-1

SUMMARY OF FLOWRATES

LAS VEGAS WASH - SLOAN CHANNEL TO CEDAR AVENUE
FLOW COMPARISON SUMMARY

	Study, Flow, Node and Model							
	2008 MPU			2008 FHMR		1998 FIS Restudy	1991 FIS	
Location	FLOW (cfs)	HEC-1 NODE	HEC-1 MODEL	FLOW (cfs)	HEC-1 MODEL	FLOW (cfs)	FLOW (cfs)	NOTE
Las Vegas Wash								
Bonanza Road	12,690	CLVW04-C	CLVWASH5	11,948	MPU1	5,900	6,730	
Downstream of Bonanza Rd	13,944	CCBN15-C	CLVWASH5	-	-	-	-	
Cedar Avenue Channel	14,354	CCCA10-C	CLVWASH5	12,706	MPU1	7,300	6,730	
Stewart Avenue	14,438	CCST03-C	CLVWASH5	12,754	MPU1	9,700	6,730	
Charleston Boulevard	14,811	CNEL04-2	CLVWASH5	13,326	MPU1	-	6,730	3,321 cfs overtopping bridge
Colorado Avenue	15,083	CCNEL06	CLVWASH5	-	-	-	-	
Nellis Boulevard	15,156	CNLWY	CLVWASH5	13,515	MPU1	12,400	6,730	852 cfs overtopping bridge
Christy Lane	15,438	CLVCH	CLVWASH5	13,861	MPU1	12,700	6,730	
Sahara Avenue	15,460	CFW37	CLVWASH5	13,861	MPU1	13,700	6,730	
Flamingo Wash	21,656	CFLWA	LVWSC2	18,601	MPU6	16,400	7,100	
Sloan Lane	21,656	CFLWA	LVWSC2	18,672	MPU1	17,900	7,100	
Vegas Valley Drive	21,656	CFLWA	LVWSC2	18,718	MPU1	18,800	7,100	
MPU Lateral Systems								
Cedar Avenue Channel	1,636	SW3	CBN15-C	-	-	-	-	
Charleston Channel (Future)	1,104	SW3	CCH77-C	-	-	-	-	
Colorado Avenue System	1,015	SW3	CNEL06	-	-	-	-	
Nellis - Wyoming Channel	338	FLAM3A	FW35	-	-	-	-	
Range Wash - Christy Lateral	1,093	RW3	2C3226B3	-	-	-	-	
Range Wash - Sloan	4,753	SLOAN4	C52A	-	-	-	-	
Flamingo Wash - LVW Peaking	6,196	-	-	-	-	-	-	
Flamingo Wash - Peaking	10,952	FLAM5B	CFW36	-	-	6,400	-	

LAS VEGAS WASH - SLOAN CHANNEL TO CEDAR AVENUE
STORM EVENT FLOWS

Location	100-YR FLOW (cfs)	50-YR FLOW (cfs)	25-YR FLOW (cfs)	10-YR FLOW (cfs)	5-YR FLOW (cfs)	2-YR FLOW (cfs)
		Reduction Factors				
Las Vegas Wash		0.87	0.74	0.57	0.44	0.26
Bonanza Road	12,690	11,040	9,391	7,233	3,299	3,299
Downstream of Bonanza Rd	13,944	12,131	10,319	7,948	3,625	3,625
Cedar Avenue Channel	14,354	12,488	10,622	8,182	3,732	3,732
Stewart Avenue	14,438	12,561	10,684	8,230	3,754	3,754
Charleston Boulevard	14,811	12,886	10,960	8,442	3,851	3,851
Colorado Avenue	15,083	13,122	11,161	8,597	3,922	3,922
Nellis Boulevard	15,156	13,186	11,215	8,639	3,941	3,941
Christy Lane	15,438	13,431	11,424	8,800	4,014	4,014
Sahara Avenue	15,460	13,450	11,440	8,812	4,020	4,020
Flamingo Wash	21,656	18,841	16,025	12,344	5,631	5,631
Sloan Lane	21,656	18,841	16,025	12,344	5,631	5,631
Vegas Valley Drive	21,656	18,841	16,025	12,344	5,631	5,631
MPU Lateral Systems						
Cedar Avenue Channel	1,636	1,423	1,211	933	425	425
Charleston Channel (Future)	1,104	960	817	629	287	287
Colorado Avenue System	1,015	883	751	579	264	264
Nellis - Wyoming Channel	338	294	250	193	88	88
Range Wash - Christy Lateral	1,093	951	809	623	284	284
Range Wash - Sloan	4,753	4,135	3,517	2,709	1,236	1,236
Flamingo Wash - LVW Peaking	6,196	5,391	4,585	3,532	1,611	1,611
Flamingo Wash - Peaking	10,952	9,528	8,104	6,243	2,848	2,848

Stanley Consultants, Inc.
5820 S. Eastern Ave. Las Vegas, NV 89119
Phone: (702) 369-9396
Fax: (702) 369-9793

Stanley Consultants INC.

Summary of MPU Flows

Project Name: Las Vegas Wash, Sloan Channel to Cedar Avenue
Job Number: 24523
Date: 4/9/2013
Calculated By: VFlock

											SEE FLOWMASTER CALCULATIONS		
ID/ River Mile	Facility Description	Q cfs	HEC-1 Node	HEC-1 Model	Tributary Area	DARF	REVISED HEC-1 MODEL [1]	Time to Peak Hours	Lateral Peak	Q in LV Wash at Lateral Peak	DEPTH OF FLOW in MAIN CHANNEL	STATION	SLOPE
LVMD 1149	LV WASH MIDDLE at Cedar Avenue Channel	13,944.00	CCBN15-C	CLVWASH5	112.59	0.5875	CLVWASH5_JR.58	4.17	3.92	12,076.00			
CACH 0000	CEDAR AVENUE CHANNEL	1,544.00	CCA10-C	SW3	1.81	0.95	SW3_JR.95	3.92					
LVMD 1121	LV WASH MIDDLE	14,354.00	CCCA10-C	CLVWASH5	114.40	0.5875	CLVWASH5_JR.58	4.17	3.92	12,256.00	8.42	16+00.00	0.23%
LVMD 1071	LV WASH MIDDLE	14,438.00	CCST03-C	CLVWASH5	114.87	0.5875	CLVWASH5_JR.58	4.17	3.92	11,923.00			
LVCA 0000	LV WASH - CHARLESTON	1,104.00	CCH77-C	SW3	1.34	0.95	SW3_JR.95	3.92					
LVMD 1069	LV WASH MIDDLE	14,438.00	CCST03-C	CLVWASH5	114.87	0.5875	CLVWASH5_JR.58	4.17	3.92	11,923.00			
LVMD 1054	LV WASH MIDDLE at Colorado Storm Drain	14,811.00	CNEL04-2	CLVWASH5	116.51	0.5875	CLVWASH5_JR.58	4.15	4.00	13,502.00			
LVCO 0000	COLORADO AVENUE SYSTEM	1,015.00	CNEL06	SW3	1.30	0.95	SW3_JR.95	4.00					
LVMD 1048	LV WASH MIDDLE at Nellis Wyoming Channel	15,083.00	CCNEL06	CLVWASH5	117.81	0.5875	CLVWASH5_JR.58	4.25	4.00	13,698.00	8.33	65+21.00	0.16%
NLWY 0000	NELLIS-WYOMING CHANNEL	338.00	FW35	FLAM3A	0.47	0.99	FLAM3A_JR.99	3.92					
LVMD 1046	LV WASH MIDDLE	15,156.00	CNLWY	CLVWASH5	118.28	0.5875	CLVWASH5_JR.58	4.25	3.92	11,935.00	8.95	68+76.00	0.16%
LVMD 1033	LV WASH MIDDLE	15,156.00	CNLWY	CLVWASH5	118.28	0.5875	CLVWASH5_JR.58	4.25	3.92	11,935.00			

(1) Revised HEC-1 Models are MPU models edited to have only nodes and DARF's pertaining to project.



Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

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Appendix A-2

GOLF COURSE FEATURES AND STORMWATER LEVELS

Golf Course Features and Storm Protection

Hole	Tee Complex	1st landing	2nd landing	Green Complex
1	100 year 1719	25 year 1711.5		100 year 1712
10	100 year 1722	10 year 1715		50 year 1719.5
11	100 year 1722	10 year 1723	10 year 1723	100 year 1726
12	100 year 1730			100 year 1729
13	100 year 1731	100 year 1730	25 year 1740	50 year 1740
14	100 year 1738	100 year 1732		50 year 1731
15	100 year 1733			100 year 1730
16	100 year 1732	25 year 1724		50 year 1725
17	100 year 1726	50 year 1721.5		25 year 1719.5
18	100 year 1724	50 year 1715		100 year 1719.5



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix A-3

GOLF COURSE ROUTING EXHIBIT

DESERT ROSE GOLF COURSE

HOLE	1	2	3	4	5	6	7	8	9	
PAR	4	4	3	5	3	5	4	4	3	35
YARDAGE	402	411	190	607	211	490	380	343	156	3,190
	346	380	171	590	190	465	366	323	145	3,011
	286	350	150	445	170	437	355	313	120	2,626
HOLE	10	11	12	13	14	15	16	17	18	
PAR	4	5	3	5	4	3	4	4	4	71
YARDAGE	352	527	166	535	425	160	356	397	300	3,305
	314	488	135	498	380	132	122	359	356	2,987
	291	451	115	458	353	105	295	332	331	2,731

CH2MHILL.

HECKENKEMPER GOLF COURSE DESIGN
5314 South Yale , Suite 710, Tulsa, Oklahoma 74135
Phone: (918)-628-1255 Fax: (918)-628-1256

Las Vegas Wash



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix A-4

LAS VEGAS WASH – SAHARA AVENUE BRIDGE REPLACEMENT

Las Vegas Wash - Sahara Avenue Bridge Replacement

PREPARED FOR: Ken Gilbreth/LAS

COPY TO: Mike Warnick/LAS

PREPARED BY: Mike Cooper/RDD

DATE: March 26, 2013

PROJECT NUMBER: 462579.02.S1.01

This memorandum summarizes the decision making process resulting in the selection of a three-span, cast-in-place, post-tensioned concrete box girder structure to replace the Sahara Avenue Bridge over the Las Vegas Wash. Bridge replacement at Sahara Avenue is required to accommodate planned flood control improvements for the reach of the Las Vegas Wash between the Sloan Channel and Cedar Avenue.

Existing Conditions

The existing Sahara Avenue Bridge (B-2306) was constructed in 1995 and comprises three spans of cast-in-place reinforced concrete flat slab construction. The span configuration is symmetric with 41-foot 6-inch end spans and a central span of 50 feet. Each integral abutment diaphragm is supported on a narrow pile cap which in turn is supported by a single row of 36-inch diameter drilled shafts. Support at the intermediate piers is provided by 24-inch diameter columns with each column extending from an isolated 36-inch diameter drilled shaft.

Sahara Avenue crosses the Las Vegas Wash at a skew of approximately 20 degrees. The roadway alignment follows a 2300-foot radius horizontal curve and is on a 630-foot crest vertical curve as it crosses the channel. The majority of the existing bridge is situated on the crest vertical curve.

The Sahara Avenue roadway section is currently striped for one 11-foot lane and a combined 25.5-foot lane and shoulder in each direction. On each side of the bridge, a 4.5-foot raised sidewalk and 1-foot-wide barrier separate the vehicle traveled way from a deck level 7-foot-wide cart path. A 4-foot median separates the two directions of traffic and a 1-foot-wide exterior concrete barrier is located along each edge of deck on the outside of the cart path. Overall bridge width is 104 feet.

Proposed Improvements

Proposed improvements include widening the existing channel to increase flow capacity in this reach of the Las Vegas Wash. At Sahara Avenue, the existing channel is approximately 120 feet wide as it passes under the bridge. With proposed flood improvements, the channel width under the bridge will increase to approximately 210 feet, nearly twice the width of the existing facility. The significant increase in channel width precludes any reasonable opportunity for salvaging the existing structure. Hence, bridge replacement is warranted.

It is planned for the new Sahara Avenue Bridge to provide the same vehicle traveled way (two lanes and shoulder in each direction separated by a 4-foot median). A raised sidewalk will be provided in each direction, but the width will be increased to 5.5 feet to meet ADA requirements. Golf course modifications are planned in conjunction with flood control improvements and the modifications will change the operation of the course. Under the new layout, it will no longer be necessary to provide dedicated cart path access on the Sahara Avenue Bridge. With wider sidewalks and no cart paths, the overall width of the new bridge will be reduced from 104 to 90 feet.

Bridge Configuration and Type Selection

Several constraints, some conflicting, must be considered in developing the span configuration and ultimately selecting the structure type for the new bridge. Longer spans are desirable to minimize the number of permanent

supports (i.e., obstructions) in the flood way. Shorter spans are desirable to minimize the superstructure depth in order to provide the required 2 feet of freeboard over flood flows yet avoid elevating the roadway profile and impacting adjacent access points.

Span Configuration

As preliminary hydraulic modeling evolved, it became apparent that minimizing the number of permanent floodway obstructions was critical to achieving the desired improvements in channel flood capacity. Therefore, a three span bridge with only two supports in the channel was deemed appropriate for the new bridge. End spans of 69 feet 9 inches and a center span of 88 feet are proposed. This span configuration with end spans that are between 75 and 80 percent of the center span maximize the efficiency of the superstructure.

Superstructure Type

Viable Alternatives

Several factors were considered in the evaluation of superstructure types for the Sahara Avenue Bridge replacement. Those included initial construction cost, long term maintenance cost, hydraulic performance, construction access, falsework feasibility and aesthetics. The following bridge types are viable for the span configuration established to maximize hydraulic performance:

- Cast-in-place, post-tensioned (CIP PT) concrete box girder
- Precast, prestressed (PC PS) concrete girders (I-girders, bulb tee and deck bulb tee girders, box beams)
- Composite steel I-girders

Cast-in-place or precast concrete flat slab structures are not viable for the 88-foot maximum span established to minimize the number of permanent obstructions in the channel.

Alternatives Analysis

Cost

Recent data in Nevada show that the CIP PT concrete box girder has a significant cost advantage over steel girders and PC PS concrete girders. The data indicate an average estimated construction cost of $150 per square foot for a CIP PT concrete box girder bridge versus $170 and $180 per square foot for steel and precast concrete girders, respectively. The long term maintenance cost for CIP PT and PC PS concrete is usually minimal and involves only routine inspections and minor repairs (expansion joint repairs, deck seals, etc.). Steel girder structures typically require more in-depth inspections to guard against potential fatigue problems and more involved maintenance procedures are typical (renewal of structural steel coating systems, for example).

Alignment

The horizontal alignment favors the CIP PT concrete box girder over the girder bridge options. Steel girders can be fabricated on a curve but this adds to an already higher construction cost. Standard PC PS concrete girders are cast in straight lengths so within each span the girders are set on chords and the overhang length is varied to follow the horizontal curve of the roadway section. Variable length overhangs add to forming costs and can detract from the structure's aesthetics.

The vertical alignment with its conflicting requirements for providing freeboard and avoiding impacts arising from large roadway profile adjustments also favors the CIP PT concrete box girder. A CIP PT concrete box provides the opportunity for the thinnest superstructure considering strength requirements and deflection properties. Pedestrian comfort on a bridge can be adversely impacted by the sensation of deflection and vibration due to passing vehicles. A concrete box girder provides a stiffer cross section than a girder structure of comparable depth and therefore minimizes live load deflections and discomforting vibrations.

Hydraulics

For hydraulic performance, the CIP PT concrete box girder offers a distinct advantage over the girder systems. Debris carried at high flows can get snagged under a bridge deck supported on individual girders (and on cross

frames in the case of a steel girder system). Once debris catches on the superstructure, the bridge is susceptible to collecting additional debris leading to a reduction in hydraulic capacity and even damage to the bridge superstructure. The solid soffit on a CIP PT concrete box girder eliminates the potential for snagging debris under the superstructure; the sloping exterior girder resists catching debris on the upstream face.

Falsework

The final item to consider in selecting the bridge type is the feasibility of falsework. PC PS concrete girders and steel girders do not require falsework for construction and therefore eliminate the need for temporary obstructions within the channel. For a CIP PT concrete box, temporary falsework is required and must stay in place until the post-tensioning strands have been installed and tensioned.

Surface soils within the channel at the Sahara Avenue crossing are expected to provide sufficient support for the typical timber bearing pad system used to support falsework; deep foundations are not anticipated for temporary foundations.

The duration to demolish the existing slab bridge and construct a CIP PT concrete box girder structure of the size proposed for the new Sahara Avenue Bridge is expected to be between 4 and 5 months. Historic rainfall data for the Las Vegas Wash between 1975 and 2010 indicate storm flows have only a slight chance of occurring during the months of February and July and have not been reported in March, April, May or June. The data therefore indicate a minimum window of 4 months with little or no chance of a storm event, and a window of 6 months, possibly greater, where the probability of a storm event is very small. From this analysis and assuming construction is timed appropriately, it is feasible to construct a CIP PT concrete box girder structure at Sahara Avenue with minimal risk of a flood event happening while falsework is in the channel.

Preferred Alternative

The CIP PT concrete box girder structure offers the following distinct advantages:

- Least construction cost (15 to 20 percent less to than the viable girder bridges)
- Least long term maintenance requirements
- Most adaptable to the curvilinear roadway alignment
- Most adaptable to freeboard and roadway profile requirements
- Best hydraulic performance

These advantages coupled with feasibility of falsework make the CIP PT concrete box girder the preferred structure type for replacing the Sahara Avenue Bridge.



Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix A-5

30% UTILITY CONFLICT SCHEDULE

CLARK COUNTY DEPARTMENT OF PUBLIC WORKS - DESIGN ENGINEERING DIVISION

30% UTILITY CONFLICT SCHEDULE

CEDAR AVENUE TO NELLIS BOULEVARD

PROJECT: Las Vegas Wash, Sloan Channel to Cedar Avenue
PROJECT NO: FCLA15D

PREPARED BY: Ddade/Vflock
CHECKED BY:

DATE: 3/26/2013
DATE: 3/26/2013

SHEET NO.	LOCATION		EXISTING UTILITY SIZE AND TYPE	ELEVATION		SOURCE OF INFO		NEW IMPROVEMENT SIZE AND TYPE	ELEVATION		REQURED CLEARANCE		DESIGN CLEARANCE		CONFLICT? YES OR NO	CONFLICT RESOLUTION				
	STA Alignment "LV"	OFFSET		TOP	BOTTOM	POTHOLE #	OTHER		TOP	BOTTOM	H	V	H	V		METHOD	WHO HAS PRIOR RIGHT?	COMPLETION COMMITMENT DATE	COMPLETED? YES OR NO	REASON FOR NO COMPLETION
PL-1	9+70.43	25.61' RT	Sanitary Sewer Manhole					Riprap channel and concrete channel	1743.58	1742.58						Adjust/remove manhole: remove cone and cover, seal pipe, install new manhole on access road				
PL-1	15+86.86	24.96' RT	Sanitary Sewer Manhole					Riprap channel and concrete channel	1742.15	1741.15						Adjust/remove manhole: remove cone and cover, seal pipe, install new manhole on access road				
PL-1	5+60 to 16+00	20' RT to 28' RT	66" RCP Sanitary Sewer					Riprap channel, cut-off wall and concrete channel	1748.49	1745.10						Protect in place				
PL-1	7+00	18' RT	66" RCP Sanitary Sewer					Concrete cut-off wall	1744.01	1734.01						Pothole				
PL-23	12+76.50	306.3' RT	8" RCP sanitary sewer					Cedar Avenue Channel	1750.00							Pothole				
PL-1	13+94.83	61.8' RT	Existing Trail Light					Access road	1760.35							Protect in place				
PL-2	21+86.3	37.86' RT	Sanitary Sewer Manhole					90' concrete rect. channel	1741.03	1740.03						Adjust/remove manhole: remove cone and cover, seal pipe, install new manhole on access road				
PL-2	16+00 to 25+00	28' RT to 50' RT	66" RCP Sanitary Sewer					90' concrete rect. channel	1742.16	1751.19						Protect in place				
PL-3	27+73.1	28.95' RT	Sanitary Sewer Manhole					90' concrete rect. channel	1737.06	1736.06						Adjust/remove manhole: remove cone and cover, seal pipe, install new manhole on access road				
PL-3	32+66.8	31.57' RT	Sanitary Sewer Manhole					90' concrete rect. channel	1734.57	1733.57						Adjust/remove manhole: remove cone and cover, seal pipe, install new manhole on access road				
PL-3	25+00 to 34+00	50' RT to 36' RT	66" RCP Sanitary Sewer					90' concrete rect. channel	1751.19	1734.32						Pothole between Sta. 28+00 to 34+00				
PL-3	28+06.1	Crossing	42" Water					90' concrete rect. channel	1736.15	1735.15						Pothole				
PL-3	28+22.1	Crossing	4" Steel Gas					90' concrete rect. channel	1736.01	1735.01						Locate, side of bridge, overhead?				
PL-3	28+27.3	Crossing	Overhead Cable TV					90' concrete rect. channel	1735.97	1734.97						Protect in place				
	28+27.3	Crossing	Overhead Electric					90' concrete rect. channel	1735.97	1734.97						Protect in place				
PL-3	28+29.1	Crossing	6-4" Underground Telephone					90' concrete rect. channel	1735.95	1734.95						Pothole				
PL-3	29+28	Crossing	Overhead Transmission 69KV					90' concrete rect. channel	1734.98	1733.98						Protect in place				
PL-3	29+43	Crossing	Overhead Transmission 69KV					90' concrete rect. channel	1734.84	1733.84						Protect in place				
PL-4	34+00 to 43+00	37' RT to 65' RT	66" RCP Sanitary Sewer					90' concrete rect. channel	1734.32	1743.43						Pothole				
PL-4	38+66.6	56.83' RT	Sanitary Sewer Manhole					90' concrete rect. channel	1744.44	1725.2						Adjust manhole ring and cover				
PL-5	44+69.51	68.29' RT	Sanitary Sewer Manhole					90' concrete rect. channel	1743.05	1724.3						Adjust manhole ring and cover				
PL-5	49+16 to 49+22	Crossing	66" RCP Sanitary Sewer					48" RCP Storm Drain	1735.76	1731.76						Pothole				
PL-5	50+73.19	59.7' RT	Sanitary Sewer Manhole					90' concrete rect. channel	1741.26	1723.4						Removal, replace with new				
PL-5	43+00 to 50+73.19	52.3' RT to 59.7' RT	66" RCP Sanitary Sewer					90' concrete rect. channel, concrete transition structure	1743.43	1741.26						Pothole				
PL-5	50+73.19 to 52+00	59.7' RT to 60' RT	66" RCP Sanitary Sewer					Concrete transition structure	1741.26	1741.28						Removal, replace with new				
PL-6	52+00.00 to 55+13.32	58.04' RT to 59.4' RT	66" RCP Sanitary Sewer					66" RCP Sanitary Sewer	1741.28	1739.14						Removal, replace with new				
PL-6	55+13.32	59.44' RT	Sanitary Sewer Manhole					New manhole at 55+18.77, 66.76' RT	1739.14							Removal, replace with new				
PL-6	55+46.17	Crossing	1-4" Underground Electric					110' concrete rect. channel	1723.69	1722.69						Pothole				
PL-6	55+54.17	Crossing	OHE/T/CATV					110' concrete rect. channel	1723.61	1722.61						Protect in place				
PL-6	55+54.9	Crossing	5-4" Underground Telephone					110' concrete rect. channel	1723.60	1722.60						Pothole				
PL-6	55+55.69	Crossing	15" Sanitary Sewer					110' concrete rect. channel	1723.58	1722.58						Pothole				
PL-6	55+57.85	Crossing	15" Sanitary Sewer					110' concrete rect. channel	1723.56	1722.56						Pothole				
PL-6	55+59.93	Crossing	12" Sanitary Sewer					110' concrete rect. channel	1723.54	1722.54						Pothole				
PL-6	56+02	Crossing	51" Sanitary Sewer					110' concrete rect. channel	1723.15	1722.15						Protect in place				
PL-6	56+17.5	Crossing	12" ACP Water					110' concrete rect. channel	1723.00	1722.00						Pothole				
PL-6	56+49	56.82' RT	Light Pole (to be relocated)					Charleston Bridge	1741.39							Relocate				
PL-6	56+50	Crossing	Communication, IC					110' concrete rect. channel	1722.71	1721.71						Pothole				
PL-6	56+54.9	Crossing	Overhead Transmission 69KV					110' concrete rect. channel	1722.67	1721.67						Protect in place				
PL-6	56+54.16	94.8' RT	Existing Power Pole					Charleston Bridge	1741.24							Protect in place				

CEDAR AVENUE TO NELLIS BOULEVARD (CONT.)

SHEET NO.	LOCATION		EXISTING UTILITY SIZE AND TYPE	ELEVATION		SOURCE OF INFO		NEW IMPROVEMENT SIZE AND TYPE	ELEVATION		REQURED CLEARANCE		DESIGN CLEARANCE		CONFLICT? YES OR NO	CONFLICT RESOLUTION				
	STA Alignment "LV"	OFFSET		TOP	BOTTOM	POTHOLE #	OTHER		TOP	BOTTOM	H	V	H	V		METHOD	WHO HAS PRIOR RIGHT?	COMPLETION COMMITMENT DATE	COMPLETED? YES OR NO	REASON FOR NO COMPLETION
PL-8	68+71	Crossing	Communication, IC					85' concrete rect. channel	1717.57	1716.57						Pothole, locate (side of bridge)				
PL-8	69+01.9	Crossing	24" Water					85' concrete rect. channel	1717.52	1716.52						Pothole				
PL-8	69+77.4	Crossing	4" Steel Gas					85' concrete rect. channel	1717.40	1716.40						Pothole, locate (side of bridge)				
PL-8	69+90	Crossing	2-6" Underground Electric					85' concrete rect. channel	1717.39	1716.39						Pothole				
PL-8	69+99.3	Crossing	24" Sanitary Sewer					85' concrete rect. channel	1717.37	1716.37						Pothole				
PL-8	70+02.5	Crossing	24" Sanitary Sewer					85' concrete rect. channel	1717.36	1716.36						Pothole				
PL-8	70+05.7	Crossing	12" Sanitary Sewer					85' concrete rect. channel	1717.35	1716.35						Pothole				
PL-8	70+15.66	120' RT	Streetlight					Nellis Bridge	1738.82							Protect in place				
PL-8	70+39.5	89.2' RT	Sanitary Sewer Manhole					Access Road	1736.00							Adjust manhole ring and cover				

Notes:
1. Conflicts include underground, at grade and overhead.
2. The Project Manager/Utility Coordinator must obtain written commitments (per the County Code) from utility companies for utility conflict resolution including date of completion committed by utility companies.
3. Elevation is at centerline of New Improvement for utilities that are "crossing"

NELLIS BOULEVARD TO SLOAN CHANNEL

PROJECT: Las Vegas Wash, Sloan Channel to Cedar Avenue
PROJECT NO: FCLA15D

PREPARED BY: BDemitropoulos
CHECKED BY: LWilcox

DATE: 3/22/2013
DATE: 4/10/2013

SHEET NO.	LOCATION		EXISTING UTILITY SIZE AND TYPE	ELEVATION		SOURCE OF INFO		NEW IMPROVEMENT SIZE AND TYPE	ELEVATION		REQURED CLEARANCE		DESIGN CLEARANCE		CONFLICT? YES OR NO	CONFLICT RESOLUTION				
	STA Alignment "LF"	OFFSET		TOP	BOTTOM	POTHOLE #	OTHER		TOP	BOTTOM	H	V	H	V		METHOD	WHO HAS PRIOR RIGHT?	COMPLETION COMMITMENT DATE	COMPLETED? YES OR NO	REASON FOR NO COMPLETION
PL-10	22+85	284.5' LT	Irrigation valve/controller		-			Regrading of the Golf Course							NO	To be removed with new Golf Course irrigation plan				
PL-11	20+38-34+70	LT, RT	NVE 138KV OH Transmission (East-West)					Channel Improvements							NO	Protect in Place				
PL-11	20+38-34+70	LT, RT	NVE 138KV OH Transmission (East-West)					Regrading of the Golf Course							NO	Protect in Place				
PL-11	30+59	87' LT	NVE 138KV OH Transmission Pole		1730.23		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-11	28+59-34+79	LT, RT	NVE 138KV OH Transmission (East-West)					Channel Improvements							NO	Protect in Place				
PL-11	28+59-34+79	LT, RT	NVE 138KV OH Transmission (East-West)					Regrading of the Golf Course							NO	Protect in Place				
PL-11	30+72	98' LT	NVE 138KV OH Transmission Pole		1731.29		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-11	29+05-37+70	LT	NVE 69KV OH Transmission (East-West)					Channel Improvements							NO	Protect in Place				
PL-11	29+05-37+70	LT	NVE 69KV OH Transmission (East-West)					Regrading of the Golf Course							NO	Protect in Place				
PL-11	29+16	288' LT	NVE 69KV OH Transmission Pole		-			Regrading of the Golf Course							NO	Protect in Place				
PL-11	31+23	80' LT	NVE 69KV OH Transmission Pole		1728.07		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-11	31+23	80' LT	NVE 69KV OH Transmission Pole		1728.07		Survey	Channel Improvements							NO	Protect in Place				
PL-12	34+68	168' RT	NVE 69KV OH Transmission Pole		1729.71		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-12	34+68	168' RT	NVE 69KV OH Transmission Pole		1729.71		Survey	Channel Improvements							NO	Protect in Place				
PL-12	36+52	97' LT	NVE 69KV OH Transmission Pole		1727.6		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-12	36+52	97' LT	NVE 69KV OH Transmission Pole		1727.6		Survey	Channel Improvements							NO	Protect in Place				
PL-15	60+88	246' RT	Water Vault and 8" RPPA		-			Regrading of the Golf Course							NO	Protect in Place				
PL-16A	69+63	408' RT	Overhead Electric Pole		1719.8		Survey	48" RCP Storm Drain Pipe							NO	Protect in Place				
PL-16A	70+00	376' RT	Overhead Electric Pole / Overhead Cable TV					48" RCP Storm Drain Pipe							NO	Protect in Place				
PL-16A	70+60	352' RT	Overhead Electric Pole		1718.8		Survey	48" RCP Storm Drain Pipe							NO	Protect in Place				
PL-18	85+80	126' LT	Overhead Electric Pole with 2 anchors		-			Regrading of the Golf Course							NO	Protect in Place				
PL-18	86+52	LT, RT	Overhead Electric					20' Wide x 1' Deep Concrete Low Flow Channel							NO	Protect in Place				
PL-18	87+24	178' RT	Overhead Electric Pole		1710.3		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-18 & PL-19	86+80 to 94+00	134' RT' to 122' RT	CLV 60" Sewer (East-West)				Survey	Regrading of the Golf Course							TBD	Protect in Place				
PL-18	87+85	124' RT	Sanitary Sewer Manhole		1710.6		Survey	Regrading of the Golf Course							NO	Protect in Place				
PL-19	92+10	148' LT	Overhead Electric Pole		1709.4		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	92+57	98' LT	NVE 69KV OH Transmission Pole		1707.7		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				

NELLIS BOULEVARD TO SLOAN CHANNEL (CONT.)

SHEET NO.	LOCATION		EXISTING UTILITY SIZE AND TYPE	ELEVATION		SOURCE OF INFO		NEW IMPROVEMENT SIZE AND TYPE	ELEVATION		REQURED CLEARANCE		DESIGN CLEARANCE		CONFLICT? YES OR NO	CONFLICT RESOLUTION				
	STA Alignment "LF"	OFFSET		TOP	BOTTOM	POTHOLE #	OTHER		TOP	BOTTOM	H	V	H	V		METHOD	WHO HAS PRIOR RIGHT?	COMPLETION COMMITMENT DATE	COMPLETED? YES OR NO	REASON FOR NO COMPLETION
PL-19	92+61	LT, RT	NVE 69KV OH Transmission (North-South)					120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	92+98	LT, RT	NVE OH Transmission/CATV (North-South)					120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	93+20	80.0' RT	2-4" Underground Telephone					120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	93+18	135' LT	Sanitary Sewer Vault		1710.5		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	93+29.2	LT, RT	CLV Sewer Siphon - 33" SS, 33" SS (North-South)	1687.6	1683.7			120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS		1693.4			5.7'		NO	Protect in Place				
PL-19	93+33	LT, RT	NVE OH Distribution (North-South)					120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	93+46	75' RT	Overhead Electric Pole		1706.4		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							YES	To Be Relocated By Others				
PL-19	93+81.1	LT, RT	CCWRD Sewer Siphon - 18" SS, 15" SS, 8" SS (North-South)	1688.0	1686.5			120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS		1693.3			5.2'		NO	Protect in Place				
PL-19	93+77	147' LT	Water Valve		1706.7		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	93+77	141' LT	Water Blow off		1706.7		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	94+04	122' RT	Sanitary Sewer Manhole		1708.1		Survey	120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS							NO	Protect in Place				
PL-19	94+19.2	LT, RT	2-6" Underground Telephone		-	-		120' Wide x 11' Deep Concrete Trapezoidal Channel 2:1 SS		1693.2					YES	To Be Relocated By Others				
RD-1	10+00	47' RT	NVE Distribution Overhead Pole		1719.83		Survey	Roadway improvements	1719.8						NO	Protect in Place				
RD-1	11+50	48' RT	NVE Distribution Overhead Pole		1721.1		Survey	Roadway improvements	1721.6						NO	Protect in Place				
RD-1	10+00-11+50	47' RT	NVE 69KV OH Transmission Line					Roadway improvements							TBD	Checking Vertical Clearances				
RD-1	11+67	51' LT	NVE 69KV OH Transmission Pole		1721.74		Survey	Roadway improvements	1721.3						NO	Protect in Place				
RD-1	11+50-11+67	50' LT	NVE OH Distribution Line					Roadway improvements							TBD	Checking Vertical Clearances				
RD-1	10+04	10' LT	Sanitary Sewer Manhole	1719.78			Survey	Roadway improvements	1719.8						YES	Adjust to finish grade				
RD-1	10+19	21' LT	Storm Drain Manhole	1719.54			Survey	Roadway improvements	1719.5						YES	Adjust to finish grade				
RD-1	11+55	6' LT	Water Valve	1721.5			Survey	Roadway improvements	1722.6						YES	Adjust to finish grade				
RD-1	11+72	4' LT	Water Blow off	1722.11			Survey	Roadway improvements	1723.1						YES	Adjust to finish grade				
RD-1	11+89-14+33	33' LT	4" PE Steel Gas Line					Bridge and Roadway improvements							YES	SWG to relocate thru new bridge				
RD-1	11+48	42' LT	CATV Box	1721.25			Survey	Roadway improvements	1722.2						YES	Adjust to finish grade by others				
RD-1	16+24	51.5' LT	NVE 69KV OH Transmission Pole		1721.9		Topo	Roadway improvements	1721.9						NO	Protect in Place				
RD-1	16+27-18+00	40' LT	4-4" Underground Telephone					Roadway improvements							NO	Protect in Place				
RD-1	10+00-18+00	LT	NVE 69KV OH Transmission Line					Roadway improvements							NO	Protect in Place				

Notes:
1. Conflicts include underground, at grade and overhead.
2. The Project Manager/Utility Coordinator must obtain written commitments (per the County Code) from utility companies for utility conflict resolution including date of completion committed by utility companies.
3. Elevation is at centerline of New Improvement for utilities that are "crossing"

Las Vegas Wash



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook
30% Submittal

Appendix A-6

30% QA/QC COMMENTS AND REPSONSES

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM
Instructions

Fields on Form to be filled out:

Submission Date: *Date Package received from Designer – By PM*
Review Date: *Due date for all CIP Comments – By PM*
Project: *Official Project Name – By PM*
Reviewer(s): *Each Reviewer should add his/her name and initials at the time comments are entered on the form. Each Reviewer will provide a date and their initials to document that their comments have been addressed. – By Reviewer.*
Package Description: *A description of the package or document(s) submitted for review. For example, Preliminary Design Review, Over-the-Shoulder review of centerline geometry, Draft Drainage Report, etc. – By PM.*
Type of Submittal: *Check appropriate box. If "Other" then provide additional information on the "If Other, please describe" area. – By PM.*

Review Comment Process:

A. Project Manager or designee prepares the comment form with the appropriate information, and names the electronic file in accordance with Project file naming conventions. Form is placed in Sharepoint for Reviewers to check out; add comments; and e-mail to .

B. Project Quality Manager (PQM) or designee provides the comments to the Designer/Engineer immediately upon completion of review process.

C. Designer/Engineer provides a response to each comment that can be one of the following: Agree (A), Partially Agree (P), or Disagree (D). A response of "P" or "D" requires an explanation. The responses should be returned to the Reviewer through the PQM or designee in a timely manner, ahead of re-submittals and/or review meetings.

D. Comment Responses of "P" or "D" will require the Reviewer and the Designer to discuss and mutually agree to a Resolution. This may occur in a variety of forums depending upon the documents being reviewed and the nature of the comment. The Designer/Engineer is responsible for filling out the Resolution to each comment in accordance with the mutually agreed upon resolution. The Review Comment Form, completed through the Resolution phase, will be returned to the Reviewer through the PQM or designee for conformation that the resolution accurately represents what was agreed to.

E. The subsequent submittal of the document will include the Review Comment Form with the Status column filled out by the Designer/Engineer indicating that the comment resolution has been incorporated and backchecked by them. The status will be verified by the Reviewers in the subsequent review by initialing and dating the "Verification" box adjacent to the Reviewer's name.

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM

Date:	Submission: 3/18/2013 Review: 3/21/2013 Response from Designer: 4/10/2013	
Project:	LV WASH: From Sloan Channel to Cedar Avenue	
Project No.	462579	
Reviewer(s) *(Only add when form is filled out)*	*Name and Initials (First Comment No.)*	*Verification (Initial & Date)*
	Mary Horvath, mch, (1)	
	David Baker, DB, (16)	
Package Description:	**30% Drawings**	

☐ Calculations ☐ Concept
☐ Plans ✓ 30% Submittal
☐ Specifications ☐ 60% Submittal
☐ Estimate ☐ 90% Submittal
Submittal
☐ Report ☐ Other

If Other, please describe:

Codes for Response:	*A = Agree Completely, Will Revise (no written response required)* *P = Agree Partially (See written response, resolution required)* *D = Disagree (See written response, resolution required)*

Codes for Status:	*V = Response/Resolution Incorporation Verified and Back-Checked by Designer/Engr* *I = Incomplete – Response/Resolution not yet incorporated* *P90 = Postponed until 90% plan preparation* *Note: Resolution column may be blank if Response Code is A*

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM

Item No.	*Rev'r Initials*	*Pg/Sht No.*	*Comment*	*Response (Filled out by Designer/Engr. Must use a code of A, P, or D. P or D require brief explanation)*	*Resolution (Determined jointly at comment resolution meeting or subsequent discussion. Filled out by Designer/Engr)*	*Stat. Code (by Engr)*
			HEC-RAS model			
1.	MCH		The stationing differences between the existing and proposed conditions RAS models and the lack of geo-referencing in the proposed model make it confusing for review purposes. I would make the stationing consistent and at least georeference the proposed model enough so the cross sections do not lay on top of each other in the spatial view of the geometry file. Transitioning from negative channel stationing to positive is especially confusing. Adding the actual channel stationing to the cross section description would also be helpful.	A		
2.	MCH		The expansion in width at Cedar Channel is very rapid-almost 1:2. A 1:1 expansion would be more hydraulically stable. In fact, the transition calculation done by Stanley Consultants suggests an 85' minimum transition length.	D: HM- the short expansion is correct. The Cedar Channel connection is parallel to the LV Wash; thus the junction is modeled as a wall opening in WSPG. An additional cross section will be added to the HECRAS model to show the expansion. Note the transition calculation is for the downstream contraction.		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM

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3.	MCH		The roughness coefficients in the upstream portion of the model do not seem to be logical. There are design calculations for a rip rap channel in this section ("LV" 5+00 to 7+00) and no roughness appropriate for rip rap has been assigned. Other values vary without explanation. A table with roughness values and justifications would be helpful.	A: HM-the roughness coefficient for riprap will be revised. The HECRAS model calculated an average roughness coefficient and will be corrected. Backup documentation will be included with the submitted calculations. The value for the existing wash upstream of the project, 0.025, was referenced from the LOMR.		
4.	MCH		There seem to be very many sections in various reaches of the model. For a regular channel that is not changing rapidly, this seems unnecessary. Is this due to the extreme velocities?	P – Cross sections were interpoloated to a maximum distance of 25' to check hydraulic stablility and velocities of the reaches.		
5.	MCH		I would take the sides of the section all the way to the bridge top on Nelllis Boulevard and all the bridges.	A		
6.	MCH		The Sahara Avenue bridge crossing needs ineffective flow areas up and downstream.	A – Ineffective flow areas have been added.		
7.	MCH		Why does just the section upstream of Sahara Bridge – 6025.88 – have a channel roughness of 0.015? From the cross section profile, it looks like a natural section-this seems low.	P – This will be revised to .03 while the internal cross section of the bridge will be concrete lined.		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM

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8.	MCH		There are areas in the downstream reach of LV (eb. Sta 10+468) Wash where the channels look like they are natural and have roughness values of 0.015 and velocities over 21 ft/s. Is this in fact a concrete lined channel? And if so, why do these sections look irregular? They look to be changed quite a bit from existing conditions.	A – These are concrete lined sections cut from the Surface which may have the irregularities, Surface will be checked with received survey data.		
9.	MCH		At the confluence of the LV Wash and Flamingo Wash- there look to be cross sections where flow commingles between the two channels. There is a WSEL differential of over a foot in places between adjacent sections (eg -7680.8 in LV Wash and Flamingo Wash). The existing conditions model has these two channels joined as one – which might be the way to go. Or a lateral weir could be put between the two so flow could commingle-although this may not work that well in steady state flow.	A – Flamingo Reach will be revised to match Pipe Area of LV Wash reach, Lateral weir will be placed.		
10.	MCH		It is hard to tell, but it looks like flow is being allowed to be conveyed in the right overbank of the Flamingo Wash where it can't actually get (eg -7800). If this is the case, a normal ineffective flow area could be used to block this area out.	A – A levee will be placed on the overbank area.		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
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11.	MCH		There are levees used throughout the model to contain flow in the channel. In my experience, FEMA reviewers do not typically like the use of levees where there are no actual levees. If these are not actual levees, you could changes these to ineffective flow areas or truncate the sections.	P: HM – Need to show levees, may truncate if able to but some areas will be a levee, additional freeboard has been provided in these areas.		
12.	MCH		The velocities in the upstream critical portion of LV Wash are very high and much higher than existing conditions. Is this ok with Clark County FCD?	A: HM- the WSPG model was revised to remove a default headworks depth. Upstream velocities are 15 ft/sec.		
13.	MCH		The expansion and contraction coefficients up and downstream of Sahara Bridge should be changed to 0.3 and 0.5.	A – will increase		
14.	MCH		The expansion and contraction coefficients through the upstream section are set to 0.01 and 0.03, which is appropriate for supercritical flow. However, up and downstream of the channel transitions, they should be set a bit higher.	A – will increase		
15.	MCH		If we are turning this in to FEMA eventually, we may want to run Check RAS on it. I ran it and it has a lot of non-relevant and pesky comments but there were a few relevant ones – like ineffective flow up and downstream of Sahara Bridge.	A – will check		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
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16.	db	HC & TY	The horizontal control sheets appear to be very thorough; however, it is unclear where on the Stanley typical sections this control line falls. Is it the middle of the R/W? Graphically, the control line appears to meander and is not necessarily in the center. How will the control line be correlated to the section of channel that needs to be constructed? Suggest adding alignment name to Stanley typical sections and to removal and plan sheets.	A – CONTROL LINE IS THE CENTER OF THE CHANNEL (CENTERLINE), NOT THE CENTER OF THE RIGHT-OF-WAY. THE CENTERLINE WILL BE ADDED TO TYPICAL SECTIONS, AND SHOWN IN PLAN VIEW ON THE REMOVAL SHEETS.		
17.	db	TY-6	Does the "LF" alignment correlate with the alignment defined on the HC sheets?	Agree. Yes, the "LF" alignment in the HC Sheets is the same as shown in the design plans.		
18.	db	TY-6	Add callout for channel bottom material (concrete?). Change fill style for material used to build maintenance road. It is same style as the drain backfill and I don't believe that is the intent. Label maintenance road fill as uncl. Exc. or as appropriate.	Agree. Maintenance road will be 6" of Type II Aggregate Base. Section will be cleaned up to reflect this. Note will be added to define the channel material.		
19.	db	TY-6	Has it been determined what type of wall is being proposed (ie gravity wall, soil nail/MSE)?	Agree. Channel walls will be cast-in-place concrete.		
20.	db	TY-8	HERCP? Is this reasonably priced and available in the area? Has a cost comparison been made between the HERCP and RCP with the same capacity?	D – HERCP is a common shelf item in the Las Vegas Area, this large amount can easily be manufactured. A hydraulic analysis prevented the use of RCP because of the additional required cover.		

LAS VEGAS WASH
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21.	db	R1	Channel coming into the LV Wash at 14+50 – I didn't see any typical section or treatment details for this drain.	A – WILL ADD A TYPICAL SECTION FOR CEDAR CREEK CHANNEL		
22.	db	general	Has the owner of the huge sanitary sewer been consulted pertaining to areas of additional fill on top of their line? The additional fill may require costly mitigation to the line. What about mitigation to pipe where it is crossing under the ret. wall? Wall foundations may be close to the sewer line and require spread footing.	A – SEWERLINE BELONGS TO CITY OF LAS VEGAS. THEY ARE AN INTEGRAL PART OF THE DESIGN TEAM. WHEN STRUCTURAL DESIGN IS ANALYZED, WE WILL TAKE THIS INTO CONSIDERATION		
8.	db	TY-4	Why is the proposed 66-in dia SS shown as octagonal and larger than the existing 66-in dia?	A – WE WILL CORRECT THIS GRAPHICAL REPRESENTATION TO MATCH SIZE AND SHAPE		
9.	db	R sheets	Noticeable callout style difference between the Stanley plans and the CH plans – the Stanley plans use text callouts while the CH plans use bubble notes. The issue with the general 'protect in place' bubble note on the CH sheets is that it may not be apparent what exactly is being protected. Also, the CH plans include a mini key map, while the Stanley plans do not.	Agree. Removal plans will be revised to show the callout bubbles for denoting removal items. Items being protected in place (Note "A") will be supplemented with a description describing what object is to be protected. All plans will be updated to include a keymap.		
10.	db	R sheets	On the CH sheets, removal notes for articulated mat and riprap generally conflict with the fill style used. Also, eventually for pay item purposes, terms for articulated mat, concrete slope paving should be consistent between Stanley and CH plansets.	Agree. Hatch patterns will be verified between plans sets to ensure consitinency.		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
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11.	db	R17	Need note for pipe removal	Agree. Note will be added.		
12.	db	R18	Need notes for pipe removal and for articulated mat removal.	Agree. Note will be added.		
13.	db	TY7-TY9	It would be helpful to know where (Station ranges) each of these typical sections is applicable.	Agree. Station limits of sections will be added.		
16.	db	R23	Need removal note for median island	Agree. Note will be added.		
17.	db	TY1 – TY5	Typical sections should callout limits of concrete channel paving	A – A CONCRETE THICKNESS WILL BE ADDED TO THE SECTIONS, WHICH WILL SHOW THE LIMITS OF THE CHANNEL.		
18.	db	PR-4	At Sta. 36+00, there is less than 1' of clearance between the concrete channel bottom and the top of the SS pipe. This will be difficult to construct without damaging the pipe. Consider a slab over the SS pipe through this area. Also, depending on wall type, there could be a conflict near this location between the wall foundation and the SS pipe.	P – THERE IS MORE THAN 1' CLEARANCE BETWEEN SEWER PIPE AND THE INVERT AT THE WALL. HOWEVER, I AGREE THAT THIS IS STILL TOO CLOSE. WILL ADDRESS THE CLOSE PROXIMITY WITH THE WITH STRUCTURAL DESIGN AT THE 90% DESIGN STAGE		
19.	db	PR-4	A 48-in dia drain pipe is introduced into LV Wash at 36+29. Why have the FL 2' above the wash FL? Is the concern that it would catch debris during small events? Typical for other side drains.	D – THE SIDEDRAINS ENTER THE CHANNEL 12" ABOVE THE INVERT ELEVATION AT THE WALL. THIS IS BY DESIGN		
20.	db	PL-3 – PL-6	North arrows appear to be incorrectly aligned	P – PL-4 AND PL-5 ARE INCORRECT AND WILL BE FIXED		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM

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21.	db	PR-6	A significant amount of material is being removed from the channel bottom and exposing existing piling for Charleston Blvd. bridge. Need to evaluate existing piling depths and whether exposure is excessive and will require mitigation.	A		
22.	db	General	Clearly, this project will involve a significant amount of excavation. Need to consider fill destination and trucking routes when preparing cost estimate. Trucking may destroy local roads and require reconstruction. Significant haul will increase excavation cost.	A		
23.	db	PL5 – PL7	Channel width on the LT side will produce an inaccessible area above the wash but below the existing trail. Consider making the channel width variable and reconstructing the existing trail wall. Or perhaps steps or access ladder from the trail down to the inaccessible area.	P – WE WILL GRADE THE SLOPE BETWEEN THE EXISTING TRAIL AND THE CHANNEL TO AVOID ANY INACCESSIBLE AREAS BETWEEN THE TRAIL AND CHANNEL		
24.	db	PR-6	Callout for LVCA 0000 RCB profile callout references sheet PL-22 – should be PL-24	A – WILL CORRECT CALLOUT		
25.	db	PR-7	5'+ vertical drop introduced between LV Wash FL and FL for 18'x8' RCB. Consider lowering box or introducing a flow spreader to reduce wear on LV Wash concrete bottom.	A – HOWEVER THE EXISTING RCB IS VERY HIGH. TO ADJUST THIS PROFILE DOWN WILL REQUIRE SIGNIFICANT RECONSTRUCTION OF EXISTING PRIVATE IMPROVEMENTS. WILL CONSIDER IN MORE DETAIL DURING 60% DESIGN STAGE		

LAS VEGAS WASH
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24.	db	PL-8, Sta. 68+50 RT.	Introducing a double swing gate for maintenance access will introduce a break in the Nellis Bridge parapet/barrier system. Need to confirm this is acceptable to NDOT as well as the addition of an approach that will require stopping traffic on one lane of Nellis Blvd.	A – WILL COORDINATE IMPROVEMENTS WITH NDOT		
25.	db	TY-5	Section C indicates that the channel fill will extend all the way to the bottom of the structure on the RT side. This will be difficult to construct. Consider lowering similar to the LT.	A		
26.	db	CD1-CD3	Consider adding the project stationing to these sheets for reference.	A		
27.	db	PL-9	Are there pathway improvements that need to be made as a part of this project to accommodate the relocated ped bridge?	Agree. Bridge relocation will also include the relocation of the cart path to match new bridge location.		
28.	db	TY general	How thick is the concrete section?	The structural concrete section has not yet been determined, but will be added on the structural sheets at a later submittal.		
29.	db	PR sheets General	Through golf course area, where the section is a not rectangular, the existing ground on the profiles is labeled as 'high point'. Is this the catch point, or is this a highpoint within the R/W? Clarify.	A – This point is the high point within the Right-of-Way, note has been changed.		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
REVIEW COMMENT FORM

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30.	db	PL-12	It appears that note 42 should reference TY-8 rather than TY-7?. Or perhaps a separate note should be added to reference the low flow culvert section.	Agree. The TY-7 reference for note 42 is correct. A separate note will be added for low flow culvert sections.		
31.	db	PL-12-PL-14	I'm not familiar with the std detail being referenced in note 68, but a 72-in dia. SD is not going to fit into a 72" dia MH.	Agree. Note will be revised to use the NDOT Type 4 manhole.		
32.	db	PL-12 & PL-13	The horizontal and vertical location of the HERCP's is uncontrolled in either the plan or profile.	Agree. Station callouts will be added for culvert begin/end station and offsets.		
33.	db	PL-13	Note 66 is not used and appears to reference incorrect profile sheets.	Agree. Note will be deleted.		
34.	db	TY-8	Purpose of this section is unclear – is it to reduce cut limits (due to golf course needs) and still convey the design event?	D – This section is to facililtate the confluence of the Las Vegas Wash and the Flamingo Wash over the golf course driving range		
35.	db	TY-7	Has a riprap or cobble bottom with bioengineered streambank stabilized low flow channel been considered in lieu of the concrete? The channel slope is moderate and the waterway (at least from Google Earth images) appears to be perennial. This may be less costly and perhaps more aesthetic.	P – Alternative linings have been considering, currently the option with less maintenance has been shown.		
36.	db	PL-16A	Adjust MH size (note 61) up to accommodate 48-in dia SD.	Agree. Manhole will be changed to 60".		

LAS VEGAS WASH
From Sloan Channel to Cedar Avenue
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37.	db	PL-17	Sta. 78 – is this the 'Driving Range Culvert Section'? This is unclear.	A – Notes have been added to the plan and profile		
38.	db	PL-18	Pedestrian crossing does not line up with the pathway that is a part of the channel cross-section.	Agree. Current path shown is the existing path. Path will be relocated to match new bridge location.		
39.	db	TY-9	The channel is defined on the plan with a height, however there is no definition on the typical as to where that height is measured from.	Agree. Channel height dimensions to be added to typicals		
40.	db	PL-22	HERCP's shown in plan are not reflected in profile.	Agree. HERCP's to be added to profile.		



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook
30% Submittal

Appendix B

HYDRAULIC ANALYSIS – LAS VEGAS WASH



Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix B-1

HEC-RAS ANALYSIS – PROPOSED CONDITION – SLOAN CHANNEL TO CEDAR AVENUE



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook
30% Submittal

Appendix B-1.1

HEC-RAS SUMMARY TABLES

LAS VEGAS WASH - SLOAN CHANNEL TO CEDAR AVENUE
PROPOSED CONDITION - PRELIMINARY RESULTS
MODIFIED HEC-RAS TABLE & FREEBOARD CHECK

Reach	River Sta	Proposed Stationing	Q Total (cfs)	Invert Slope	Min Ch El (ft)	W.S. Elev (ft)	Depth (ft)	Vel Chnl (ft/s)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)	FB Avail. (ft)	FB Req. (ft)	FB Check	FB Elev. (ft)
Las Vegas Wash	-1338.41	"LV" 73+32.16 = "LF" 13+38.42	15156	0.14%	1716.81	1732.59	15.78	11.61	85.00	0.52	1736.16	1736.31	3.57	2.59	YES	1735.18
Las Vegas Wash	-1880.50	"LF" 18+80.50	15156	0.15%	1716.05	1732.42	16.37	11.18	85.00	0.49	1735.40	1735.55	2.98	2.44	YES	1734.86
Las Vegas Wash	-1935.00	"LF" 19+35.00	15156	0.16%	1715.97	1732.95	16.98	8.49	178.63	0.47	1736.85	1741.00	3.90	1.62	YES	1734.57
Las Vegas Wash	-1953.64	"LF" 19+53.64	15156	0.13%	1715.94	1732.92	16.98	8.49	181.82	0.48	1736.84	1741.00	3.92	1.62	YES	1734.54
Las Vegas Wash	-2000.00	"LF" 20+00.00	15156	0.14%	1715.88	1732.90	17.02	8.25	202.92	0.48	1736.57	1740.84	3.67	1.56	YES	1734.46
Las Vegas Wash	-2044.07	"LF" 20+44.07	15156	0.14%	1715.82	1732.83	17.01	8.24	234.29	0.52	1736.10	1740.00	3.27	1.55	YES	1734.38
Las Vegas Wash	-2100.00	"LF" 21+00.00	15156	0.14%	1715.74	1732.68	16.94	8.40	231.37	0.53	1735.78	1740.00	3.10	1.60	YES	1734.28
Las Vegas Wash	-2166.63	"LF" 21+66.63	15156	0.24%	1715.65	1732.56	16.91	8.37	237.06	0.53	1735.65	1737.21	3.09	1.59	YES	1734.15
Las Vegas Wash	-2200.00	"LF" 22+00.00	15156	0.26%	1715.57	1732.52	16.95	8.20	243.11	0.52	1737.00	1738.00	4.48	1.54	YES	1734.06
Las Vegas Wash	-2227.02	"LF" 22+27.02	15156	0.26%	1715.50	1732.51	17.01	7.98	250.83	0.51	1737.00	1735.98	3.47	1.49	YES	1734.00
Las Vegas Wash	-2250.00	"LF" 22+50.00	15156	0.23%	1715.44	1732.49	17.05	7.88	258.93	0.51	1737.00	1738.00	4.51	1.46	YES	1733.95
Las Vegas Wash	-2297.33	"LF" 22+97.33	15156	0.26%	1715.33	1732.45	17.12	7.62	284.05	0.51	1737.00	1737.00	4.55	1.40	YES	1733.85
Las Vegas Wash	-2331.65	"LF" 23+31.65	15156	0.23%	1715.24	1732.31	17.07	7.92	253.44	0.51	1738.00	1737.00	4.69	1.47	YES	1733.78
Las Vegas Wash	-2365.98	"LF" 23+65.98	15156	0.26%	1715.16	1732.11	16.95	8.40	237.58	0.54	1738.00	1737.00	4.89	1.60	YES	1733.71
Las Vegas Wash	-2400.00	"LF" 24+00.00	15156	0.23%	1715.07	1731.95	16.88	8.71	237.62	0.57	1737.33	1737.00	5.05	1.68	YES	1733.63
Las Vegas Wash	-2426.00	"LF" 24+26.00	15156	0.25%	1715.01	1731.90	16.89	8.63	255.89	0.58	1738.00	1737.00	5.10	1.66	YES	1733.56
Las Vegas Wash	-2450.00	"LF" 24+50.00	15156	0.26%	1714.95	1731.83	16.88	8.66	270.18	0.60	1738.00	1737.00	5.17	1.66	YES	1733.49
Las Vegas Wash	-2500.00	"LF" 25+00.00	15156	0.24%	1714.82	1731.69	16.87	8.68	281.07	0.61	1735.36	1737.00	3.67	1.67	YES	1733.36
Las Vegas Wash	-2550.00	"LF" 25+50.00	15156	0.24%	1714.70	1731.45	16.75	9.02	270.80	0.64	1735.00	1736.00	3.55	1.76	YES	1733.21
Las Vegas Wash	-2600.00	"LF" 26+00.00	15156	0.27%	1714.58	1731.19	16.61	9.33	278.46	0.68	1734.00	1736.00	2.81	1.85	YES	1733.04
Las Vegas Wash	-2621.93	"LF" 26+21.93	15156	0.25%	1714.52	1731.04	16.52	9.56	275.96	0.70	1734.00	1736.00	2.96	1.92	YES	1732.96
Las Vegas Wash	-2650.00	"LF" 26+50.00	15156	0.24%	1714.45	1730.91	16.46	9.65	272.51	0.71	1733.32	1737.00	2.41	1.95	YES	1732.86
Las Vegas Wash	-2700.00	"LF" 27+00.00	15156	0.23%	1714.33	1730.80	16.47	9.31	281.90	0.68	1733.51	1737.00	2.71	1.85	YES	1732.65
Las Vegas Wash	-2721.29	"LF" 27+21.29	15156	0.25%	1714.28	1730.82	16.54	8.81	320.47	0.67	1733.59	1737.00	2.77	1.71	YES	1732.53
Las Vegas Wash	-2760.57	"LF" 27+60.57	15156	0.25%	1714.18	1730.71	16.53	8.76	292.74	0.63	1733.67	1736.20	2.96	1.69	YES	1732.40
Las Vegas Wash	-2800.00	"LF" 28+00.00	15156	0.24%	1714.08	1730.33	16.25	9.59	238.74	0.66	1733.62	1734.68	3.29	1.93	YES	1732.26
Las Vegas Wash	-2850.00	"LF" 28+50.00	15156	0.26%	1713.96	1730.26	16.30	9.30	201.76	0.58	1733.27	1734.74	3.01	1.84	YES	1732.10
Las Vegas Wash	-2900.00	"LF" 29+00.00	15156	0.24%	1713.83	1730.23	16.40	8.92	189.21	0.52	1733.66	1734.70	3.43	1.74	YES	1731.97
Las Vegas Wash	-2950.00	"LF" 29+50.00	15156	0.26%	1713.71	1730.21	16.50	8.51	243.62	0.56	1733.40	1734.51	3.19	1.62	YES	1731.83
Las Vegas Wash	-3000.00	"LF" 30+00.00	15156	0.23%	1713.58	1730.14	16.56	8.36	245.94	0.54	1733.63	1734.34	3.49	1.59	YES	1731.73
Las Vegas Wash	-3043.11	"LF" 30+43.11	15156	0.25%	1713.48	1729.86	16.38	8.99	191.87	0.53	1733.13	1734.14	3.27	1.75	YES	1731.61
Las Vegas Wash	-3100.00	"LF" 31+00.00	15156	0.24%	1713.34	1729.78	16.44	8.93	180.29	0.51	1732.59	1734.14	2.81	1.74	YES	1731.52
Las Vegas Wash	-3150.00	"LF" 31+50.00	15156	0.26%	1713.22	1729.71	16.49	8.82	197.15	0.53	1732.60	1733.86	2.89	1.71	YES	1731.42
Las Vegas Wash	-3200.00	"LF" 32+00.00	15156	0.24%	1713.09	1729.63	16.54	8.81	184.52	0.51	1732.00	1733.64	2.37	1.71	YES	1731.34
Las Vegas Wash	-3250.00	"LF" 32+50.00	15156	0.26%	1712.97	1729.50	16.53	8.97	176.82	0.51	1732.00	1733.55	2.50	1.75	YES	1731.25
Las Vegas Wash	-3312.37	"LF" 33+12.37	15156	0.26%	1712.81	1729.60	16.79	7.86	225.33	0.47	1731.15	1733.33	1.55	1.46	YES	1731.06
Las Vegas Wash	-3363.25	"LF" 33+63.25	15156	0.24%	1712.68	1729.60	16.92	7.41	271.87	0.48	1730.99	1733.37	1.39	1.35	YES	1730.95
Las Vegas Wash	-3414.13	"LF" 34+14.13	15156	0.26%	1712.56	1729.50	16.94	7.47	288.73	0.50	1730.95	1733.38	1.45	1.37	YES	1730.87
Las Vegas Wash	-3460.73	"LF" 34+60.73	15156	0.27%	1712.44	1729.33	16.89	7.80	299.30	0.54	1730.90	1732.90	1.57	1.44	YES	1730.77
Las Vegas Wash	-3497.30	"LF" 34+97.30	15156	-1.56%	1712.34	1728.47	16.13	10.26	206.07	0.67	1730.80	1730.80	2.33	2.13	YES	1730.60
Las Vegas Wash	**-3500.00**	**"LF" 35+00.00**	**Inl Struct**													
Las Vegas Wash	-3600.00	"LF" 36+00.00	15156	1.88%	1713.94	1726.26	12.32	14.29	136.75	0.90	1733.00	1730.00	3.74	3.67	YES	1729.93
Las Vegas Wash	-3650.00	"LF" 36+50.00	15156	1.77%	1713.00	1726.94	13.94	10.95	204.66	0.74	1733.00	1729.56	2.62	2.36	YES	1729.30
Las Vegas Wash	-3717.28	"LF" 37+17.28	15156	0.25%	1711.81	1726.78	14.97	10.70	162.05	0.64	1729.98	1729.89	3.11	2.28	YES	1729.06
Las Vegas Wash	-3765.90	"LF" 37+65.90	15156	0.25%	1711.69	1727.00	15.31	9.16	213.94	0.58	1730.47	1729.78	2.78	1.80	YES	1728.80
Las Vegas Wash	-3814.51	"LF" 38+14.51	15156	0.28%	1711.57	1727.17	15.60	7.77	221.73	0.46	1730.11	1729.67	2.50	1.44	YES	1728.61
Las Vegas Wash	-3850.00	"LF" 38+50.00	15156	0.24%	1711.47	1727.24	15.77	7.04	244.88	0.42	1730.23	1729.42	2.18	1.27	YES	1728.51
Las Vegas Wash	-3900.00	"LF" 39+00.00	15156	0.24%	1711.35	1727.21	15.86	6.91	244.61	0.41	1732.45	1729.00	1.79	1.24	YES	1728.45

Reach	River Sta	Proposed Stationing	Q Total (cfs)	Invert Slope	Min Ch El (ft)	W.S. Elev (ft)	Depth (ft)	Vel Chnl (ft/s)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)	FB Avail. (ft)	FB Req. (ft)	FB Check	FB Elev. (ft)
Las Vegas Wash	-3950.00	"LF" 39+50.00	15156	0.26%	1711.23	1727.16	15.93	6.85	272.22	0.42	1733.00	1730.00	2.84	1.23	YES	1728.39
Las Vegas Wash	-4000.00	"LF" 40+00.00	15156	0.22%	1711.10	1727.05	15.95	7.04	281.02	0.45	1731.92	1730.00	2.95	1.27	YES	1728.32
Las Vegas Wash	-4044.66	"LF" 40+44.66	15156	0.25%	1711.00	1726.91	15.91	7.32	291.87	0.48	1730.98	1730.00	3.09	1.33	YES	1728.24
Las Vegas Wash	-4100.00	"LF" 41+00.00	15156	0.24%	1710.86	1726.65	15.79	7.93	301.93	0.56	1731.00	1730.00	3.35	1.48	YES	1728.13
Las Vegas Wash	-4150.00	"LF" 41+50.00	15156	0.26%	1710.74	1726.35	15.61	8.60	260.95	0.58	1731.00	1731.00	4.65	1.65	YES	1728.00
Las Vegas Wash	-4176.51	"LF" 41+76.51	15156	0.19%	1710.67	1726.34	15.67	8.30	277.34	0.57	1731.00	1731.00	4.66	1.57	YES	1727.91
Las Vegas Wash	-4203.02	"LF" 42+03.02	15156	0.29%	1710.62	1726.32	15.70	8.07	292.91	0.56	1730.99	1729.82	3.50	1.51	YES	1727.83
Las Vegas Wash	-4237.46	"LF" 42+37.46	15156	0.26%	1710.52	1726.41	15.89	7.07	343.91	0.50	1731.00	1728.47	2.06	1.28	YES	1727.69
Las Vegas Wash	-4271.91	"LF" 42+71.91	15156	0.24%	1710.43	1726.26	15.83	7.44	324.28	0.52	1731.00	1727.67	1.41	1.36	YES	1727.62
Las Vegas Wash	-4325.00	"LF" 43+25.00	Inl Struct													
Las Vegas Wash	-4506.50	"LF" 45+06.50	15156	0.26%	1709.86	1725.51	15.65	9.08	308.90	0.69	1731.80	1727.69	2.18	1.78	YES	1727.29
Las Vegas Wash	-4555.96	"LF" 45+55.96	15156	0.25%	1709.73	1725.61	15.88	7.79	316.25	0.55	1730.00	1727.86	2.25	1.44	YES	1727.05
Las Vegas Wash	-4591.64	"LF" 45+91.64	15156	0.25%	1709.64	1725.56	15.92	7.59	333.39	0.55	1730.00	1728.48	2.92	1.39	YES	1726.95
Las Vegas Wash	-4627.56	"LF" 46+27.56	15156	0.22%	1709.55	1725.47	15.92	7.61	359.23	0.57	1730.00	1727.00	1.53	1.40	YES	1726.87
Las Vegas Wash	-4650.00	"LF" 46+50.00	15156	0.26%	1709.50	1725.40	15.90	7.68	359.10	0.58	1730.00	1727.82	2.42	1.42	YES	1726.82
Las Vegas Wash	-4700.00	"LF" 47+00.00	15156	0.25%	1709.37	1725.24	15.87	7.84	314.23	0.56	1730.00	1728.10	2.86	1.45	YES	1726.69
Las Vegas Wash	-4763.19	"LF" 47+63.19	15156	0.24%	1709.21	1724.99	15.78	8.24	264.93	0.55	1730.00	1727.99	3.00	1.55	YES	1726.54
Las Vegas Wash	-4800.00	"LF" 48+00.00	15156	0.24%	1709.12	1724.95	15.83	8.00	296.74	0.56	1727.91	1729.00	2.96	1.49	YES	1726.44
Las Vegas Wash	-4850.00	"LF" 48+50.00	15156	0.26%	1709.00	1724.93	15.93	7.47	352.20	0.55	1726.88	1727.88	1.95	1.37	YES	1726.30
Las Vegas Wash	-4876.97	"LF" 48+76.97	15156	0.26%	1708.93	1724.70	15.77	8.10	314.24	0.59	1726.70	1727.97	2.00	1.52	YES	1726.22
Las Vegas Wash	-4900.00	"LF" 49+00.00	15156	0.24%	1708.87	1724.43	15.56	8.82	286.56	0.63	1726.98	1728.00	2.55	1.71	YES	1726.14
Las Vegas Wash	-4950.00	"LF" 49+50.00	15156	0.24%	1708.75	1723.82	15.07	10.20	222.48	0.70	1726.85	1728.01	3.03	2.12	YES	1725.94
Las Vegas Wash	-5000.00	"LF" 50+00.00	15156	0.24%	1708.63	1723.55	14.92	10.51	169.06	0.63	1726.00	1728.00	2.45	2.22	YES	1725.77
Las Vegas Wash	-5050.00	"LF" 50+50.00	15156	0.16%	1708.51	1723.46	14.95	10.37	168.14	0.62	1726.00	1728.00	2.54	2.17	YES	1725.63
Las Vegas Wash	-5086.63	"LF" 50+86.63	15156	0.30%	1708.45	1723.45	15.00	9.88	277.00	0.74	1726.00	1728.00	2.55	2.02	YES	1725.47
Las Vegas Wash	-5150.00	"LF" 51+50.00	15156	0.24%	1708.26	1723.51	15.25	8.50	308.54	0.62	1726.00	1727.00	2.49	1.62	YES	1725.13
Las Vegas Wash	-5195.07	"LF" 51+95.07	15156	0.25%	1708.15	1723.44	15.29	8.16	335.56	0.61	1726.00	1726.24	2.56	1.53	YES	1724.97
Las Vegas Wash	-5250.00	"LF" 52+50.00	15156	0.26%	1708.01	1723.42	15.41	7.47	354.28	0.55	1726.00	1726.21	2.58	1.37	YES	1724.79
Las Vegas Wash	-5300.00	"LF" 53+00.00	15156	0.21%	1707.88	1723.45	15.57	6.65	399.92	0.49	1725.00	1726.00	1.55	1.19	YES	1724.64
Las Vegas Wash	-5323.31	"LF" 53+23.31	15156	0.26%	1707.83	1723.31	15.48	7.05	375.61	0.52	1725.96	1726.11	2.65	1.27	YES	1724.58
Las Vegas Wash	-5350.00	"LF" 53+50.00	15156	0.26%	1707.76	1723.17	15.41	7.37	392.01	0.57	1726.00	1726.00	2.83	1.34	YES	1724.51
Las Vegas Wash	-5400.32	"LF" 54+00.32	15156	0.24%	1707.63	1722.90	15.27	7.89	366.91	0.61	1726.00	1725.07	2.17	1.47	YES	1724.37
Las Vegas Wash	-5450.00	"LF" 54+50.00	15156	0.24%	1707.51	1722.57	15.06	8.54	336.46	0.65	1726.00	1724.67	2.10	1.63	YES	1724.20
Las Vegas Wash	-5500.00	"LF" 55+00.00	15156	0.24%	1707.39	1722.24	14.85	9.03	336.80	0.71	1726.00	1724.05	1.81	1.77	YES	1724.01
Las Vegas Wash	-5524.59	"LF" 55+24.59	15156	0.24%	1707.33	1722.15	14.82	8.97	344.77	0.71	1726.00	1724.00	1.85	1.75	YES	1723.90
Las Vegas Wash	-5550.00	"LF" 55+50.00	15438	0.24%	1707.27	1722.08	14.81	8.84	355.98	0.70	1726.00	1724.70	2.62	1.71	YES	1723.79
Las Vegas Wash	-5579.17	"LF" 55+79.17	15438	0.29%	1707.20	1721.88	14.68	9.10	341.12	0.72	1725.38	1725.00	3.12	1.79	YES	1723.67
Las Vegas Wash	-5600.00	"LF" 56+00.00	15438	0.24%	1707.14	1721.80	14.66	9.12	319.12	0.70	1724.44	1725.00	2.64	1.79	YES	1723.59
Las Vegas Wash	-5650.00	"LF" 56+50.00	15438	0.15%	1707.02	1721.73	14.71	8.61	321.36	0.64	1724.00	1725.00	2.27	1.65	YES	1723.38
Las Vegas Wash	-5669.52	"LF" 56+69.52	15438	0.33%	1706.99	1721.57	14.58	8.96	293.47	0.65	1725.00	1724.90	3.33	1.75	YES	1723.32
Las Vegas Wash	-5700.00	"LF" 57+00.00	15438	0.24%	1706.89	1721.12	14.23	9.98	272.69	0.74	1724.99	1724.09	2.97	2.05	YES	1723.17
Las Vegas Wash	-5750.00	"LF" 57+50.00	15438	0.26%	1706.77	1720.97	14.20	9.83	239.43	0.68	1725.41	1724.04	3.07	2.00	YES	1722.97
Las Vegas Wash	-5800.00	"LF" 58+00.00	15438	0.22%	1706.64	1720.93	14.29	9.28	255.15	0.64	1726.00	1725.00	4.07	1.84	YES	1722.77
Las Vegas Wash	-5827.45	"LF" 58+27.45	15438	0.27%	1706.58	1720.84	14.26	9.33	268.20	0.66	1726.00	1724.02	3.18	1.85	YES	1722.69
Las Vegas Wash	-5850.00	"LF" 58+50.00	15438	0.25%	1706.52	1720.75	14.23	9.39	279.57	0.68	1725.87	1724.00	3.25	1.87	YES	1722.62
Las Vegas Wash	-5886.01	"LF" 58+86.01	15438	0.25%	1706.43	1720.54	14.11	9.63	289.15	0.72	1724.94	1724.00	3.46	1.94	YES	1722.48
Las Vegas Wash	-5950.00	"LF" 59+50.00	15438	0.24%	1706.27	1720.46	14.19	8.93	287.68	0.64	1725.00	1724.00	3.54	1.74	YES	1722.20
Las Vegas Wash	-5995.45	"LF" 59+95.45	15438	0.23%	1706.16	1720.29	14.13	9.11	221.99	0.58	1726.00	1724.00	3.71	1.79	YES	1722.08
Las Vegas Wash	-6025.88	"LF" 60+25.88	15438	0.00%	1706.09	1720.55	14.46	7.53	256.93	0.42	1727.00	1724.27	3.72	1.38	YES	1721.93
Las Vegas Wash	**-6100.00**	**"LF" 61+00.00**	**Bridge**													
Las Vegas Wash	-6150.00	"LF" 61+50.00	15438	0.26%	1705.78	1720.32	14.54	8.00	255.27	0.42	1729.85	1724.00	3.68	1.49	YES	1721.81
Las Vegas Wash	-6200.00	"LF" 62+00.00	15438	0.30%	1705.65	1720.33	14.68	7.64	218.83	0.41	1729.45	1723.41	3.08	1.41	YES	1721.74
Las Vegas Wash	-6250.00	"LF" 62+50.00	15438	0.30%	1705.50	1720.11	14.61	8.18	272.42	0.55	1723.00	1724.00	2.89	1.54	YES	1721.65
Las Vegas Wash	-6300.00	"LF" 63+00.00	15438	0.30%	1705.35	1719.84	14.49	8.72	282.03	0.61	1723.00	1721.97	2.13	1.68	YES	1721.52
Las Vegas Wash	-6350.00	"LF" 63+50.00	15438	0.30%	1705.20	1719.77	14.57	8.40	293.13	0.59	1722.69	1723.00	2.92	1.60	YES	1721.37
Las Vegas Wash	-6400.00	"LF" 64+00.00	15438	0.30%	1705.05	1719.75	14.70	7.85	302.89	0.54	1722.00	1722.41	2.25	1.46	YES	1721.21

Reach	River Sta	Proposed Stationing	Q Total (cfs)	Invert Slope	Min Ch El (ft)	W.S. Elev (ft)	Depth (ft)	Vel Chnl (ft/s)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)	FB Avail. (ft)	FB Req. (ft)	FB Check	FB Elev. (ft)
Las Vegas Wash	-6450.00	"LF" 64+50.00	15438	0.30%	1704.90	1719.73	14.83	7.38	294.03	0.49	1722.00	1722.00	2.27	1.35	YES	1721.08
Las Vegas Wash	-6500.00	"LF" 65+00.00	15438	0.30%	1704.75	1719.68	14.93	7.22	288.54	0.47	1722.00	1722.00	2.32	1.31	YES	1720.99
Las Vegas Wash	-6536.85	"LF" 65+36.85	15438	0.30%	1704.64	1719.69	15.05	6.85	302.04	0.44	1722.02	1722.00	2.31	1.23	YES	1720.92
Las Vegas Wash	-6600.00	"LF" 66+00.00	15438	0.36%	1704.45	1719.39	14.94	7.64	307.66	0.53	1722.00	1722.88	2.61	1.41	YES	1720.80
Las Vegas Wash	-6650.00	"LF" 66+50.00	15438	0.41%	1704.27	1719.03	14.76	8.53	293.58	0.61	1723.00	1723.00	3.97	1.63	YES	1720.66
Las Vegas Wash	-6689.17	"LF" 66+89.17	15438	0.39%	1704.11	1719.02	14.91	8.06	307.63	0.57	1722.00	1722.90	2.98	1.51	YES	1720.53
Las Vegas Wash	-6750.00	"LF" 67+50.00	15460	0.40%	1703.87	1718.82	14.95	8.22	329.61	0.61	1723.00	1722.00	3.18	1.55	YES	1720.37
Las Vegas Wash	-6800.00	"LF" 68+00.00	15460	0.39%	1703.67	1718.28	14.61	9.47	280.21	0.69	1723.00	1720.67	2.39	1.89	YES	1720.17
Las Vegas Wash	-6841.19	"LF" 68+41.19	15460	0.41%	1703.51	1718.46	14.95	7.88	341.44	0.58	1723.00	1720.40	1.94	1.46	YES	1719.92
Las Vegas Wash	-6900.00	"LF" 69+00.00	15460	0.40%	1703.27	1718.39	15.12	7.54	336.21	0.54	1723.00	1720.56	2.17	1.38	YES	1719.77
Las Vegas Wash	-6950.00	"LF" 69+50.00	15460	0.40%	1703.07	1718.22	15.15	7.73	350.20	0.57	1723.00	1720.51	2.29	1.43	YES	1719.65
Las Vegas Wash	-7000.00	"LF" 70+00.00	15460	0.40%	1702.87	1717.63	14.76	9.24	341.98	0.74	1722.00	1720.02	2.39	1.83	YES	1719.46
Las Vegas Wash	-7050.00	"LF" 70+50.00	15460	0.40%	1702.67	1717.12	14.45	10.19	217.78	0.68	1722.00	1722.00	4.88	2.11	YES	1719.23
Las Vegas Wash	-7099.52	"LF" 70+99.52	15460	0.40%	1702.47	1716.86	14.39	10.48	211.95	0.70	1722.00	1722.97	5.14	2.21	YES	1719.07
Las Vegas Wash	-7149.64	"LF" 71+49.64	15460	0.39%	1702.27	1716.27	14.00	11.58	163.57	0.71	1722.00	1718.90	2.63	2.58	YES	1718.85
Las Vegas Wash	-7180.12	"LF" 71+80.12	15460	0.40%	1702.15	1716.20	14.05	11.48	158.07	0.69	1721.00	1720.15	3.95	2.55	YES	1718.75
Las Vegas Wash	-7200.00	"LF" 72+00.00	15460	0.40%	1702.07	1716.31	14.24	10.78	152.88	0.62	1721.00	1720.19	3.88	2.30	YES	1718.61
Las Vegas Wash	-7232.90	"LF" 72+32.90	15460	0.41%	1701.94	1715.93	13.99	11.55	137.98	0.65	1720.19	1719.23	3.30	2.57	YES	1718.50
Las Vegas Wash	-7250.00	"LF" 72+50.00	15460	0.40%	1701.87	1716.03	14.16	10.96	139.33	0.61	1720.00	1719.91	3.88	2.37	YES	1718.40
Las Vegas Wash	-7300.00	"LF" 73+00.00	15460	0.40%	1701.67	1714.62	12.95	13.91	124.55	0.82	1719.08	1718.20	3.58	3.50	YES	1718.12
Las Vegas Wash	-7360.59	"LF" 73+60.59	15460	0.41%	1701.43	1714.59	13.16	13.14	132.53	0.78	1719.00	1718.09	3.50	3.18	YES	1717.77
Las Vegas Wash	-7400.00	"LF" 74+00.00	15460	0.32%	1701.27	1715.11	13.84	10.59	184.82	0.66	1718.00	1717.40	2.29	2.24	YES	1717.35
Las Vegas Wash	-7450.00	"LF" 74+50.00	15460	0.32%	1701.11	1715.24	14.13	9.35	218.07	0.60	1718.00	1718.00	2.76	1.86	YES	1717.10
Las Vegas Wash	-7500.00	"LF" 75+00.00	15460	0.30%	1700.95	1715.48	14.53	7.51	286.82	0.49	1718.07	1717.31	1.83	1.38	YES	1716.86
Las Vegas Wash	-7550.00	"LF" 75+50.00	15460	0.30%	1700.80	1715.71	14.91	5.41	410.57	0.36	1718.04	1717.00	1.29	0.95	YES	1716.66
Las Vegas Wash	-7600.00	"LF" 76+00.00	15460	0.30%	1700.65	1715.48	14.83	6.31	306.97	0.39	1718.03	1717.00	1.52	1.12	YES	1716.60
Las Vegas Wash	-7650.00	"LF" 76+50.00	15460	0.29%	1700.50	1715.53	15.03	5.64	338.82	0.35	1718.00	1717.00	1.47	0.99	YES	1716.52
Las Vegas Wash	-7680.80	"LF" 76+80.80	15460	-6.60%	1700.41	1715.12	14.71	7.35	257.58	0.45	1718.00	1717.00	1.88	1.34	YES	1716.46
Las Vegas Wash	**-7700.00**	**"LF" 77+00.00**	**Inl Struct**													
Las Vegas Wash	-7750.00	"LF" 77+50.00	15460	0.08%	1704.98	1714.32	9.34	8.19	321.77	0.60	1720.00	1716.00	1.68	1.54	YES	1715.86
Las Vegas Wash	-7800.00	"LF" 78+00.00	15460	0.06%	1704.94	1714.27	9.33	7.73	354.56	0.57	1720.00	1716.00	1.73	1.43	YES	1715.70
Las Vegas Wash	-7850.00	"LF" 78+50.00	15460	0.08%	1704.91	1714.19	9.28	7.53	351.12	0.55	1718.40	1716.00	1.81	1.38	YES	1715.57
Las Vegas Wash	-7900.00	"LF" 79+00.00	15460	5.42%	1704.87	1714.32	9.45	6.10	394.88	0.42	1719.00	1716.00	1.68	1.08	YES	1715.40
Las Vegas Wash	-8000.00	"LF" 80+00.00	15460	0.80%	1699.45	1713.87	14.42	7.34	335.66	0.52	1719.00	1716.00	2.13	1.34	YES	1715.21
Las Vegas Wash	-8050.00	"LF" 80+50.00	15460	0.15%	1699.05	1713.88	14.83	6.76	308.93	0.44	1718.25	1716.00	2.12	1.21	YES	1715.09
Las Vegas Wash-2	-8300.00	"LF" 83+00.00	21656	0.22%	1698.67	1713.69	15.02	5.82	590.43	0.41	1717.01	1715.50	1.81	1.03	YES	1714.72
Las Vegas Wash-2	-8350.00	"LF" 83+50.00	21656	0.08%	1698.56	1713.52	14.96	6.34	511.13	0.43	1715.65	1715.50	1.98	1.12	YES	1714.64
Las Vegas Wash-2	-8400	"LF" 84+00.00	21656	0.002	1698.52	1713.08	14.56	7.82	435.75	0.55	1716.05	1715.5	2.42	1.45	YES	1714.53
Las Vegas Wash-2	-8450.00	"LF" 84+50.00	21656	0.10%	1698.42	1712.63	14.21	9.04	276.88	0.54	1717.00	1715.50	2.87	1.77	YES	1714.40
Las Vegas Wash-2	-8500.00	"LF" 85+00.00	21656	0.18%	1698.37	1712.27	13.90	9.86	242.11	0.58	1715.87	1715.00	2.73	2.01	YES	1714.28
Las Vegas Wash-2	-8550.00	"LF" 85+50.00	21656	0.12%	1698.28	1712.06	13.78	10.11	252.66	0.61	1715.00	1715.00	2.94	2.09	YES	1714.15
Las Vegas Wash-2	-8600.00	"LF" 86+00.00	21656	0.16%	1698.22	1711.96	13.74	9.99	260.99	0.61	1715.00	1715.00	3.04	2.05	YES	1714.01
Las Vegas Wash-2	-8650.00	"LF" 86+50.00	21656	0.14%	1698.14	1711.49	13.35	10.96	207.39	0.63	1714.00	1715.00	2.51	2.37	YES	1713.86
Las Vegas Wash-2	-8700.00	"LF" 87+00.00	21656	0.06%	1698.07	1708.96	10.89	16.04	169.33	1.00	1714.00	1716.58	5.04	1.89	YES	1710.85
Las Vegas Wash-2	-8720.00	"LF" 87+20.00	21656	0.08%	1698.04	1707.40	9.36	18.39	152.64	1.17	1714.04	1715.86	6.64	1.97	YES	1709.37
Las Vegas Wash-2	-8750.00	"LF" 87+50.00	21656	0.04%	1698.00	1707.29	9.29	18.57	152.33	1.18	1714.00	1715.82	6.71	1.98	YES	1709.27
Las Vegas Wash-2	-8800.00	"LF" 88+00.00	21656	0.02%	1697.98	1707.17	9.19	18.63	152.20	1.19	1713.00	1713.00	5.83	1.98	YES	1709.15
Las Vegas Wash-2	-8842.58	"LF" 88+42.58	21656	0.13%	1697.97	1707.11	9.14	18.59	152.20	1.18	1713.00	1713.00	5.89	1.97	YES	1709.08
Las Vegas Wash-2	-8850.00	"LF" 88+50.00	21656	0.04%	1697.96	1707.10	9.14	18.58	152.22	1.18	1712.99	1713.00	5.89	1.97	YES	1709.07
Las Vegas Wash-2	-8900.00	"LF" 89+00.00	21656	0.02%	1697.94	1707.00	9.06	18.65	152.12	1.19	1712.00	1712.00	5.00	1.97	YES	1708.97
Las Vegas Wash-2	-8950.00	"LF" 89+50.00	21656	1.86%	1697.93	1706.91	8.98	18.76	152.05	1.20	1712.00	1712.00	5.09	1.97	YES	1708.88
Las Vegas Wash-2	-9000.00	"LF" 90+00.00	21656	2.24%	1697.00	1705.49	8.49	20.66	149.22	1.37	1712.00	1712.00	6.51	2.05	YES	1707.54
Las Vegas Wash-2	-9050.00	"LF" 90+50.00	21656	1.76%	1695.88	1703.64	7.76	22.88	146.43	1.59	1709.00	1708.70	5.06	2.13	YES	1705.77
Las Vegas Wash-2	-9100.00	"LF" 91+00.00	21656	0.00%	1695.00	1702.55	7.55	23.93	149.18	1.71	1707.50	1707.00	4.45	2.17	YES	1704.72
Las Vegas Wash-2	-9150.00	"LF" 91+50.00	21656	0.00%	1695.00	1702.21	7.21	24.02	148.91	1.72	1707.35	1707.00	4.79	2.16	YES	1704.37
Las Vegas Wash-2	-9200.00	"LF" 92+00.00	21656	0.00%	1695.00	1702.41	7.41	23.14	147.87	1.62	1707.44	1706.00	3.59	2.13	YES	1704.54

Reach	River Sta	Proposed Stationing	Q Total (cfs)	Invert Slope	Min Ch El (ft)	W.S. Elev (ft)	Depth (ft)	Vel Chnl (ft/s)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)	FB Avail. (ft)	FB Req. (ft)	FB Check	FB Elev. (ft)
Las Vegas Wash-2	-9250.00	"LF" 92+50.00	21656	0.00%	1695.00	1702.38	7.38	22.73	147.76	1.58	1706.68	1706.00	3.62	2.11	YES	1704.49
Las Vegas Wash-2	-9300.00	"LF" 93+00.00	21656	0.00%	1695.00	1702.62	7.62	21.82	147.74	1.48	1706.72	1705.72	3.10	2.07	YES	1704.69
Las Vegas Wash-2	-9350.00	"LF" 93+50.00	21656	0.34%	1695.00	1702.67	7.67	21.30	149.33	1.44	1705.47	1706.00	2.80	2.05	YES	1704.72
Las Vegas Wash-2	-9400.00	"LF" 94+00.00	21656	0.74%	1694.83	1702.76	7.93	20.72	150.95	1.39	1705.71	1706.00	2.95	2.03	YES	1704.79
Las Vegas Wash-2	-9450.00	"LF" 94+50.00	21656	0.76%	1694.46	1702.43	7.97	20.94	150.09	1.41	1705.14	1706.00	2.71	2.05	YES	1704.48
Las Vegas Wash-2	-9500.00	"LF" 95+00.00	21656	0.16%	1694.08	1702.15	8.07	21.07	149.57	1.42	1705.23	1706.00	3.08	2.06	YES	1704.21
Las Vegas Wash-2	-9550.00	"LF" 95+50.00	21656	0.00%	1694.00	1702.07	8.07	20.85	149.80	1.40	1705.02	1706.00	2.95	2.05	YES	1704.12
Las Vegas Wash-2	-9600.00	"LF" 96+00.00	21656	0.12%	1694.00	1702.02	8.02	20.60	150.25	1.37	1704.81	1705.00	2.79	2.03	YES	1704.05
Las Vegas Wash-2	-9650.00	"LF" 96+50.00	21656	0.72%	1693.94	1702.15	8.21	19.97	151.65	1.32	1704.72	1705.00	2.57	2.01	YES	1704.16
Las Vegas Wash-2	-9700.00	"LF" 97+00.00	21656	0.72%	1693.58	1701.82	8.24	20.24	151.37	1.34	1704.48	1704.90	2.66	2.02	YES	1703.84
Las Vegas Wash-2	-9750.00	"LF" 97+50.00	21656	0.46%	1693.22	1701.40	8.18	20.60	150.72	1.37	1703.99	1705.00	2.59	2.04	YES	1703.44
Las Vegas Wash-2	-9800.00	"LF" 98+00.00	21656	0.02%	1692.99	1701.12	8.13	20.75	150.43	1.39	1703.67	1705.00	2.55	2.04	YES	1703.16
Las Vegas Wash-2	-9850.00	"LF" 98+50.00	21656	0.18%	1692.98	1700.97	7.99	20.69	150.71	1.38	1703.75	1704.00	2.78	2.03	YES	1703.00
Las Vegas Wash-2	-9900.00	"LF" 99+00.00	21656	0.76%	1692.89	1701.07	8.18	20.10	151.82	1.33	1703.66	1704.00	2.59	2.01	YES	1703.08
Las Vegas Wash-2	-9950.00	"LF" 99+50.00	21656	0.76%	1692.51	1700.71	8.20	20.39	151.06	1.35	1703.58	1704.00	2.87	2.03	YES	1702.74
Las Vegas Wash-2	-10000.00	"LF" 100+00.00	21656	0.28%	1692.13	1700.28	8.15	20.75	150.28	1.39	1703.40	1704.00	3.12	2.04	YES	1702.32
Las Vegas Wash-2	-10050.00	"LF" 100+50.00	21656	0.02%	1691.99	1700.00	8.01	20.91	150.06	1.40	1703.20	1703.98	3.20	2.05	YES	1702.05
Las Vegas Wash-2	-10100.00	"LF" 101+00.00	21656	0.10%	1691.98	1699.99	8.01	20.54	150.78	1.37	1702.95	1703.00	2.96	2.03	YES	1702.02
Las Vegas Wash-2	-10150.00	"LF" 101+50.00	21656	0.88%	1691.93	1700.07	8.14	20.01	151.97	1.32	1702.72	1703.00	2.65	2.01	YES	1702.08
Las Vegas Wash-2	-10200.00	"LF" 102+00.00	21656	0.88%	1691.49	1699.61	8.12	20.44	151.11	1.36	1702.55	1703.00	2.94	2.03	YES	1701.64
Las Vegas Wash-2	-10250.00	"LF" 102+50.00	21656	3.72%	1691.05	1699.10	8.05	20.93	150.13	1.40	1702.25	1703.00	3.15	2.05	YES	1701.15
Las Vegas Wash-2	-10300.00	"LF" 103+00.00	21656	-0.40%	1689.19	1698.42	9.23	21.61	149.21	1.47	1701.88	1703.00	3.46	2.13	YES	1700.55
Las Vegas Wash-2	-10350.00	"LF" 103+50.00	21656	-0.38%	1689.39	1698.15	8.76	21.71	148.37	1.48	1701.66	1702.00	3.51	2.12	YES	1700.27
Las Vegas Wash-2	-10400.00	"LF" 104+00.00	21656	-0.12%	1689.58	1697.95	8.37	21.70	150.97	1.49	1701.16	1702.00	3.21	2.10	YES	1700.05
Las Vegas Wash-2	**-10468.80**	**"LF" 104+68.80**	**21656**	**0.39%**	**1689.66**	**1697.53**	**7.87**	**21.88**	**153.89**	**1.52**	**1700.41**	**1702.00**	**2.88**	**2.09**	**YES**	**1699.62**
Las Vegas Wash-2	-10500.00	"LF" 105+00.00	21656	0.38%	1689.54	1696.76	7.22	22.72	159.30	1.64	1700.26	1700.17	3.41	2.10	YES	1698.86
Las Vegas Wash-2	-10550.00	"LF" 105+50.00	21656	0.40%	1689.35	1696.63	7.28	22.47	159.68	1.61	1700.00	1699.83	3.20	2.09	YES	1698.72
Las Vegas Wash-2	-10600.00	"LF" 106+00.00	21656	0.44%	1689.15	1696.46	7.31	22.35	159.49	1.60	1699.93	1699.80	3.34	2.08	YES	1698.54
Las Vegas Wash-2	-10650.00	"LF" 106+50.00	21656	0.47%	1688.93	1696.33	7.40	22.14	159.94	1.58	1699.77	1699.55	3.22	2.08	YES	1698.41
Las Vegas Wash-2	-10750.00	"LF" 107+50.00	21656	0.44%	1688.46	1695.82	7.36	22.21	160.34	1.59	1699.15	1699.02	3.20	2.08	YES	1697.90
Las Vegas Wash-2	-10800.00	"LF" 108+00.00	21656	0.33%	1688.24	1695.58	7.34	22.21	165.50	1.61	1698.42	1698.83	2.84	2.08	YES	1697.66
Las Vegas Wash-2	-10900.00	"LF" 109+00.00	21656	0.20%	1687.91	1699.87	11.96	10.06	266.64	0.55	1698.74	1698.44	-1.43	2.07	EX.	1701.94
Las Vegas Wash-2	-10950.00	"LF" 109+50.00	21656	0.12%	1687.81	1699.19	11.38	11.82	251.61	0.67	1698.46	1698.26	-0.93	2.67	EX.	1701.86
Las Vegas Wash-2	-11000.00	"LF" 110+00.00	21656	0.22%	1687.75	1698.13	10.38	14.10	187.60	0.85	1698.19	1698.23	0.06	3.59	EX.	1701.72
Las Vegas Wash-2	-11050.00	"LF" 110+50.00	21656	0.44%	1687.64	1697.16	9.52	15.87	174.76	1.00	1697.91	1698.12	0.75	1.84	EX.	1699.00
Las Vegas Wash-2	-11077.50	"LF" 110+77.50	21656	0.44%	1687.52	1696.72	9.20	16.58	172.73	1.06	1697.81	1697.98	1.09	1.87	EX.	1698.59
Las Vegas Wash-2	-11100.00	"LF" 111+00.00	21656	0.42%	1687.42	1696.74	9.32	16.38	173.26	1.05	1697.72	1697.87	0.98	1.86	EX.	1698.60
Las Vegas Wash-2	-11150.00	"LF" 111+50.00	21656	0.42%	1687.21	1696.07	8.86	17.36	171.47	1.13	1697.53	1697.65	1.46	1.90	EX.	1697.97
Las Vegas Wash-2	-11200.00	"LF" 112+00.00	21656	0.40%	1687.00	1696.52	9.52	15.86	175.66	1.00	1697.37	1697.43	0.85	1.84	EX.	1698.36
Las Vegas Wash-2	-11250.00	"LF" 112+50.00	21656	0.40%	1686.80	1695.63	8.83	17.27	171.18	1.12	1697.15	1697.22	1.52	1.89	EX.	1697.52
Las Vegas Wash-2	-11300.00	"LF" 113+00.00	21656	0.40%	1686.60	1695.32	8.72	17.60	170.19	1.15	1696.95	1697.01	1.63	1.91	EX.	1697.23
Las Vegas Wash-2	-11350.00	"LF" 113+50.00	21656	0.16%	1686.40	1694.66	8.26	18.47	168.01	1.23	1696.60	1696.83	1.94	1.93	YES	1696.59
Las Vegas Wash-2	-11400.00	"LF" 114+00.00	21656	0.32%	1686.32	1694.42	8.10	18.63	167.86	1.25	1696.31	1696.54	1.89	1.94	EX.	1696.36
Las Vegas Wash-2	-11450.00	"LF" 114+50.00	21656	0.50%	1686.16	1694.22	8.06	18.73	167.57	1.26	1696.24	1696.45	2.02	1.94	YES	1696.16
Las Vegas Wash-2	-11500.00	"LF" 115+00.00	21656	0.28%	1685.91	1694.03	8.12	18.82	167.42	1.26	1696.08	1696.26	2.05	1.95	YES	1695.98
Las Vegas Wash-2	-11550.00	"LF" 115+50.00	21656	0.96%	1685.77	1693.69	7.92	19.12	166.17	1.29	1695.84	1696.10	2.15	1.95	YES	1695.64
Las Vegas Wash-2	-11600.00	"LF" 116+00.00	21656	0.02%	1685.29	1693.33	8.04	19.44	165.09	1.32	1695.71	1696.17	2.38	1.97	YES	1695.30
Las Vegas Wash-2	-11650.00	"LF" 116+50.00	21656	0.00%	1685.28	1693.14	7.86	19.49	164.78	1.32	1695.48	1695.89	2.34	1.97	YES	1695.11
Las Vegas Wash-2	-11700.00	"LF" 117+00.00	21656	0.96%	1685.28	1693.42	8.14	18.47	168.32	1.23	1695.11	1695.52	1.69	1.93	EX.	1695.35
Las Vegas Wash-2	-11750.00	"LF" 117+50.00	21656	0.44%	1684.80	1692.80	8.00	19.22	166.95	1.30	1694.39	1695.24	1.59	1.96	EX.	1694.76
Las Vegas Wash-2	-11800.00	"LF" 118+00.00	21656	0.30%	1684.58	1692.38	7.80	19.61	165.87	1.34	1694.69	1695.07	2.31	1.97	YES	1694.35
Las Vegas Wash-2	-11850.00	"LF" 118+50.00	21656	0.04%	1684.43	1692.49	8.06	19.00	167.54	1.28	1694.52	1694.17	1.68	1.95	EX.	1694.44
Las Vegas Wash-2	-11900.00	"LF" 119+00.00	21656	0.86%	1684.41	1692.35	7.94	18.99	167.62	1.28	1694.35	1694.70	2.00	1.95	YES	1694.30
Las Vegas Wash-2	-11950.00	"LF" 119+50.00	21656	0.32%	1683.98	1691.67	7.69	19.79	165.47	1.36	1694.15	1694.30	2.48	1.98	YES	1693.65
Las Vegas Wash-2	-12000.00	"LF" 120+00.00	21656	-0.06%	1683.82	1691.47	7.65	19.82	165.63	1.36	1693.98	1693.21	1.74	1.98	EX.	1693.45
Las Vegas Wash-2	-12050.00	"LF" 120+50.00	21656	0.29%	1683.85	1694.59	10.74	13.14	241.77	0.78	1693.89	1693.78	-0.81	3.18	EX.	1697.77

Reach	River Sta	Proposed Stationing	Q Total (cfs)	Invert Slope	Min Ch El (ft)	W.S. Elev (ft)	Depth (ft)	Vel Chnl (ft/s)	Top Width (ft)	Froude # Chl	LOB Elev (ft)	ROB Elev (ft)	FB Avail. (ft)	FB Req. (ft)	FB Check	FB Elev. (ft)
Las Vegas Wash-2	-12101.40	"LF" 121+01.40	21656	0.78%	1683.70	1694.57	10.87	13.03	227.29	0.77	1693.78	1693.98	-0.79	3.14	EX.	1697.71
Las Vegas Wash-2	-12150.00	"LF" 121+50.00	21656	0.80%	1683.32	1694.43	11.11	13.23	197.45	0.76	1693.42	1694.21	-1.01	3.22	EX.	1697.65
Las Vegas Wash-2	-12200.00	"LF" 122+00.00	21656	0.40%	1682.92	1694.12	11.20	13.81	203.71	0.77	1693.01	1693.87	-1.11	3.46	EX.	1697.58
Las Vegas Wash-2	-12250.00	"LF" 122+50.00	21656		1682.72	1692.31	9.59	17.09	140.53	1.00	1692.69	1691.76	-0.55	1.91	EX.	1694.22
Flamingo Wash	-7450.00		6196	0.50%	1704.84	1714.61	9.77	6.19	190.26	0.48	1718.00	1716.76	2.15	1.09	YES	1715.70
Flamingo Wash	-7500.00		6196	0.64%	1704.59	1714.56	9.97	5.89	231.16	0.49	1717.31	1717.07	2.51	1.04	YES	1715.60
Flamingo Wash	-7550.00		6196	0.62%	1704.27	1714.57	10.30	5.05	296.01	0.44	1716.00	1716.62	1.43	0.90	YES	1715.47
Flamingo Wash	-7600.00		6196	0.52%	1703.96	1714.69	10.73	3.29	362.76	0.25	1716.00	1717.30	1.31	0.67	YES	1715.36
Flamingo Wash	-7650.00		6196	0.62%	1703.70	1714.57	10.87	4.01	248.34	0.28	1716.00	1717.10	1.43	0.75	YES	1715.32
Flamingo Wash	-7680.80		6196	0.48%	1703.51	1714.62	11.11	3.23	322.14	0.23	1716.00	1716.52	1.38	0.66	YES	1715.28
Flamingo Wash	-7750.00		6196	0.40%	1703.18	1714.51	11.33	3.79	290.63	0.28	1716.00	1716.11	1.49	0.72	YES	1715.23
Flamingo Wash	-7800.00		6196	0.42%	1702.98	1714.50	11.52	3.61	365.17	0.29	1716.00	1716.00	1.50	0.70	YES	1715.20
Flamingo Wash	-7850.00		6196	0.44%	1702.77	1714.49	11.72	3.31	388.90	0.27	1716.00	1715.24	0.75	0.67	YES	1715.16
Flamingo Wash	-7900.00		6196	0.42%	1702.55	1714.38	11.83	3.95	328.18	0.32	1716.00	1715.50	1.12	0.74	YES	1715.12
Flamingo Wash	-8000.00		6196	0.44%	1702.13	1714.34	12.21	3.59	315.75	0.27	1715.25	1715.50	0.91	0.70	YES	1715.04
Flamingo Wash	-8050.00		6196	1.30%	1701.91	1714.31	12.40	3.55	347.09	0.28	1715.50	1715.19	0.88	0.70	YES	1715.01



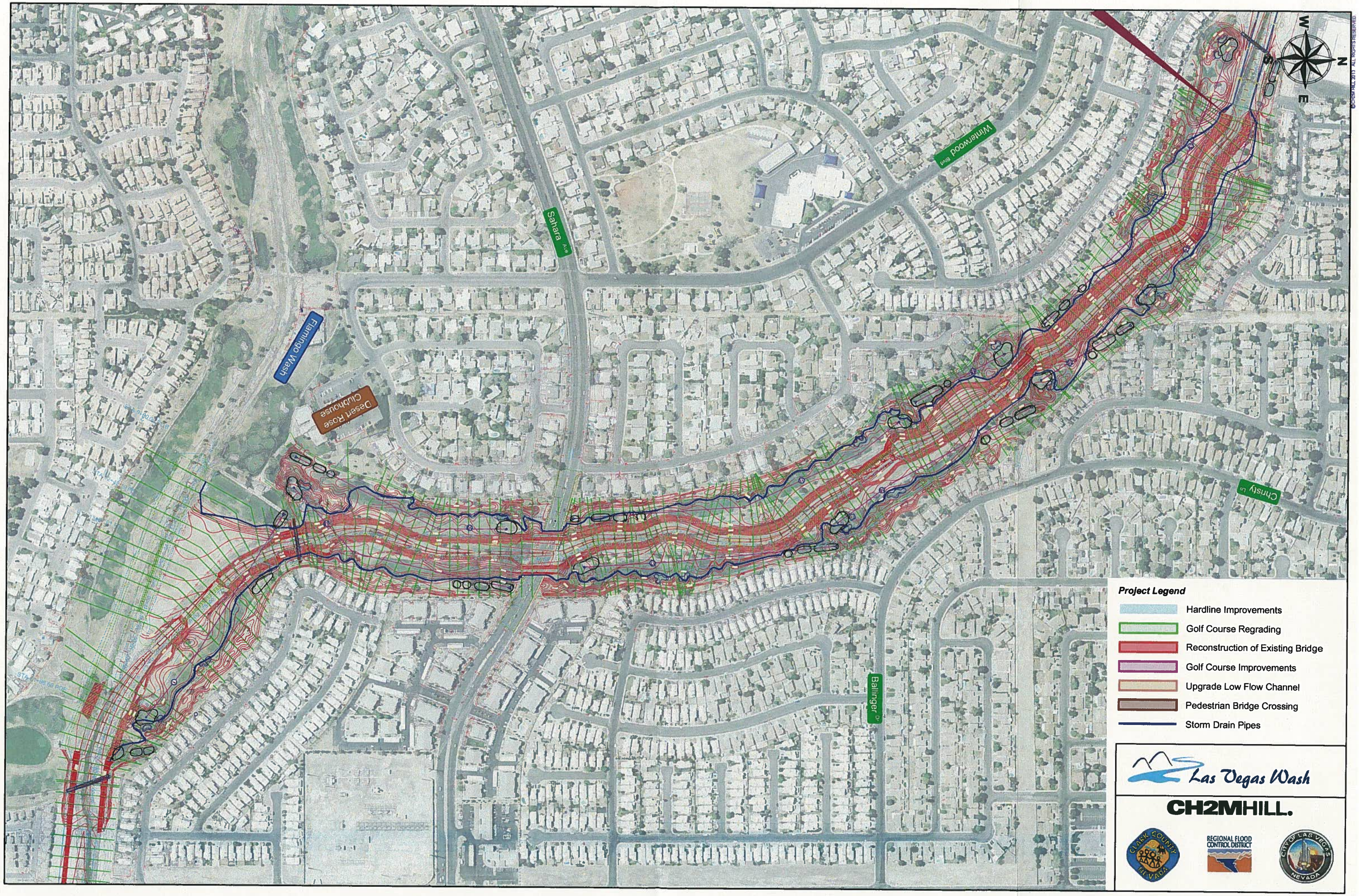
Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix B-1.2

HEC-RAS PROPOSED CONDITION CROSS SECTION EXHIBIT


Sahara Ave
Wilnarwood Blvd
Flamingo Wash
Desert Rose Clubhouse
Christy Ln
Ballinger Dr
W
N
E
S
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Project Legend
Hardline Improvements
Golf Course Regrading
Reconstruction of Existing Bridge
Golf Course Improvements
Upgrade Low Flow Channel
Pedestrian Bridge Crossing
Storm Drain Pipes
Las Vegas Wash
CH2MHILL.
CLARK COUNTY NEVADA
REGIONAL FLOOD CONTROL DISTRICT
CITY OF LAS VEGAS NEVADA



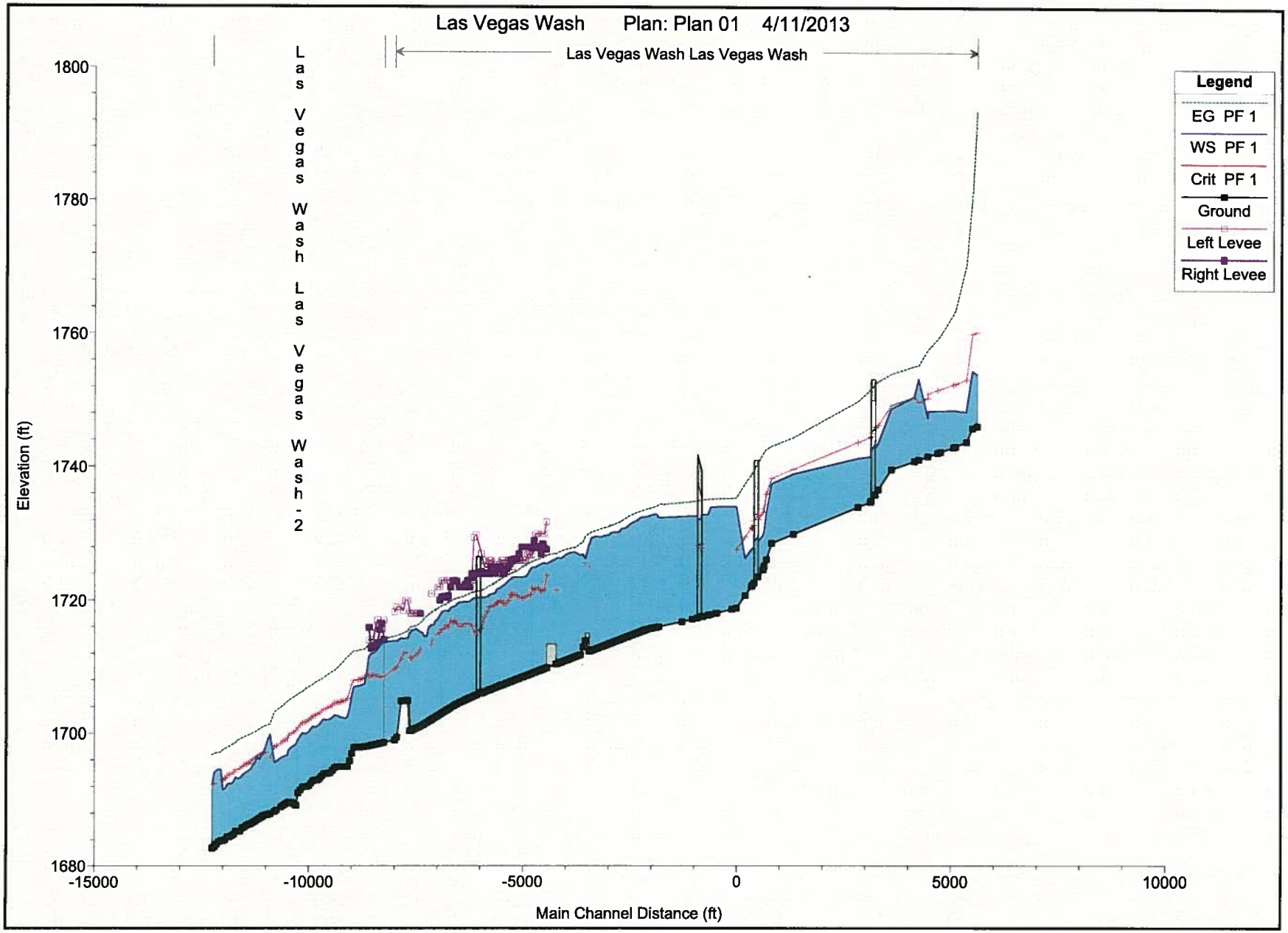
Las Vegas Wash— Sloan Channel to Cedar Avenue

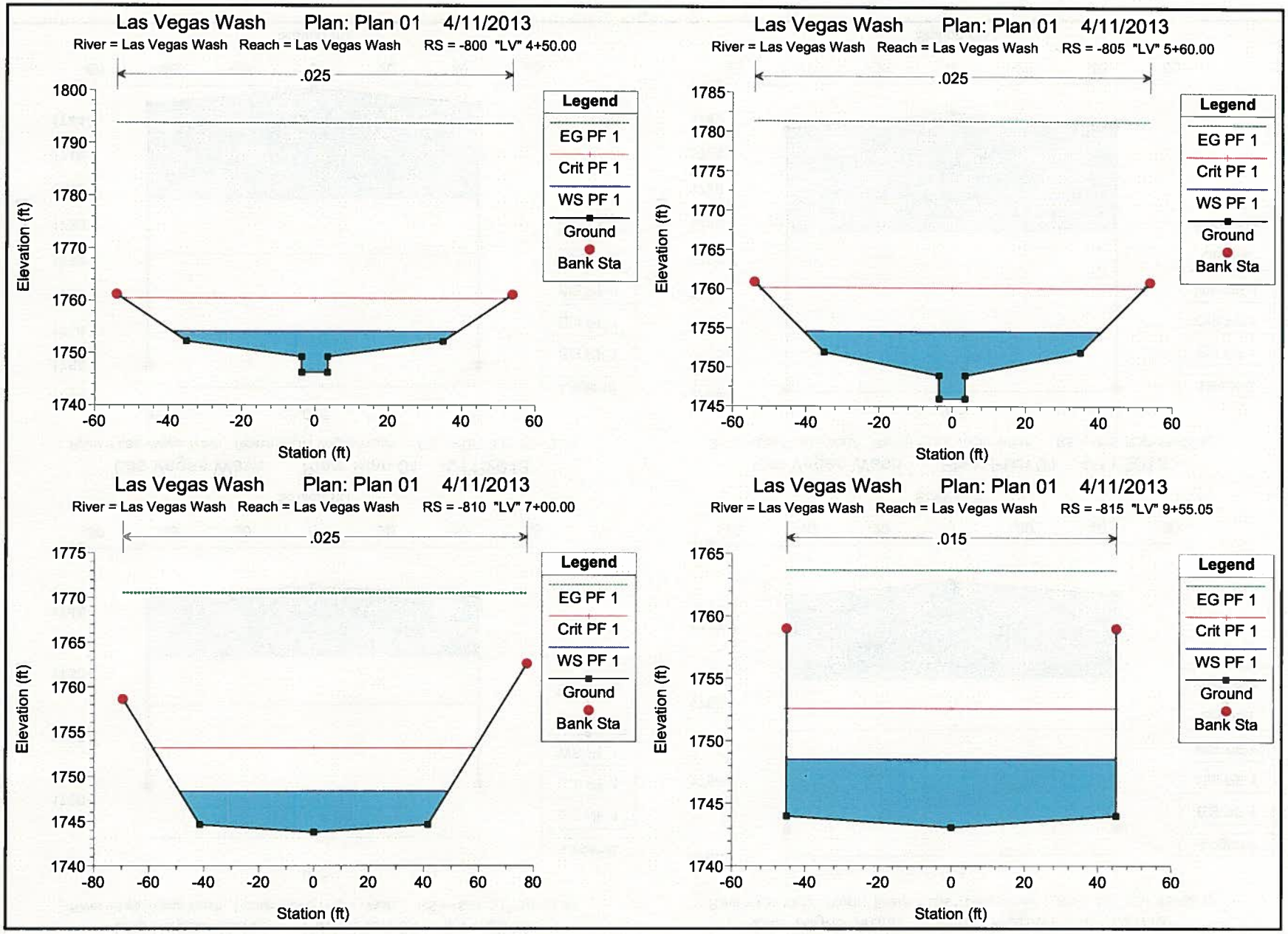
Technical Notebook

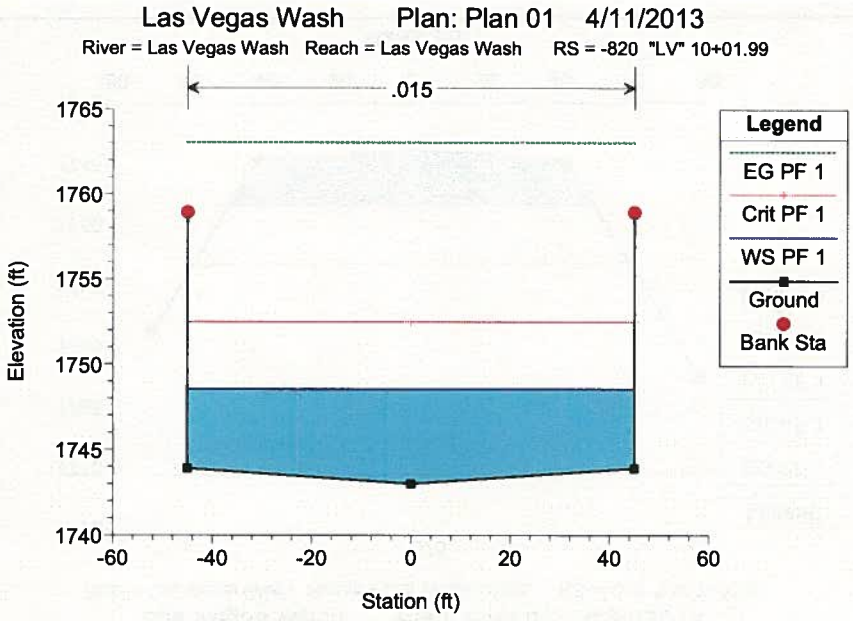
30% Submittal

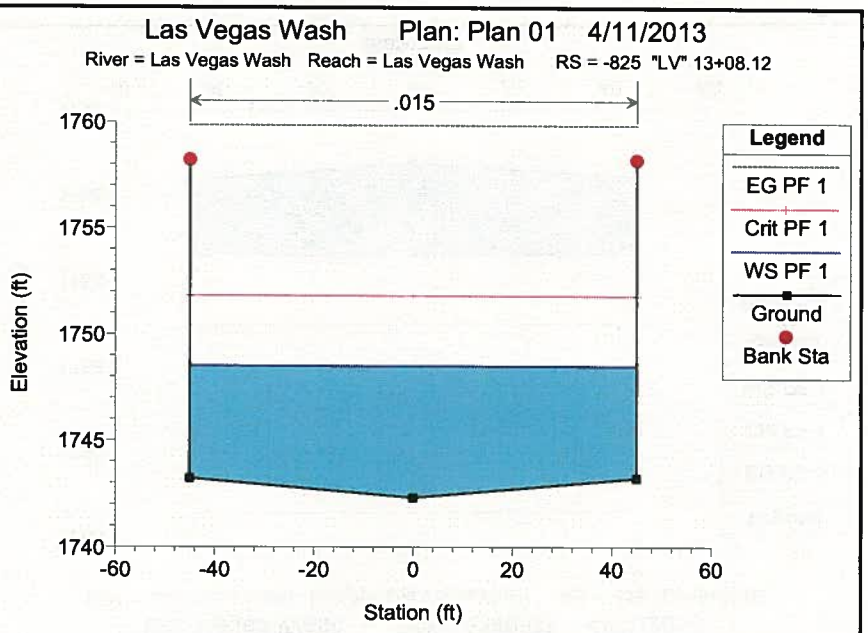
Appendix B-1.3

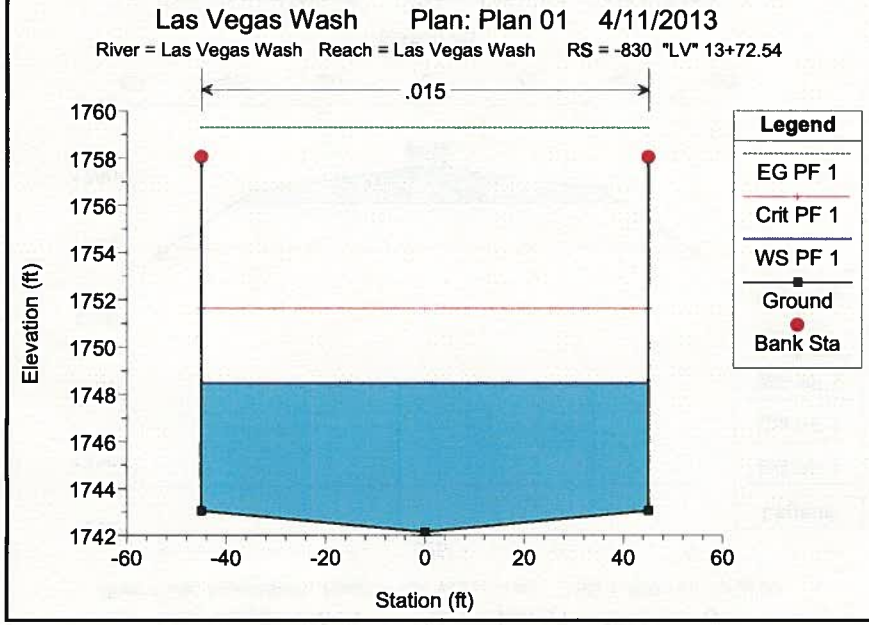
HEC-RAS PROPOPOSED CONDITION PROFILE AND CROSS SECTIONS

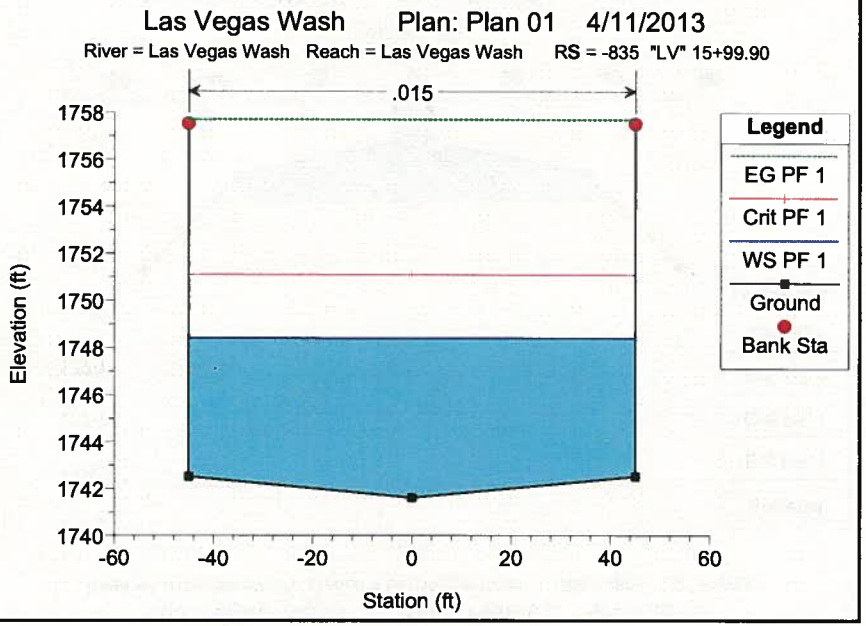

Las Vegas Wash Plan: Plan 01 4/11/2013
Las Vegas Wash Las Vegas Wash
Las Vegas Wash Las Vegas Wash-2
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Left Levee
Right Levee
Elevation (ft)
1800
1780
1760
1740
1720
1700
1680
-15000
-10000
-5000
0
5000
10000
Main Channel Distance (ft)

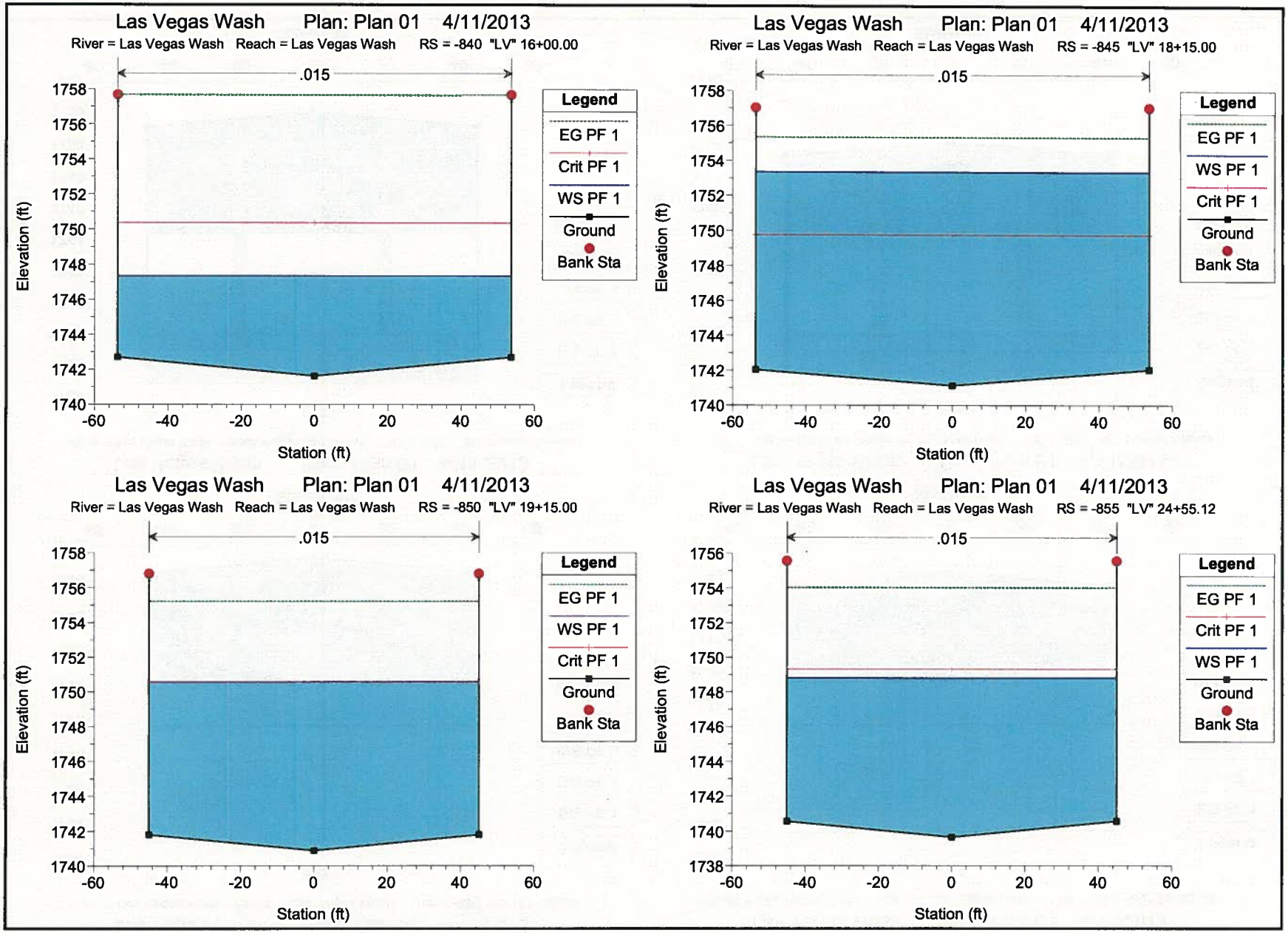

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -800 "LV" 4+50.00
.025
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -805 "LV" 5+60.00
.025
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -810 "LV" 7+00.00
.025
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -815 "LV" 9+55.05
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

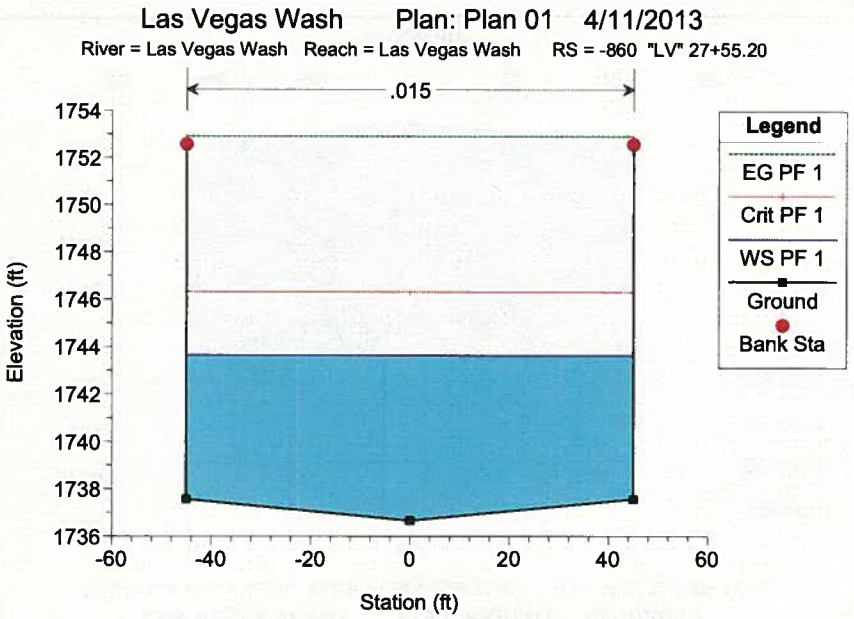

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -820 "LV" 10+01.99
.015
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

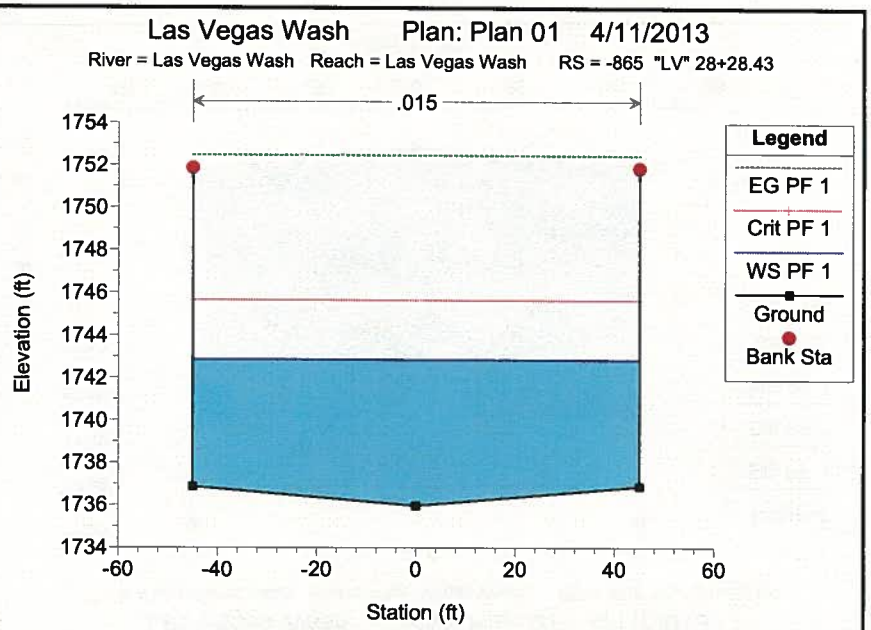

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -825 "LV" 13+08.12
.015
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

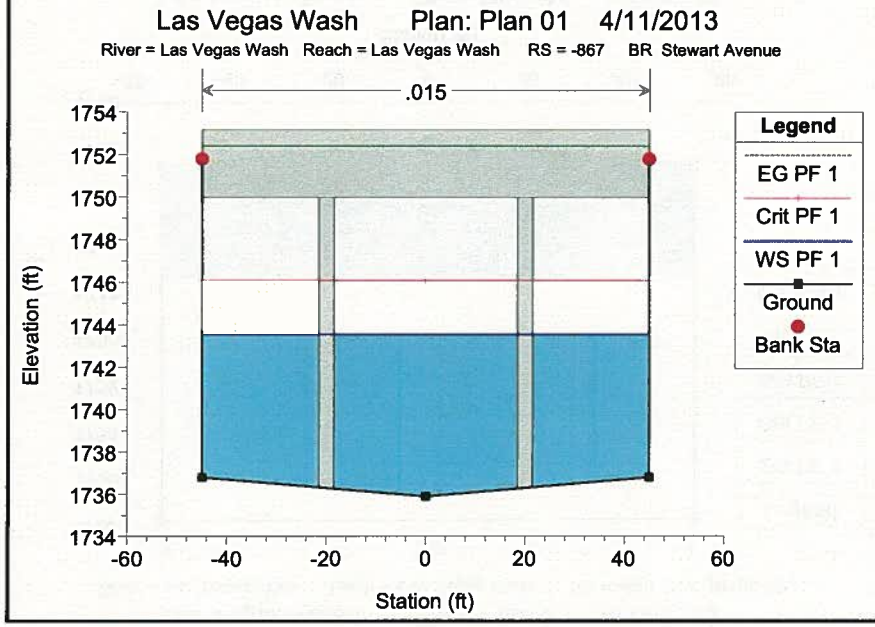

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -830 "LV" 13+72.54
.015
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

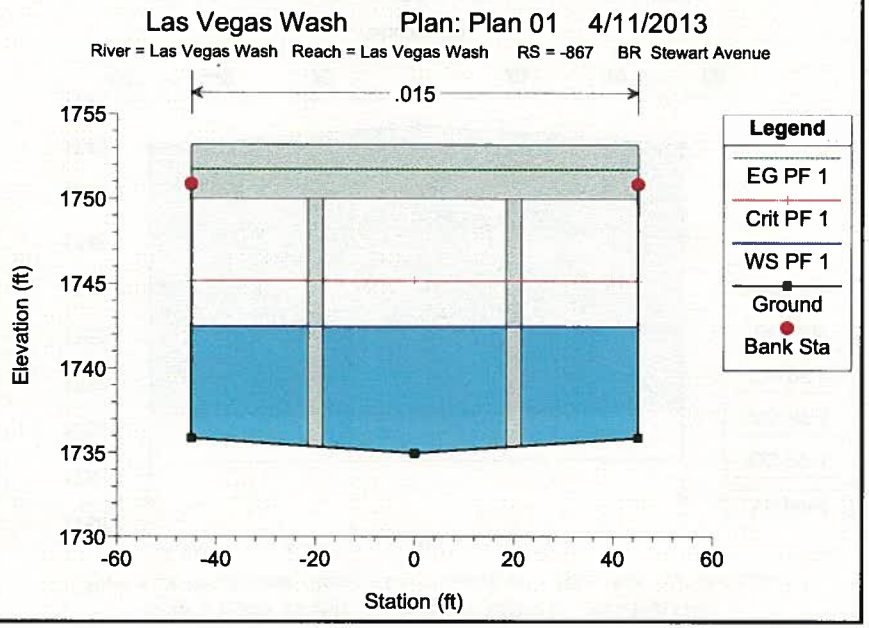

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -835 "LV" 15+99.90
.015
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

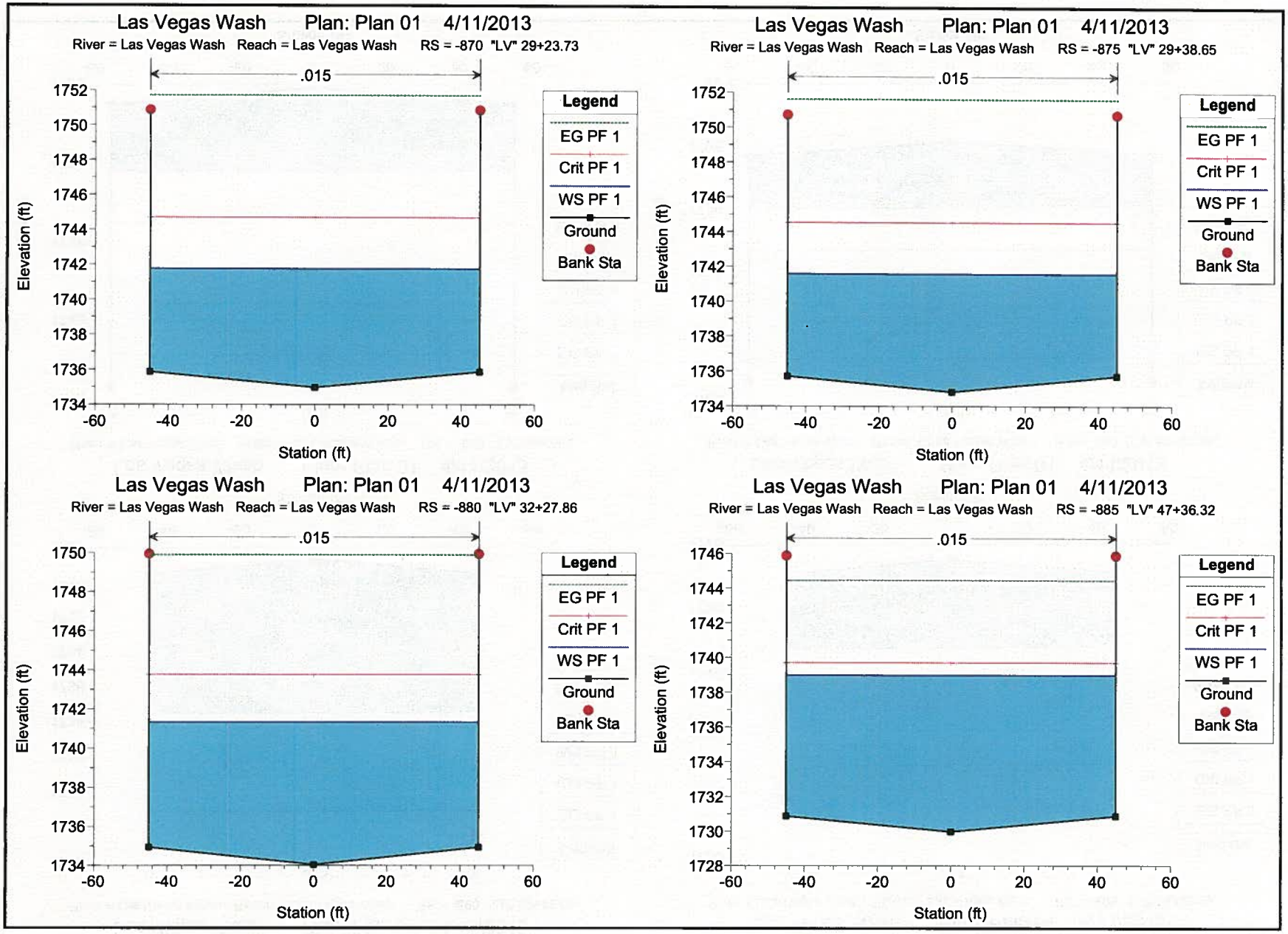

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -840 "LV" 16+00.00
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -845 "LV" 18+15.00
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -850 "LV" 19+15.00
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -855 "LV" 24+55.12
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

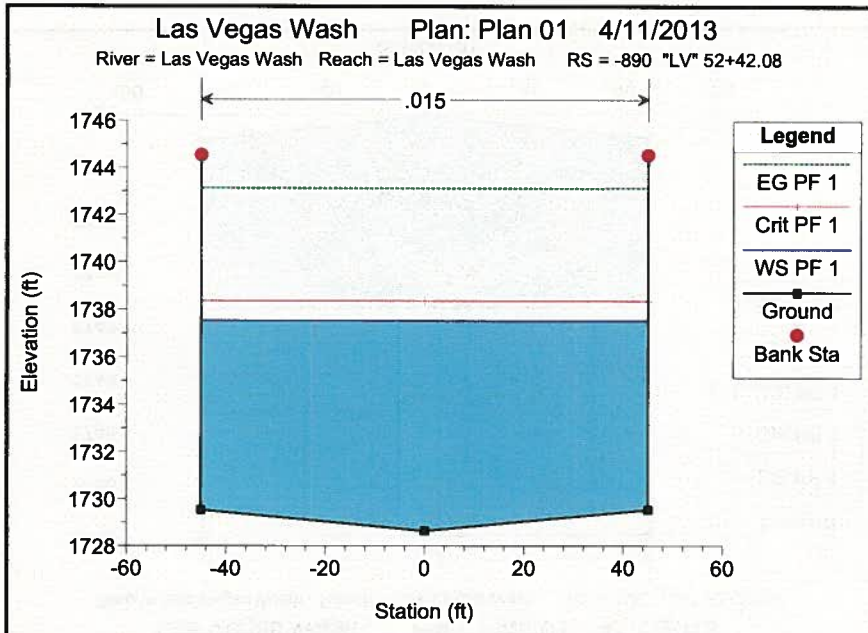

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -860 "LV" 27+55.20
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

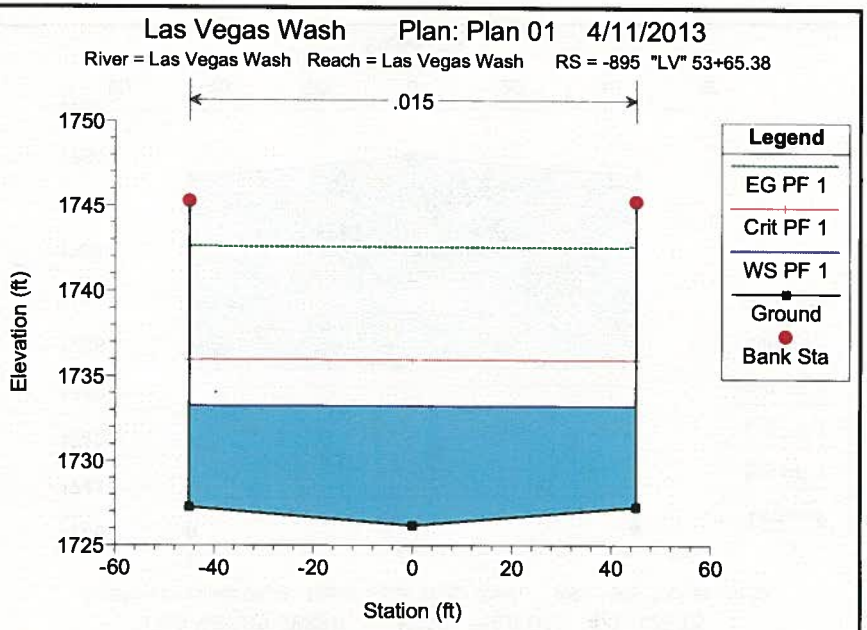

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -865 "LV" 28+28.43
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

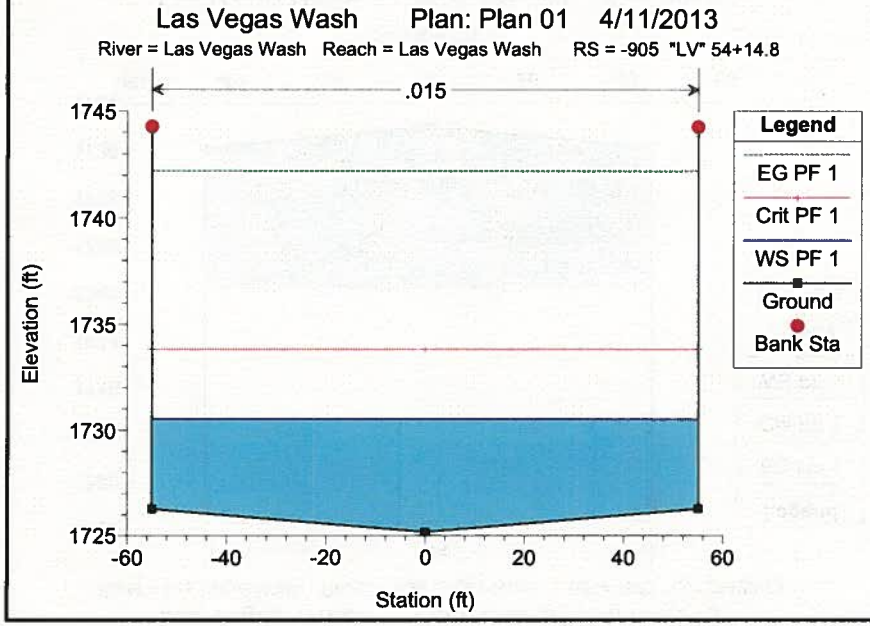

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -867 BR Stewart Avenue
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

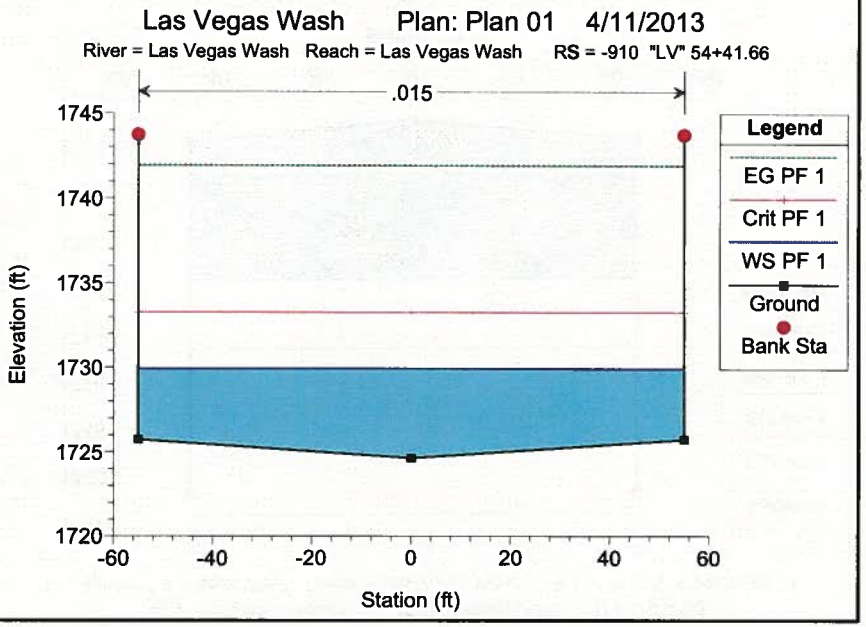

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -867 BR Stewart Avenue
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

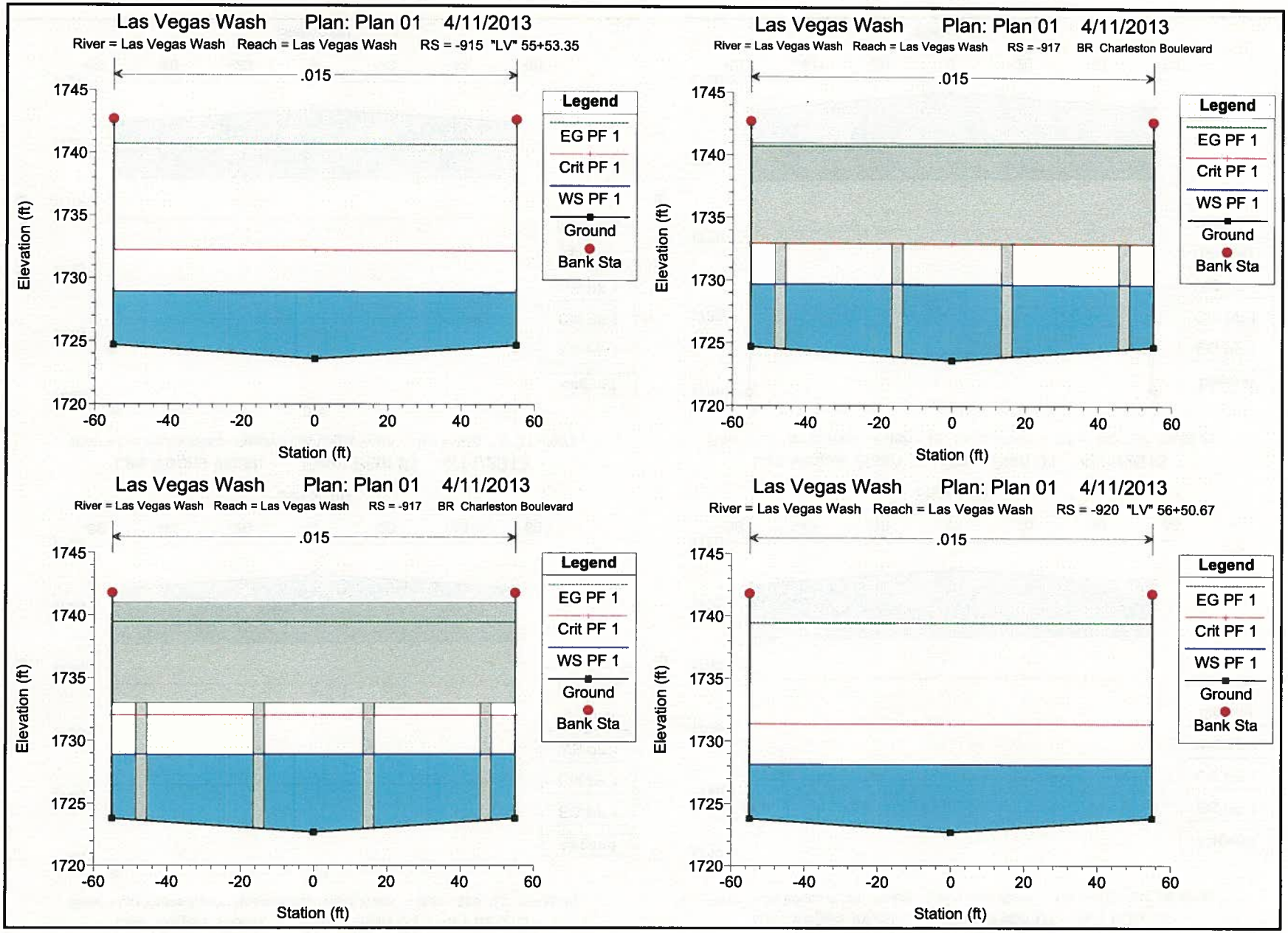

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -870 "LV" 29+23.73
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -875 "LV" 29+38.65
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -880 "LV" 32+27.86
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -885 "LV" 47+36.32
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

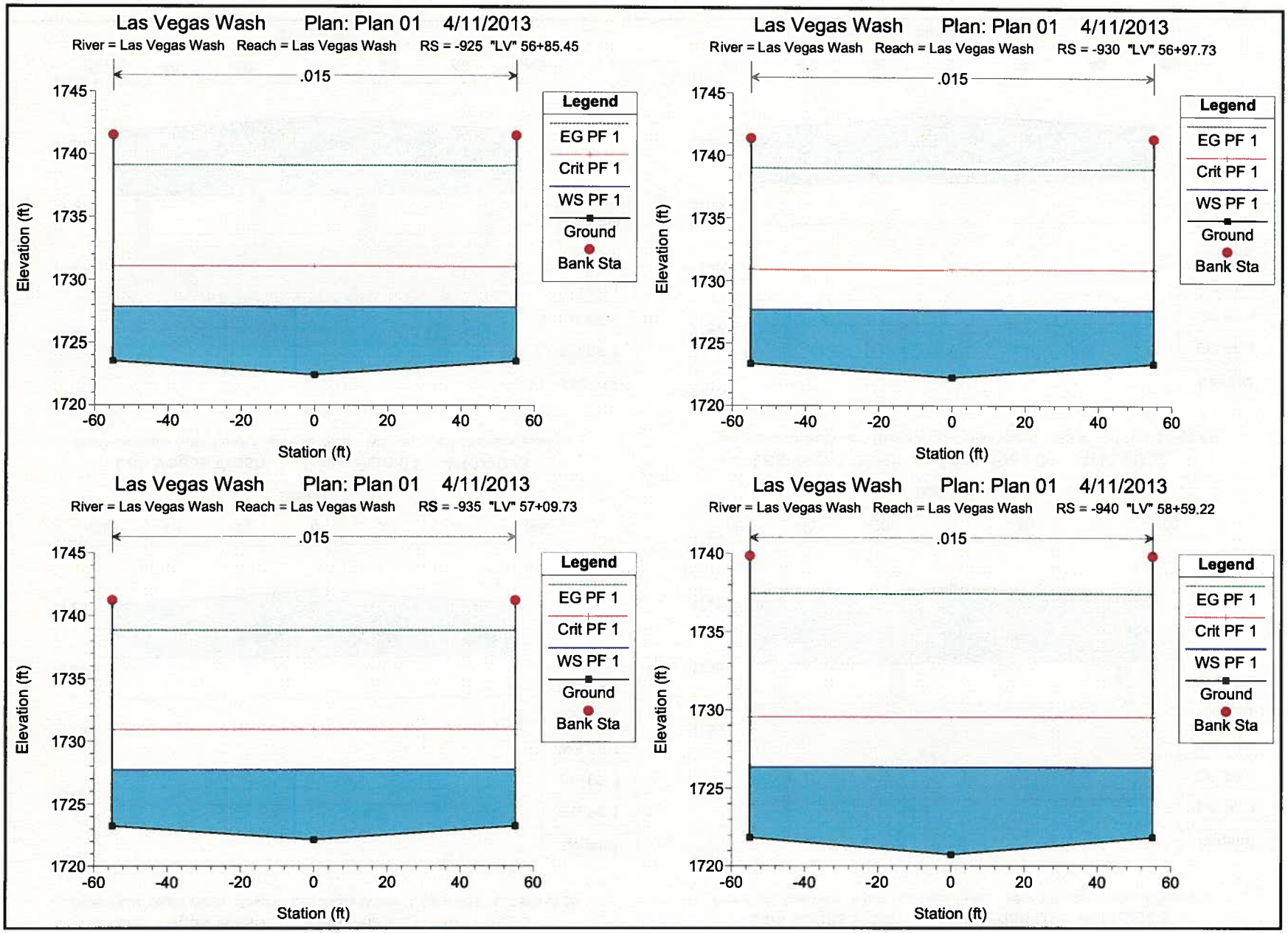

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -890 "LV" 52+42.08
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

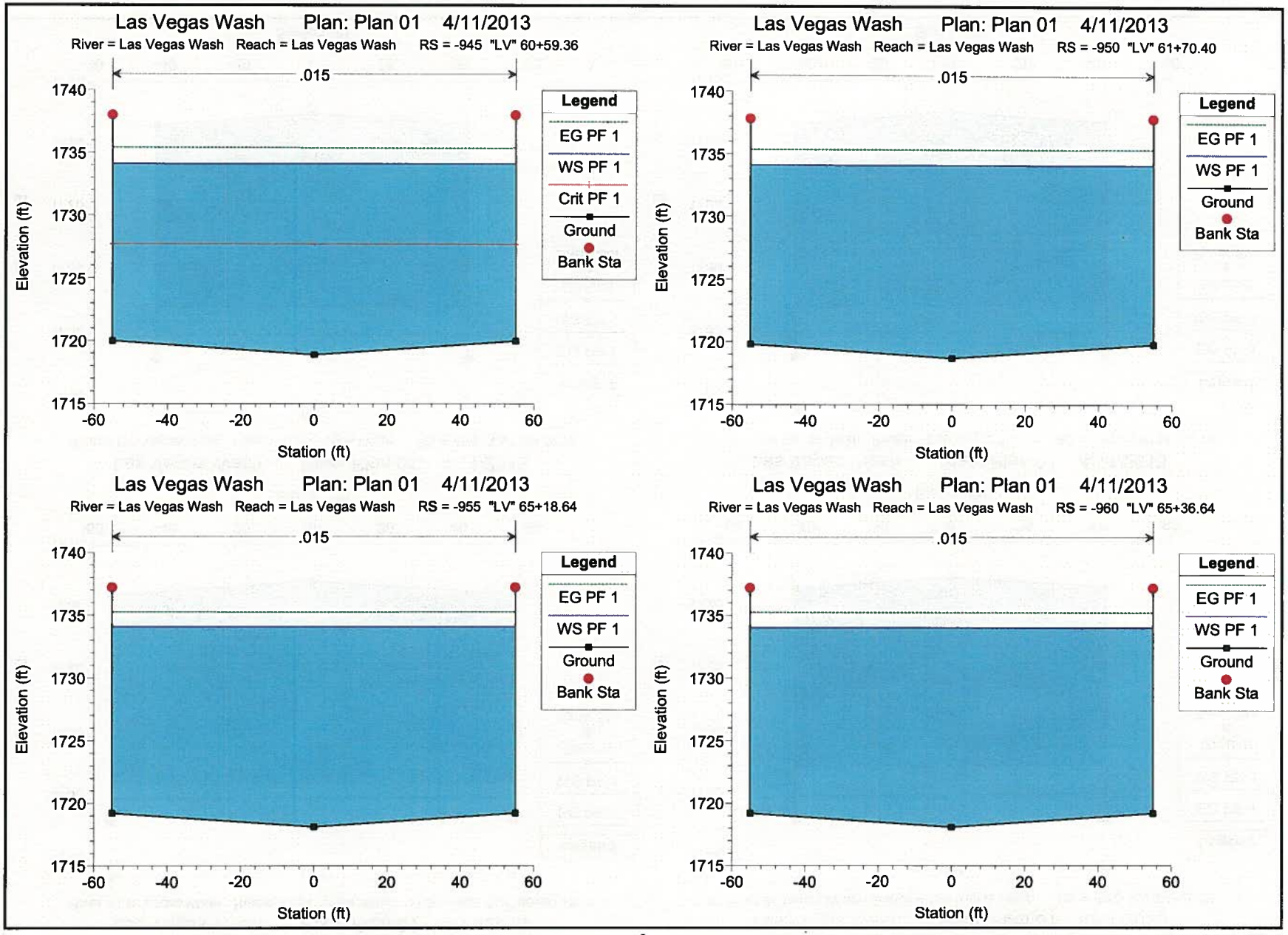

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -895 "LV" 53+65.38
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

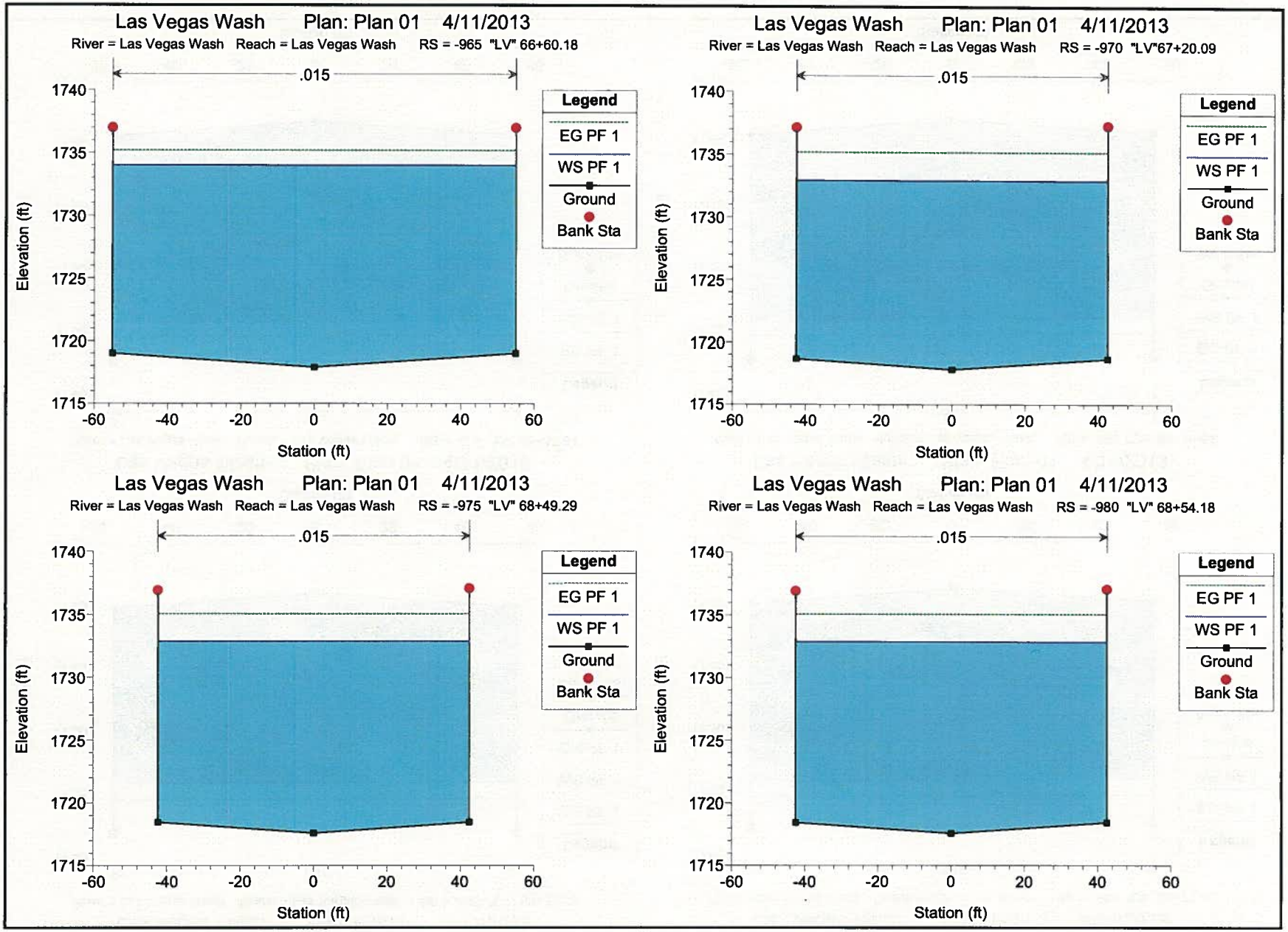

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -905 "LV" 54+14.8
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

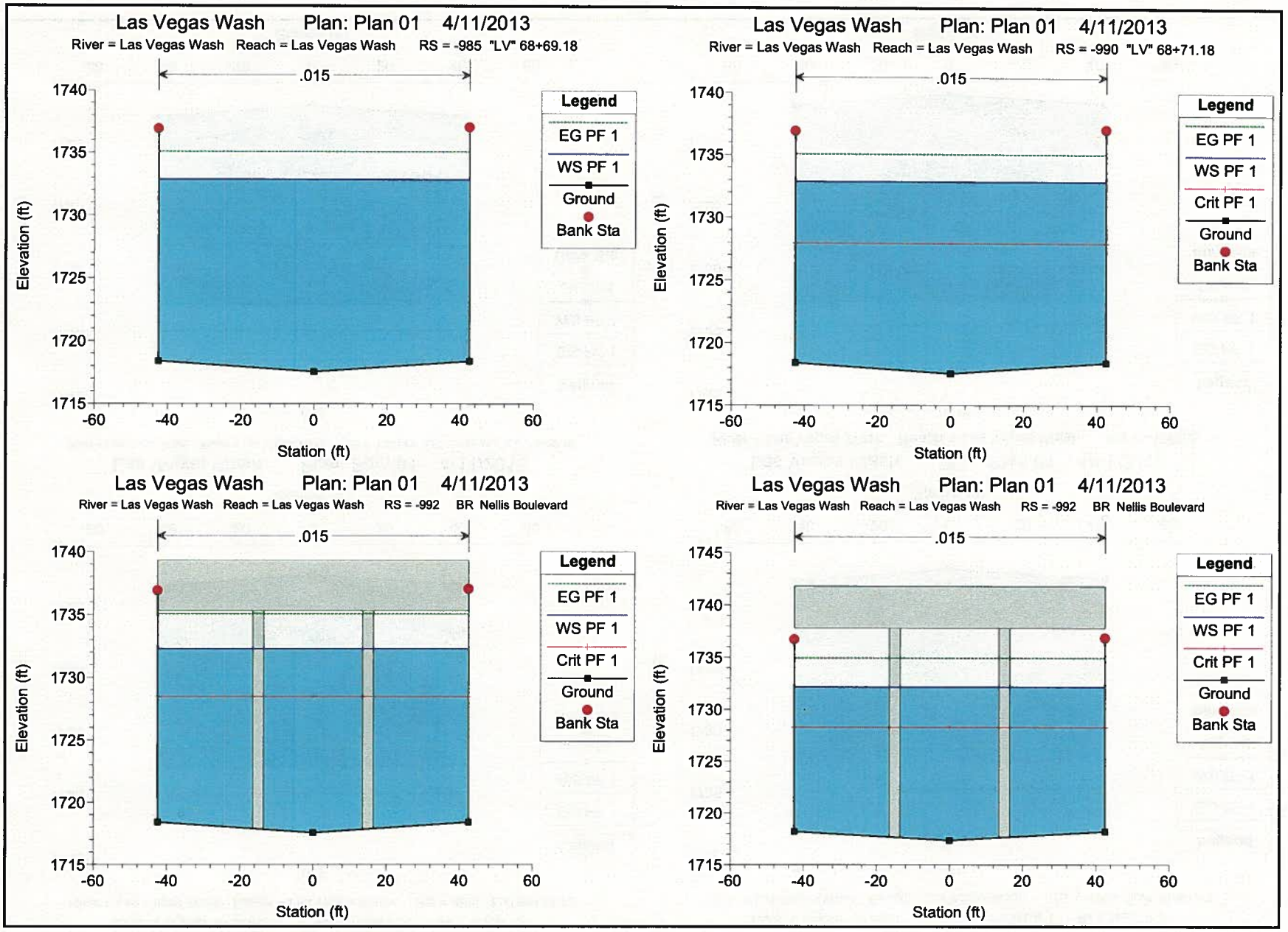

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -910 "LV" 54+41.66
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

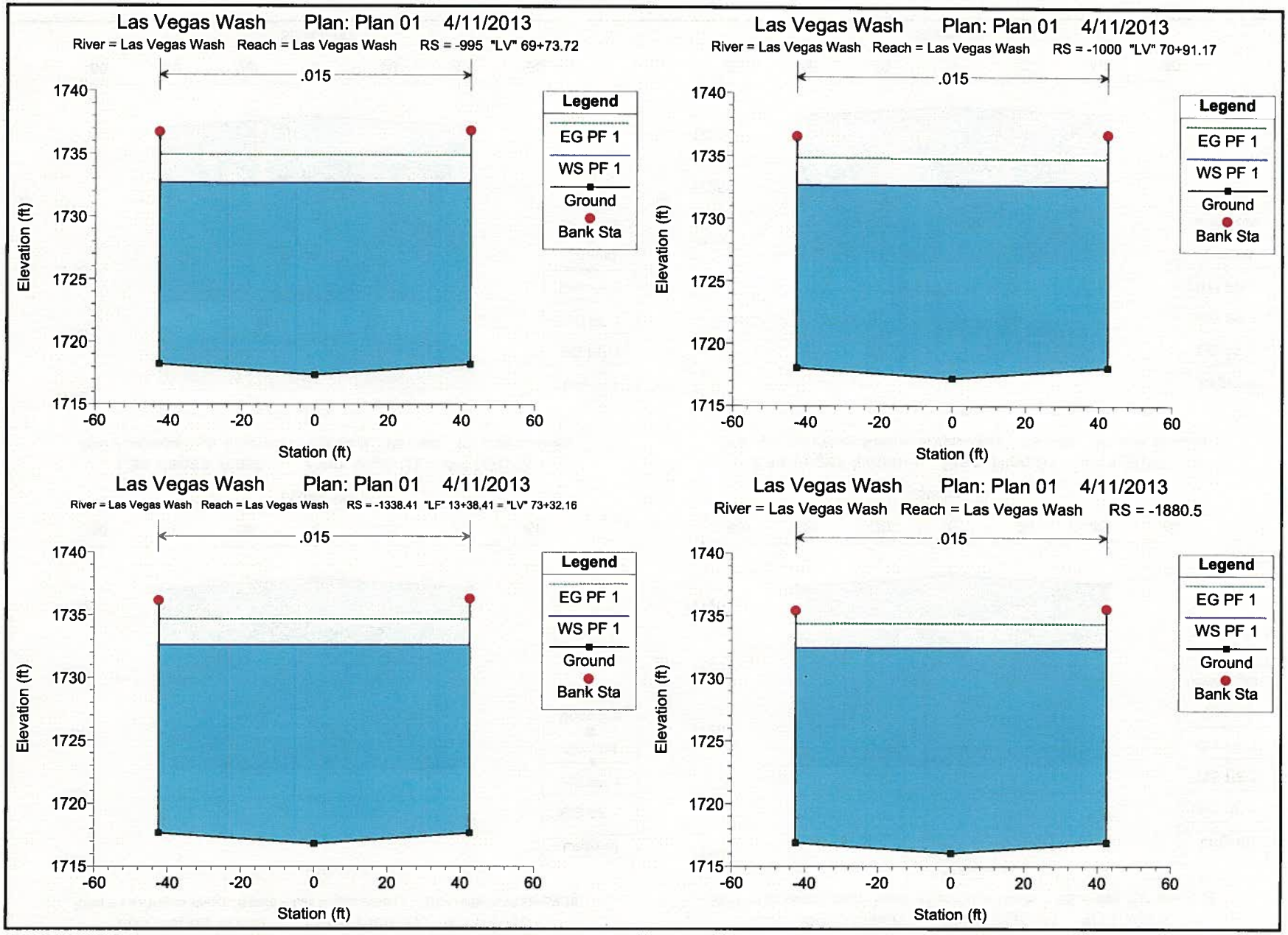

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -915 "LV" 55+53.35
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -917 BR Charleston Boulevard
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -917 BR Charleston Boulevard
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -920 "LV" 56+50.67
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

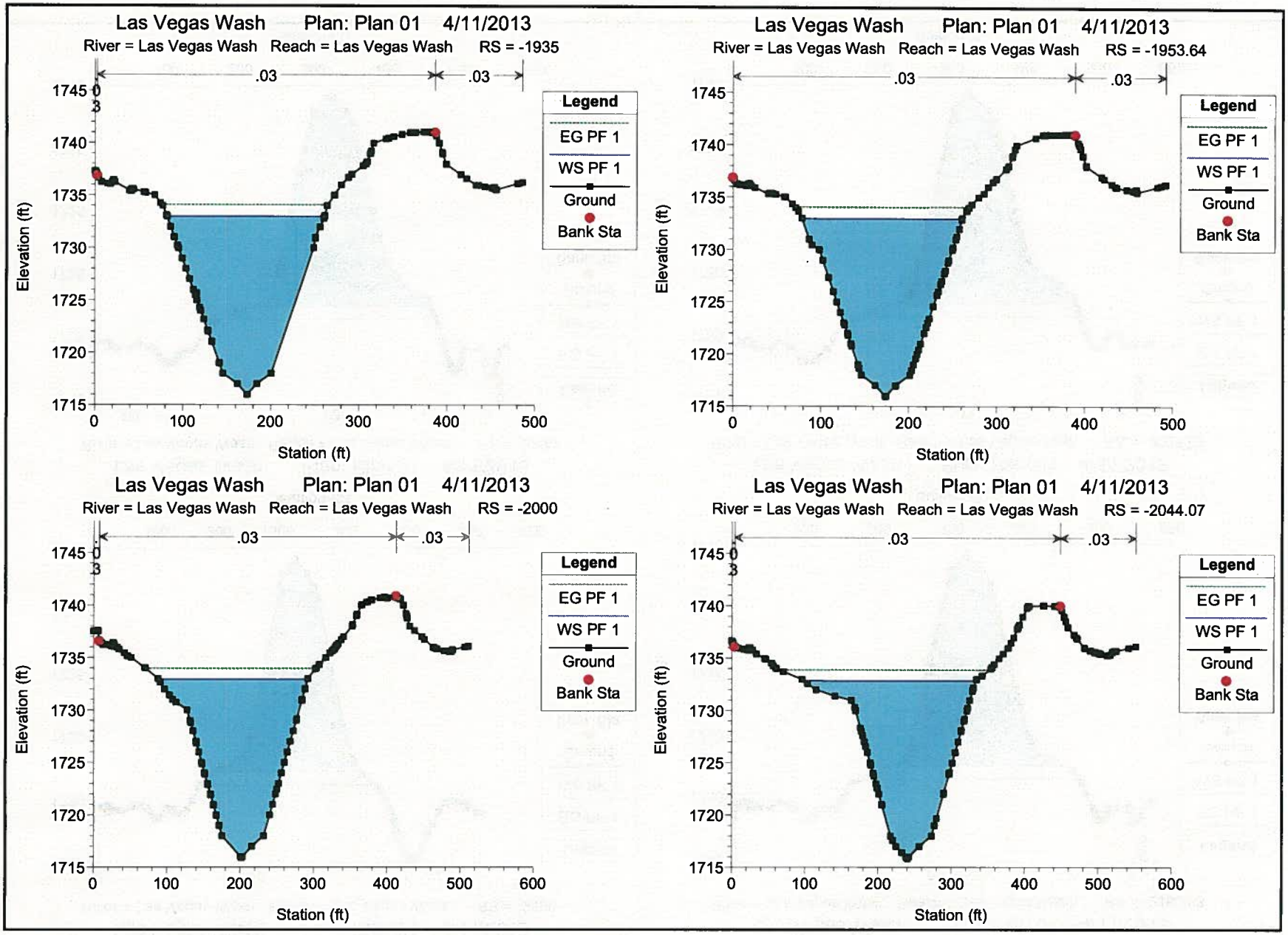

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -925 "LV" 56+85.45
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -930 "LV" 56+97.73
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -935 "LV" 57+09.73
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -940 "LV" 58+59.22
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

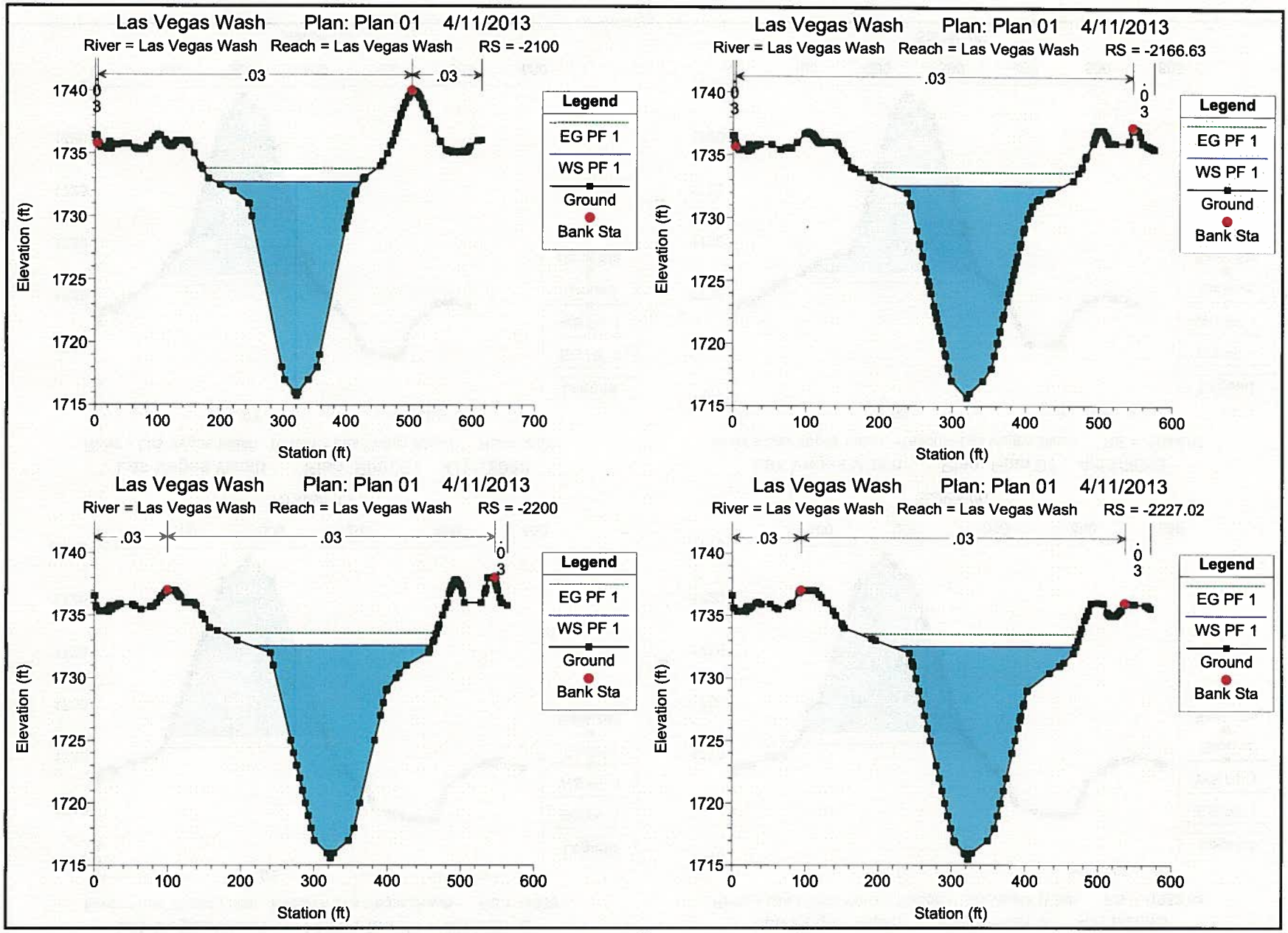

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -945 "LV" 60+59.36
.015
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -950 "LV" 61+70.40
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -955 "LV" 65+18.64
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -960 "LV" 65+36.64
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

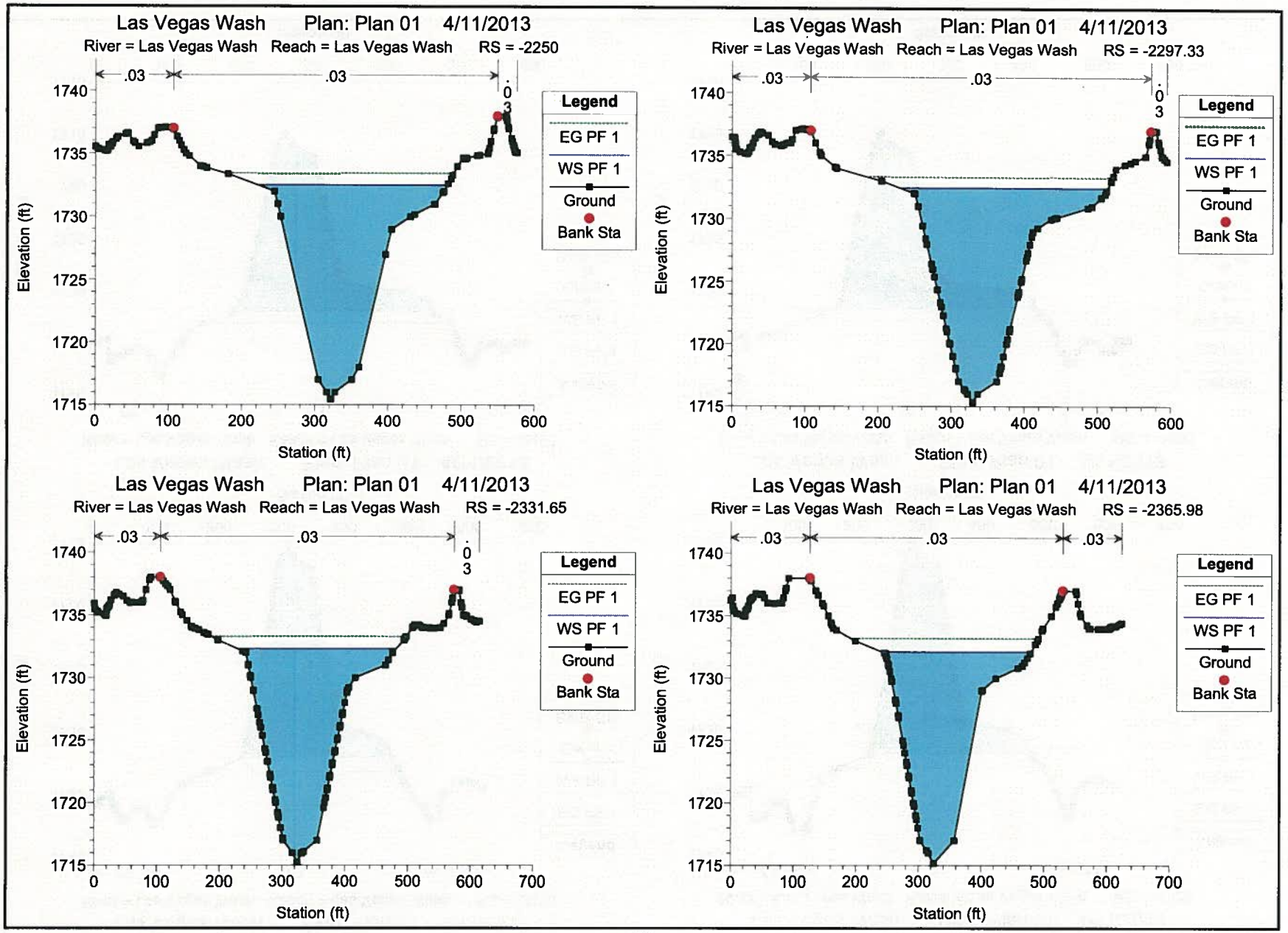

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -965 "LV" 66+60.18
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -970 "LV"67+20.09
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -975 "LV" 68+49.29
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -980 "LV" 68+54.18
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

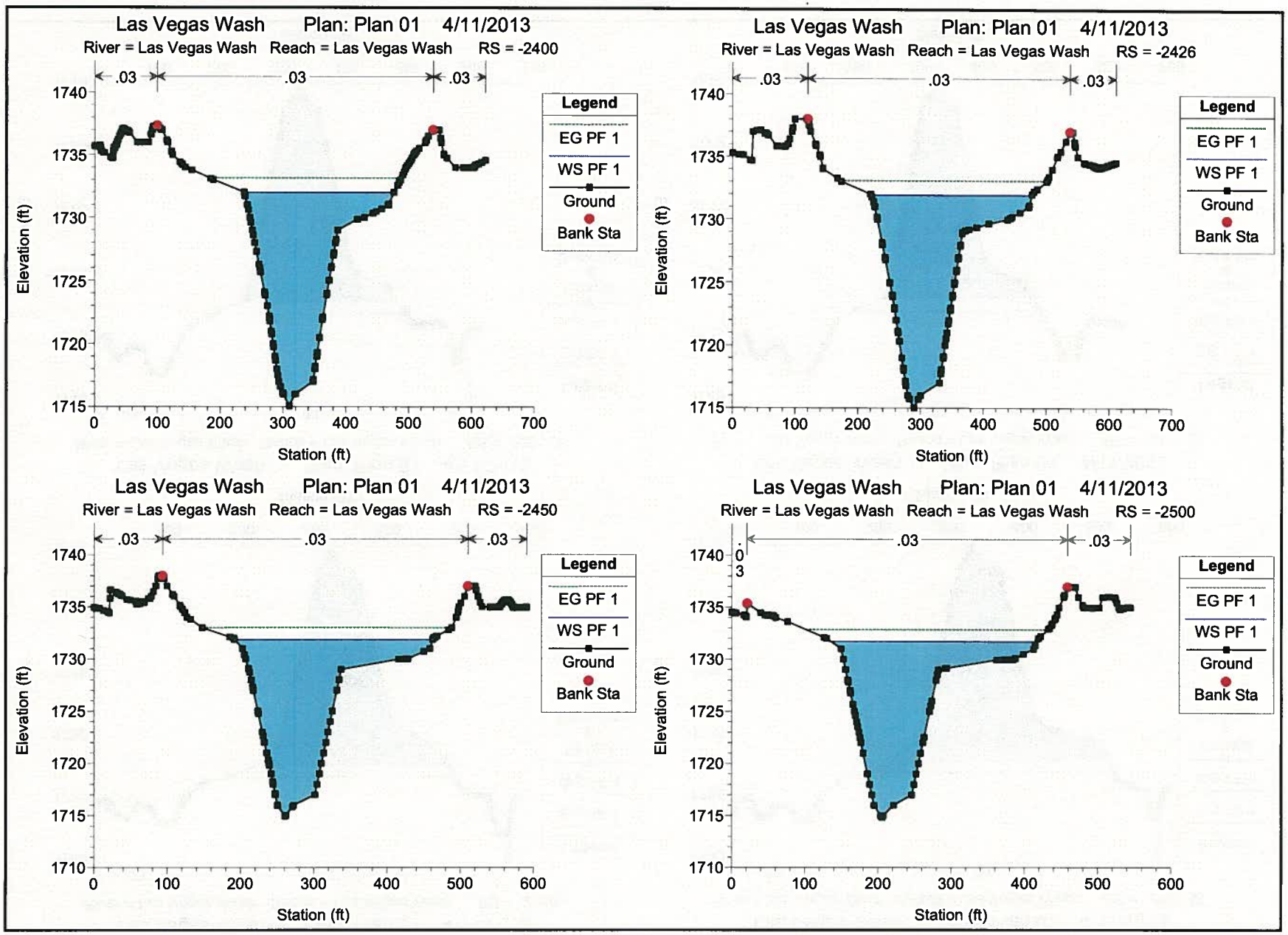

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -985 "LV" 68+69.18
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -990 "LV" 68+71.18
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -992 BR Nellis Boulevard
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -992 BR Nellis Boulevard
.015
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta

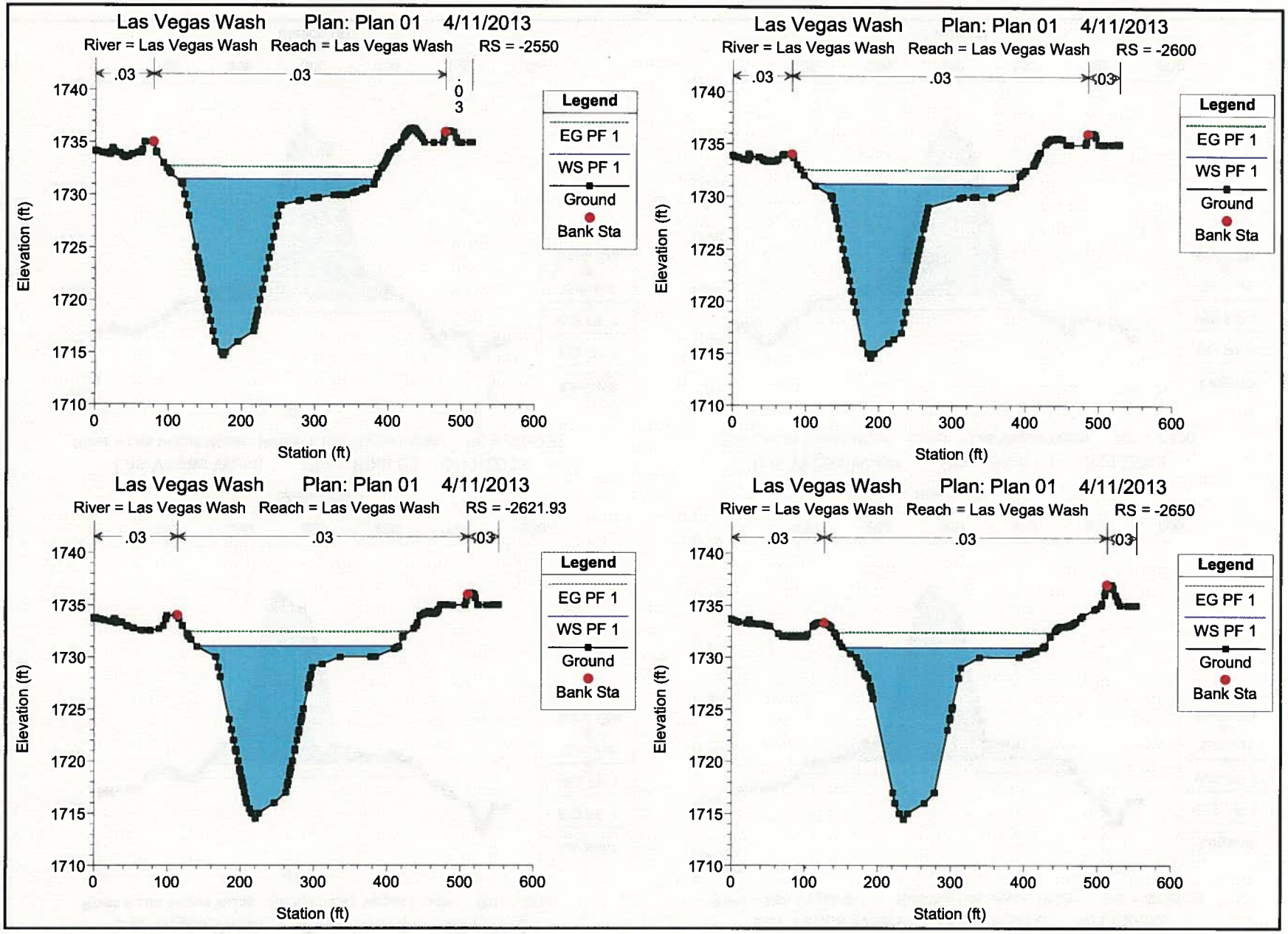

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -995 "LV" 69+73.72
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -1000 "LV" 70+91.17
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -1338.41 "LF" 13+38.41 = "LV" 73+32.16
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -1880.5
.015
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

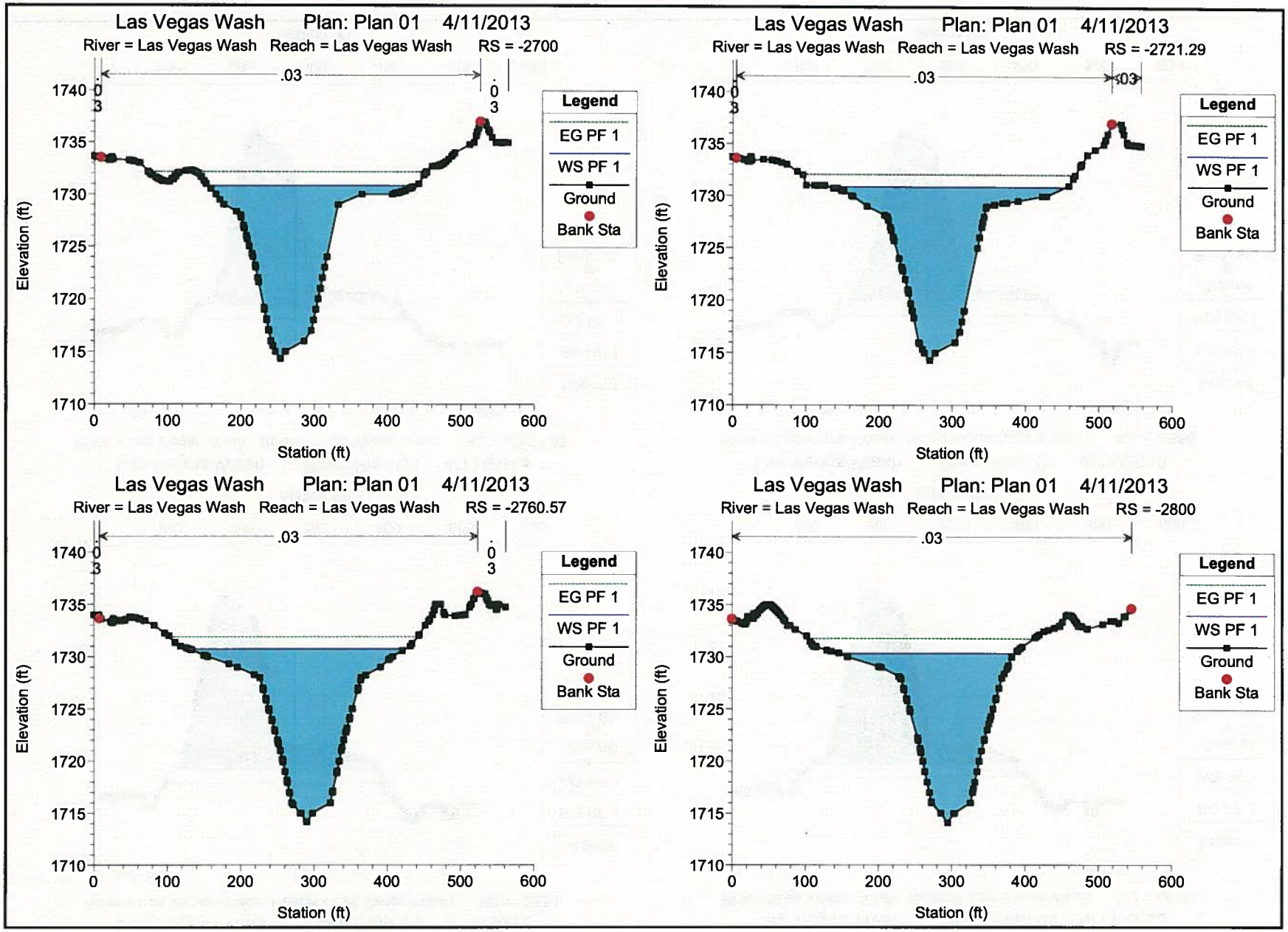

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -1935
.03
.03
0
3
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -1953.64
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2000
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2044.07

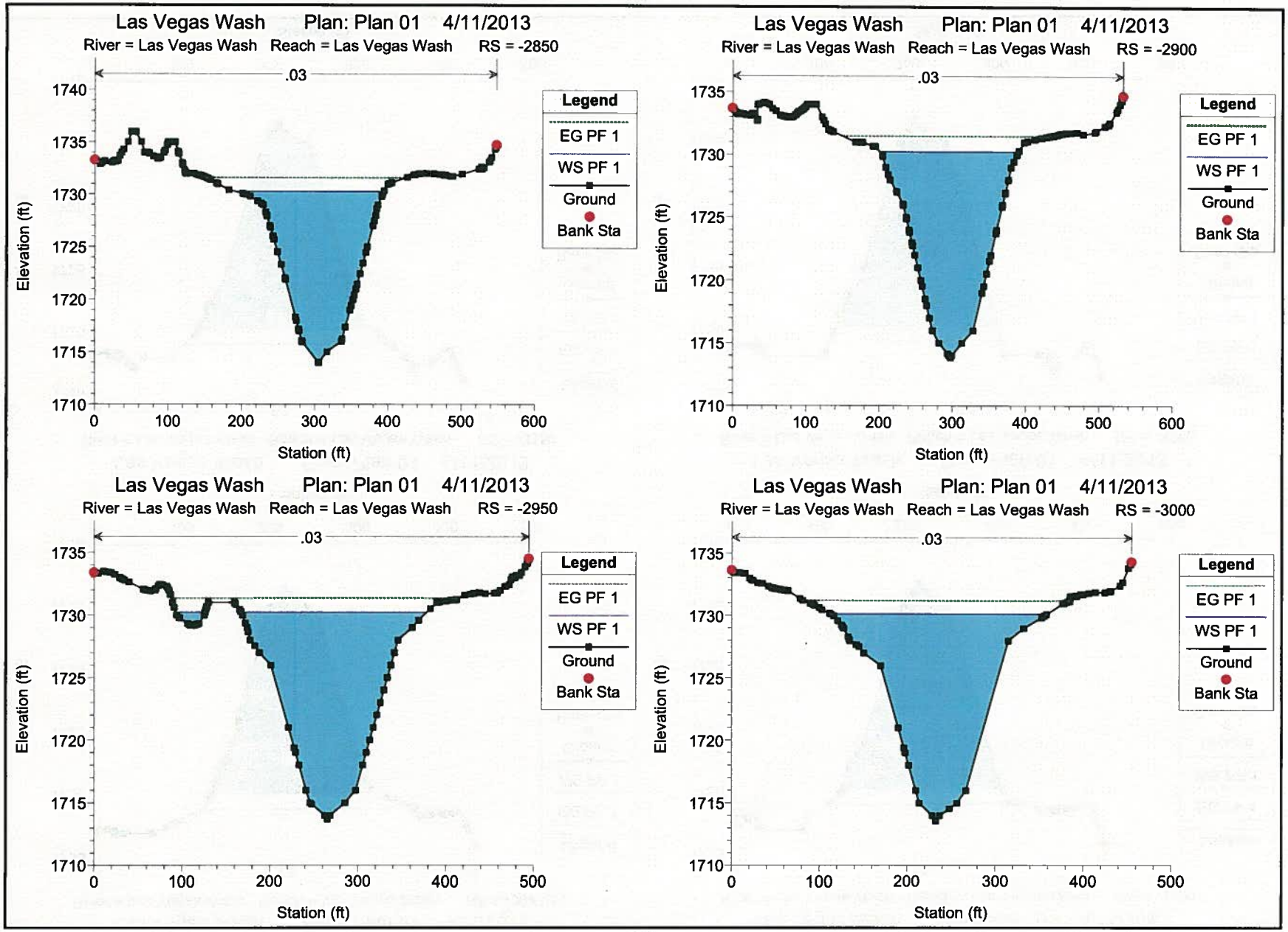

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2100
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2166.63
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2200
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2227.02
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

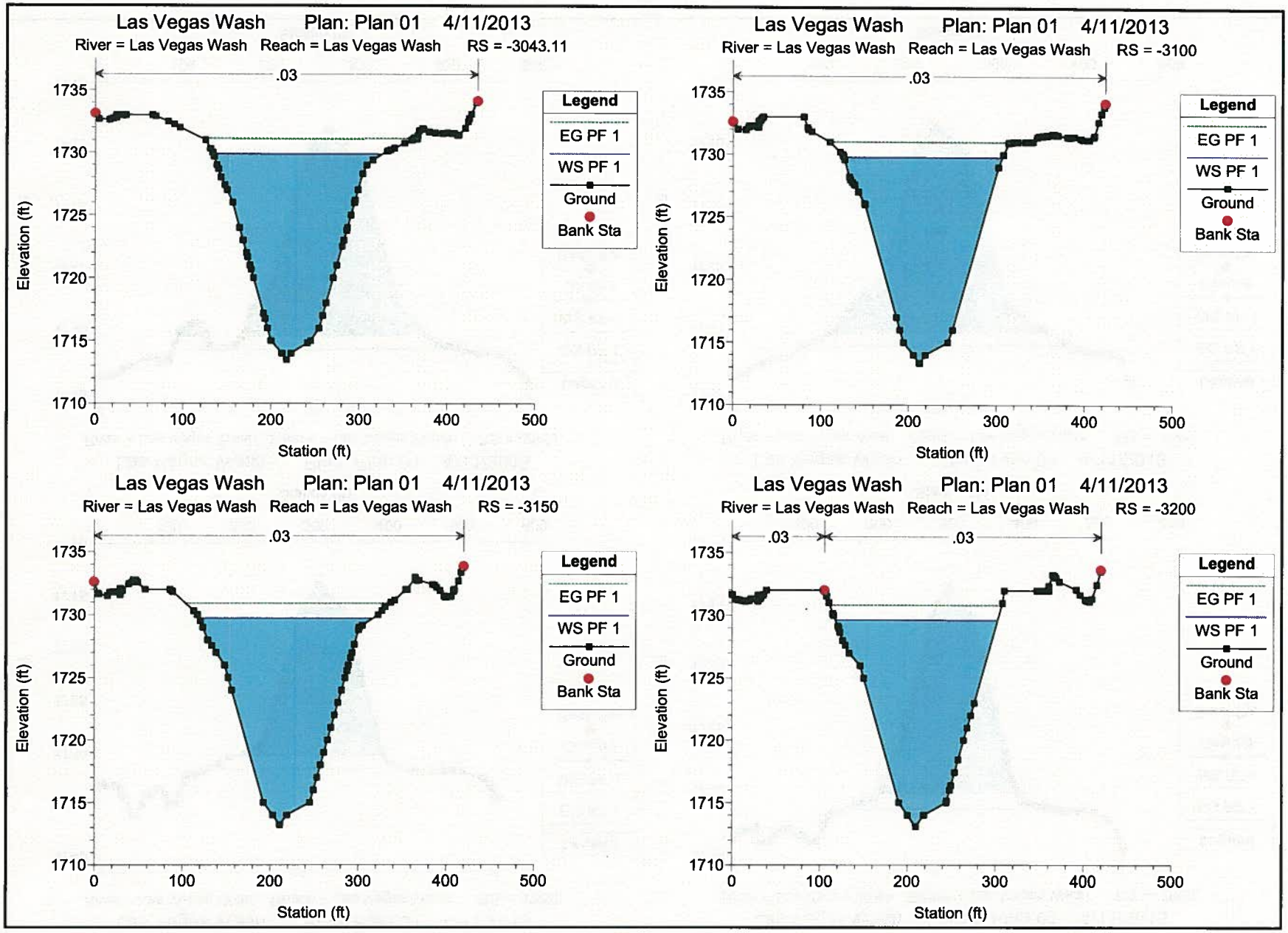

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2250
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2297.33
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2331.65
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2365.98
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

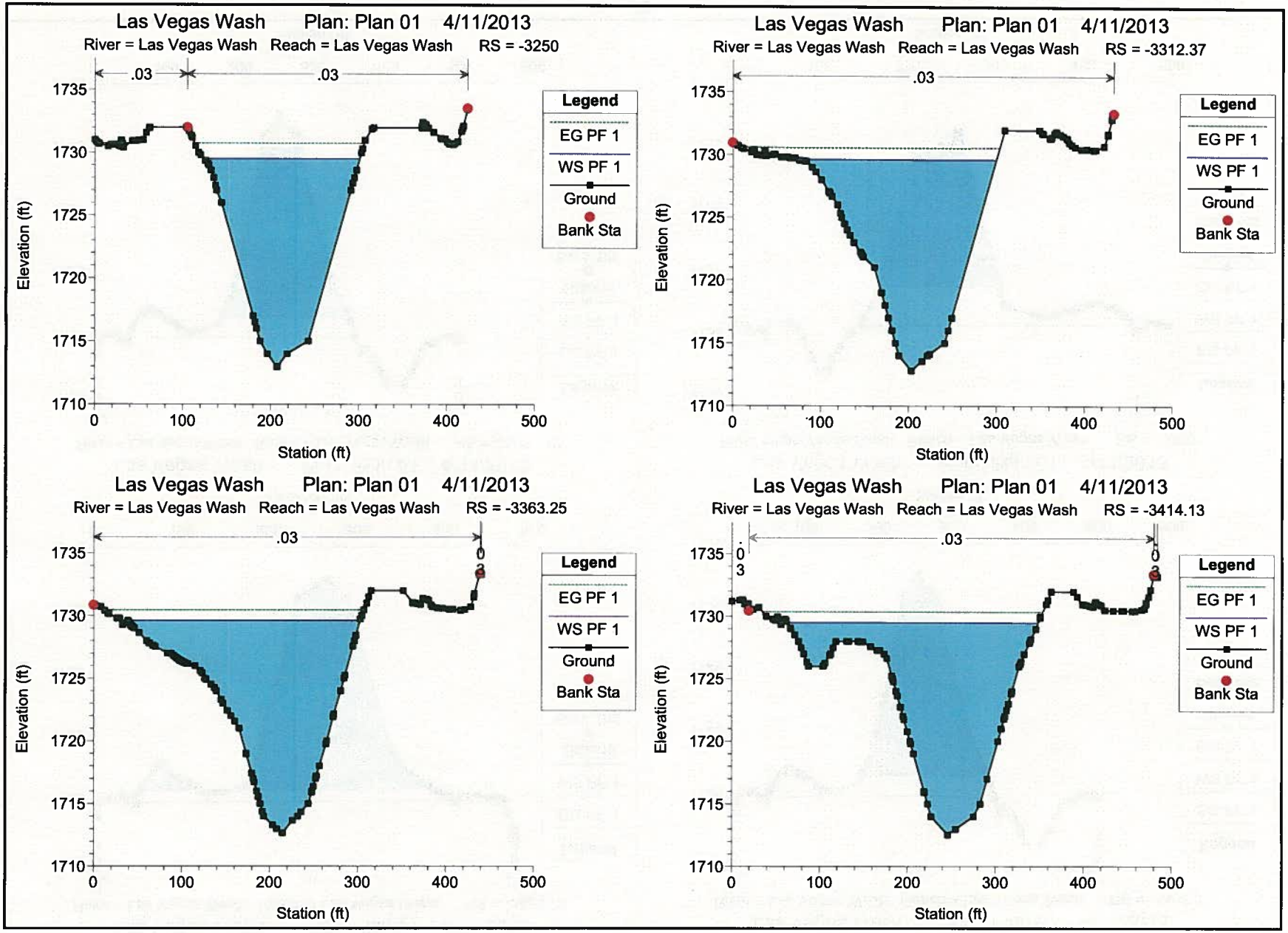

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2400
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2426
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2450
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2500
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

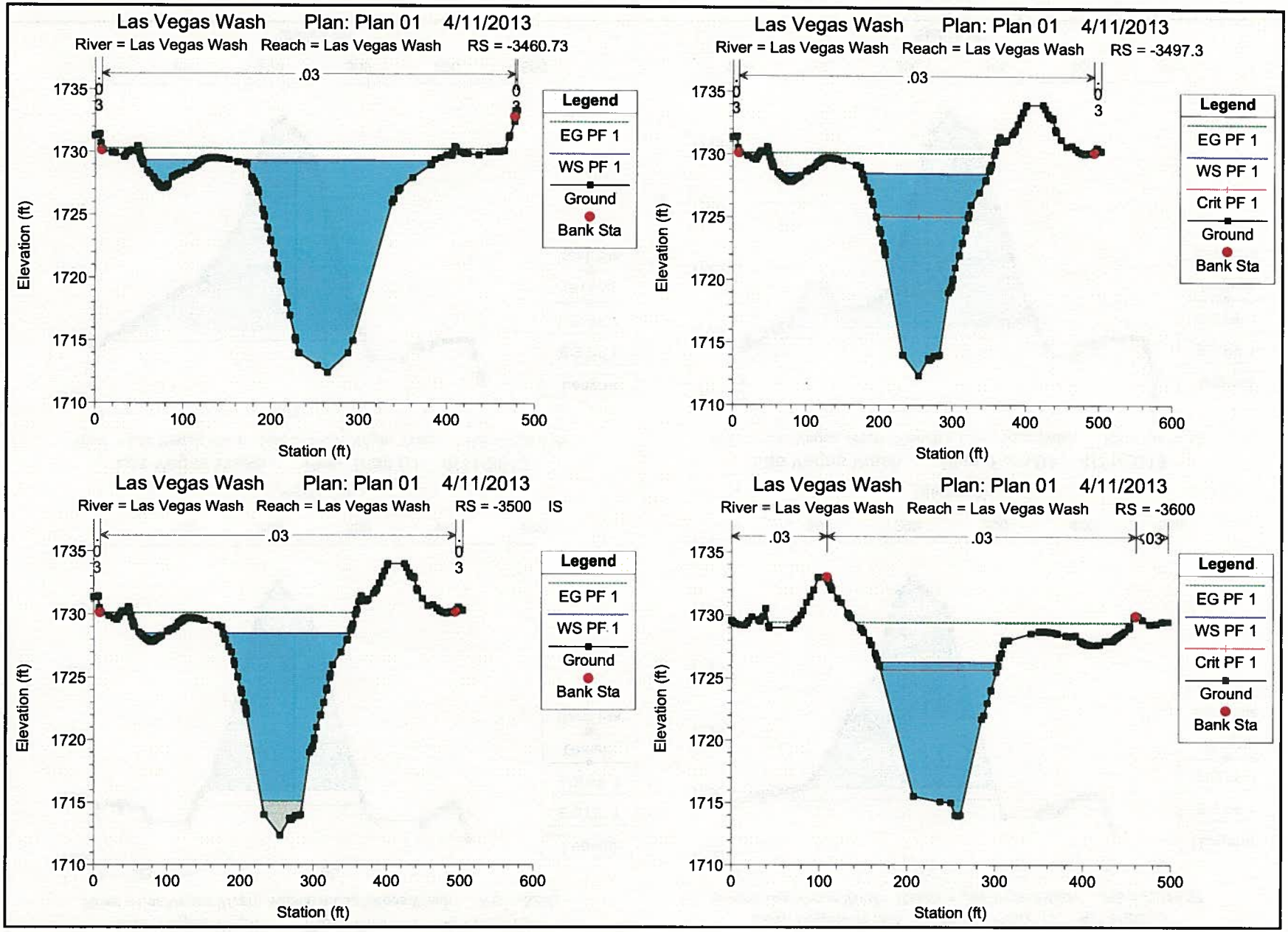

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2550
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2600
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2621.93
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2650
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

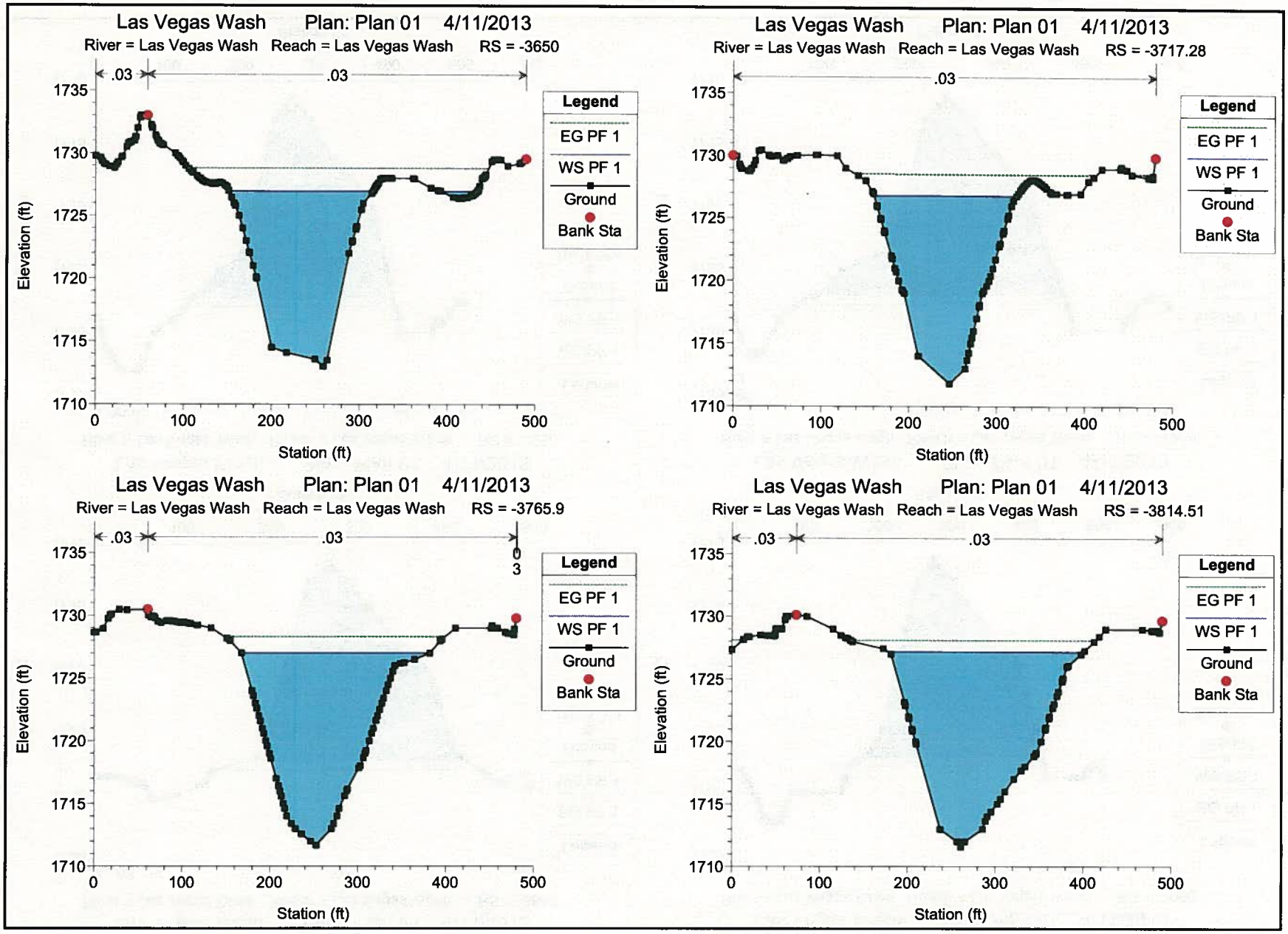

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2700
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1740
1735
1730
1725
1720
1715
1710
0
100
200
300
400
500
600
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2721.29
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2760.57
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2800
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

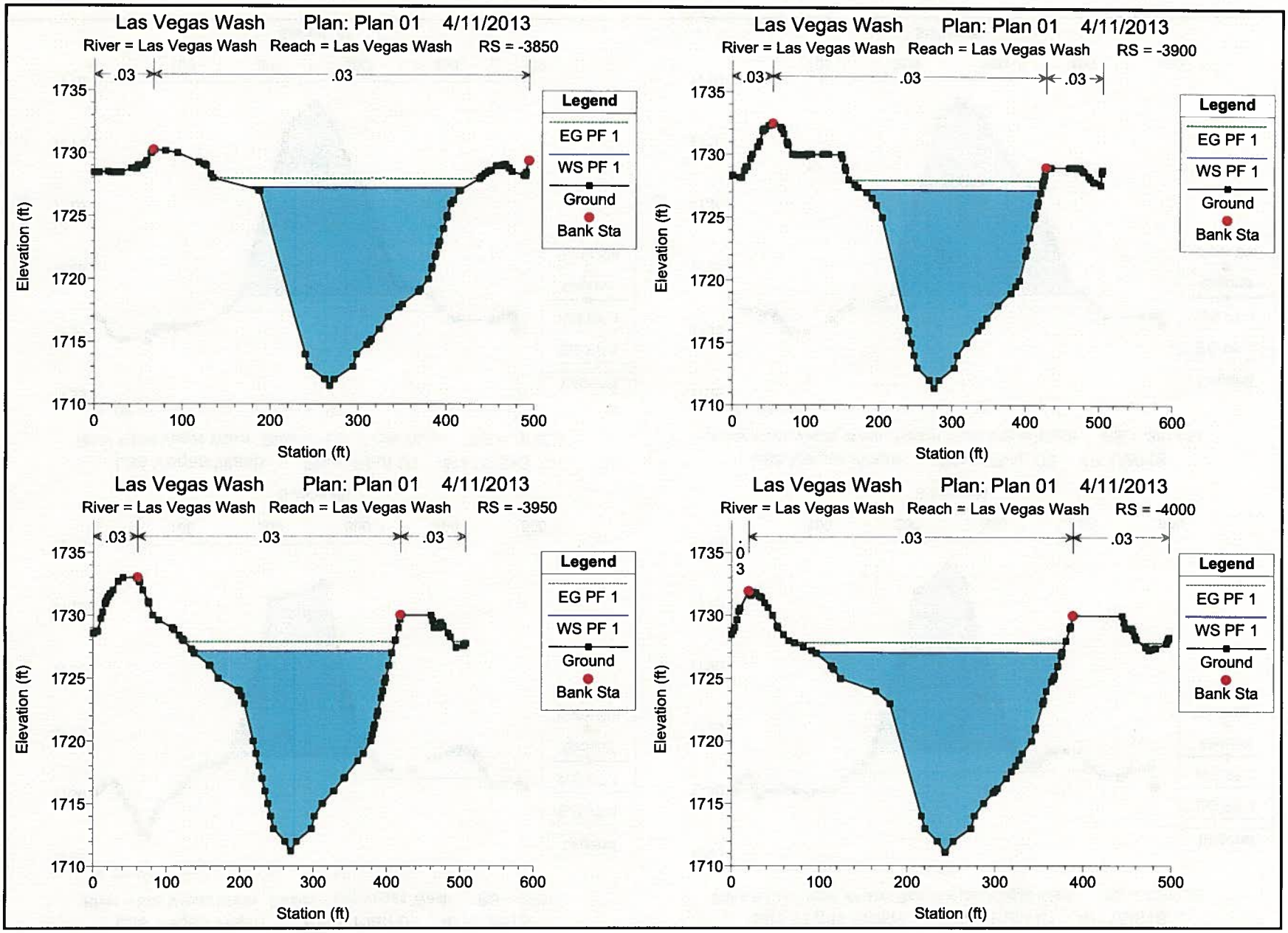

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2850
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2900
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -2950
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3000
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

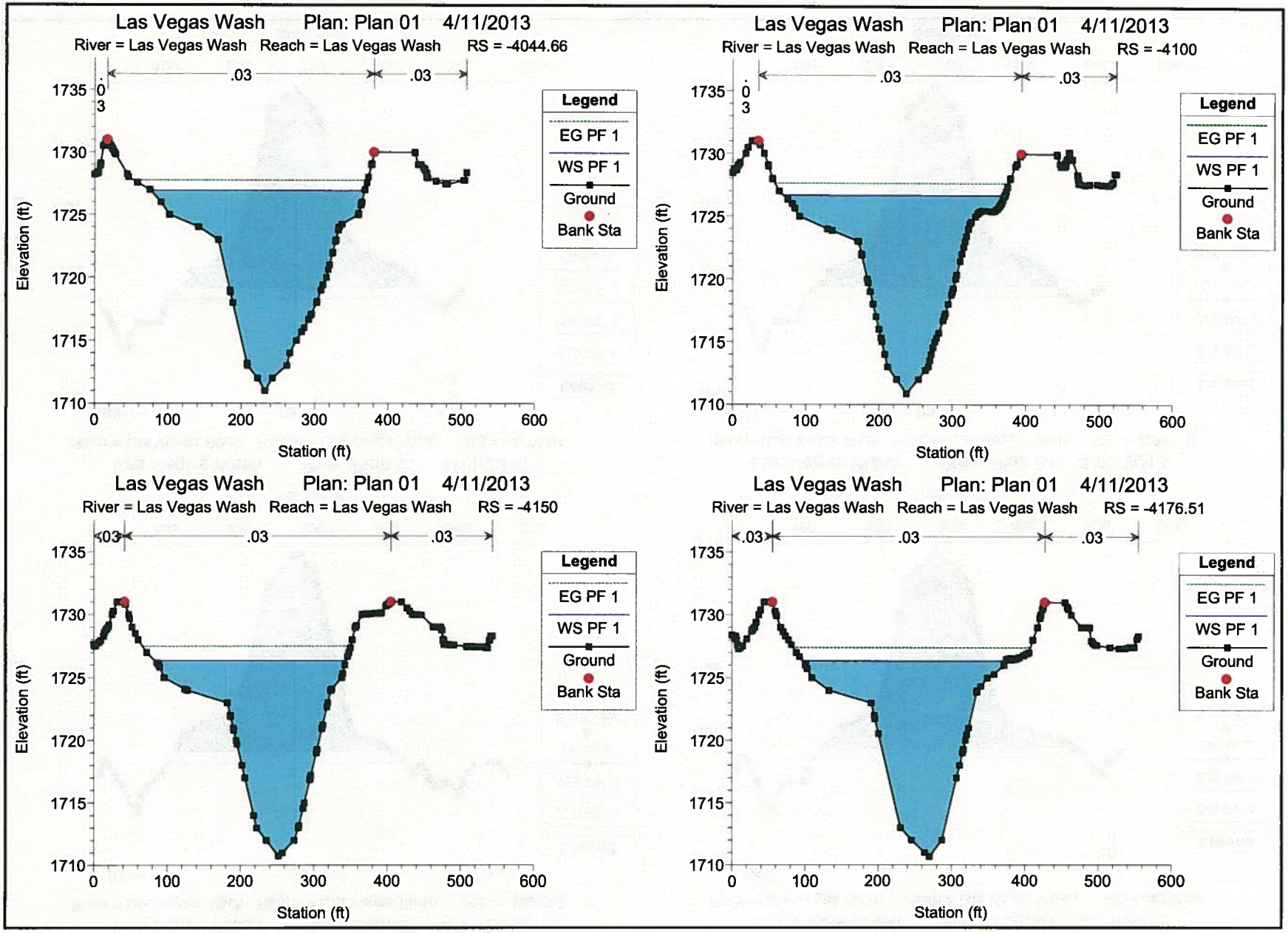

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3043.11
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1735
1730
1725
1720
1715
1710
0
100
200
300
400
500
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3100
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3150
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3200
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

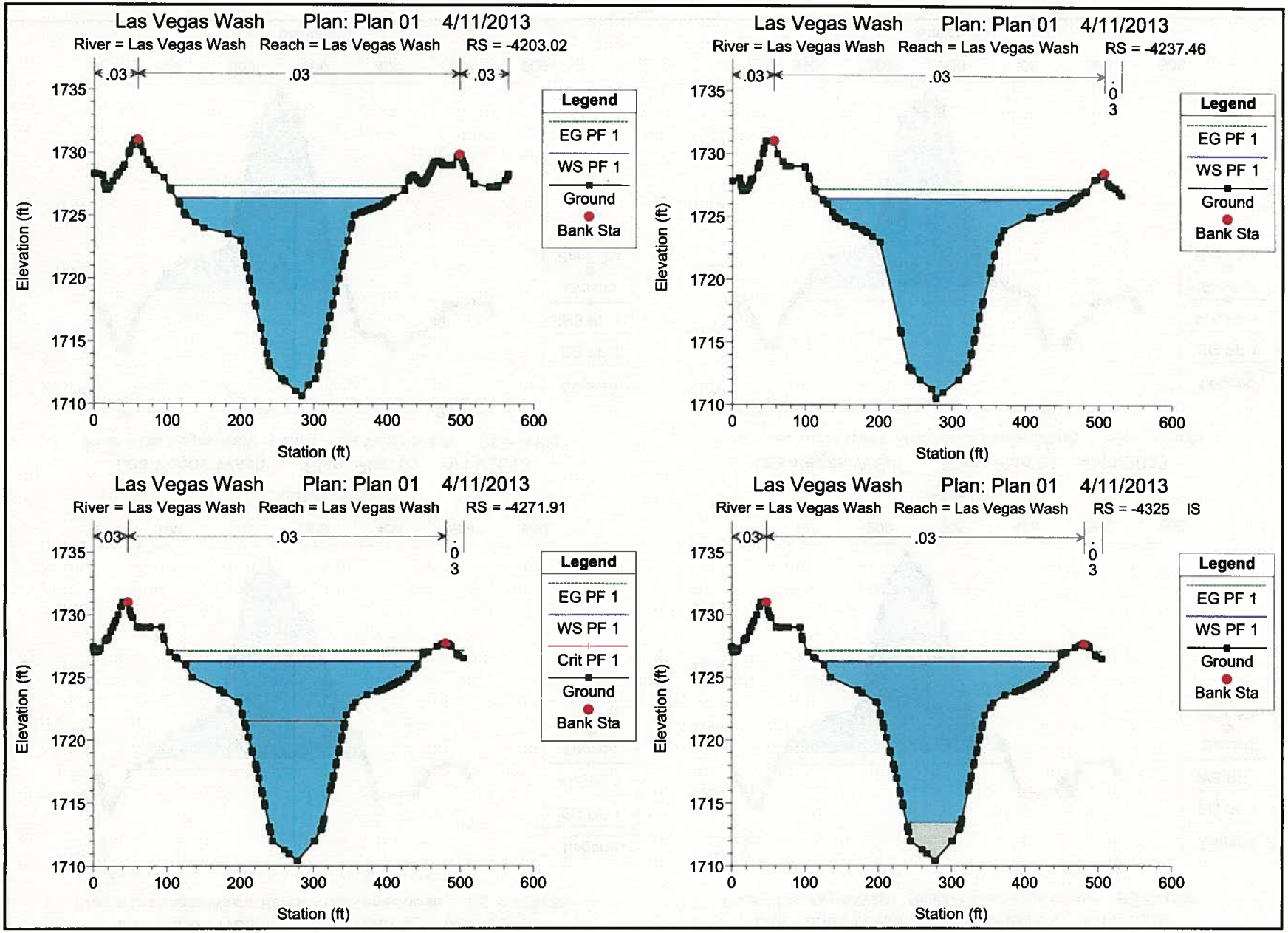

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3250
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3312.37
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3363.25
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3414.13
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

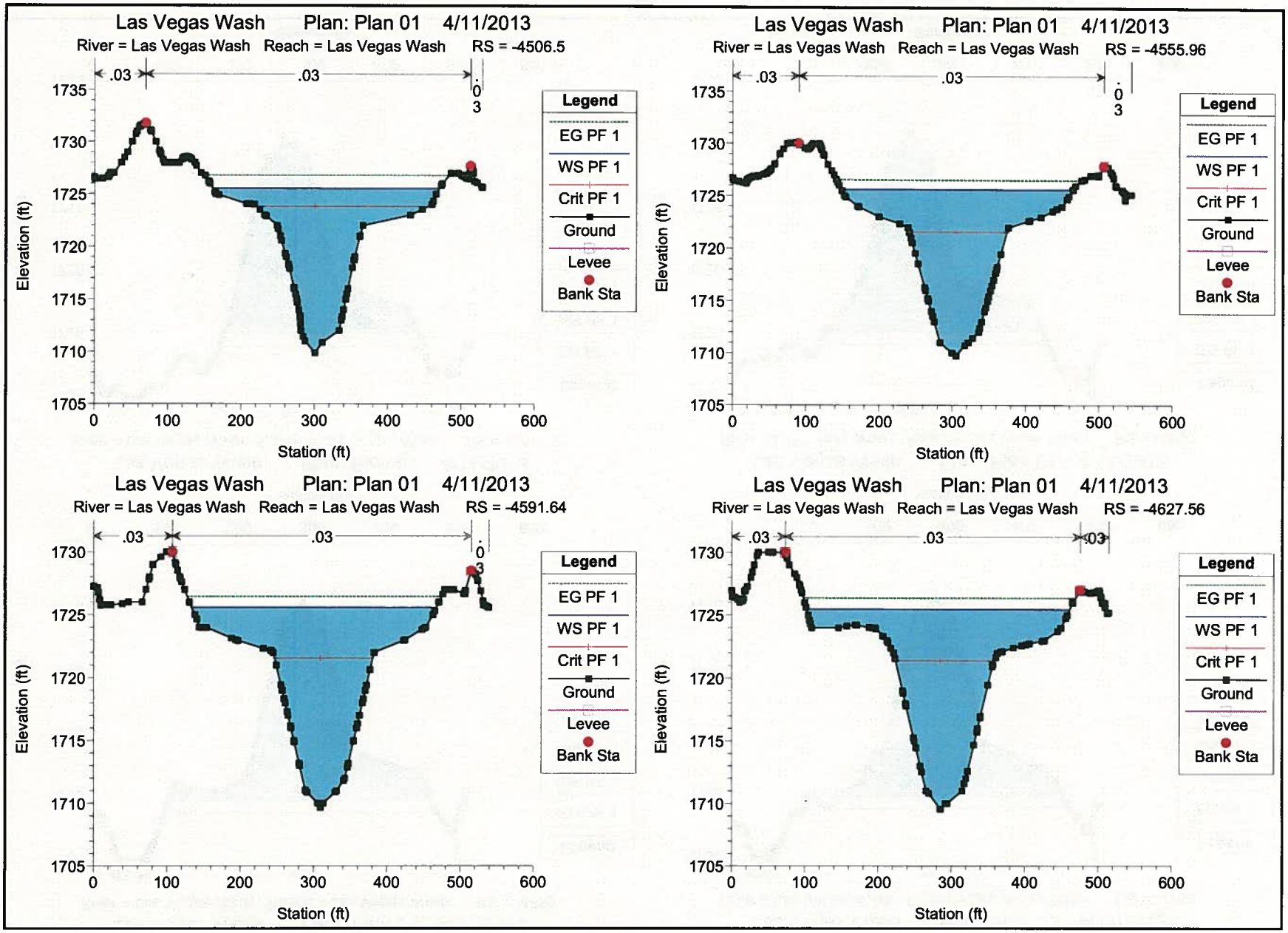

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3460.73
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3497.3
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3500 IS
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3600
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

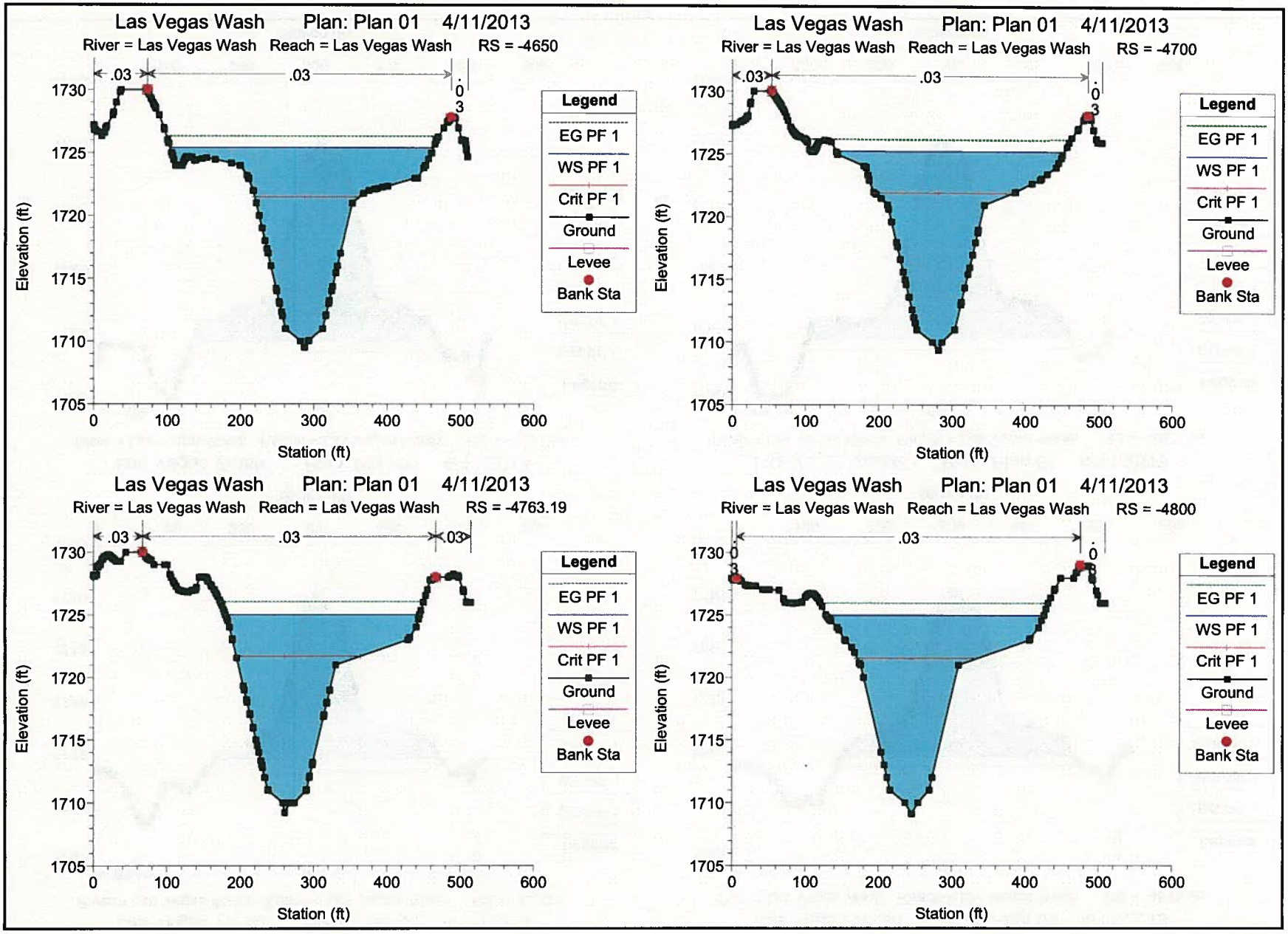

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3650
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3717.28
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3765.9
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3814.51
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

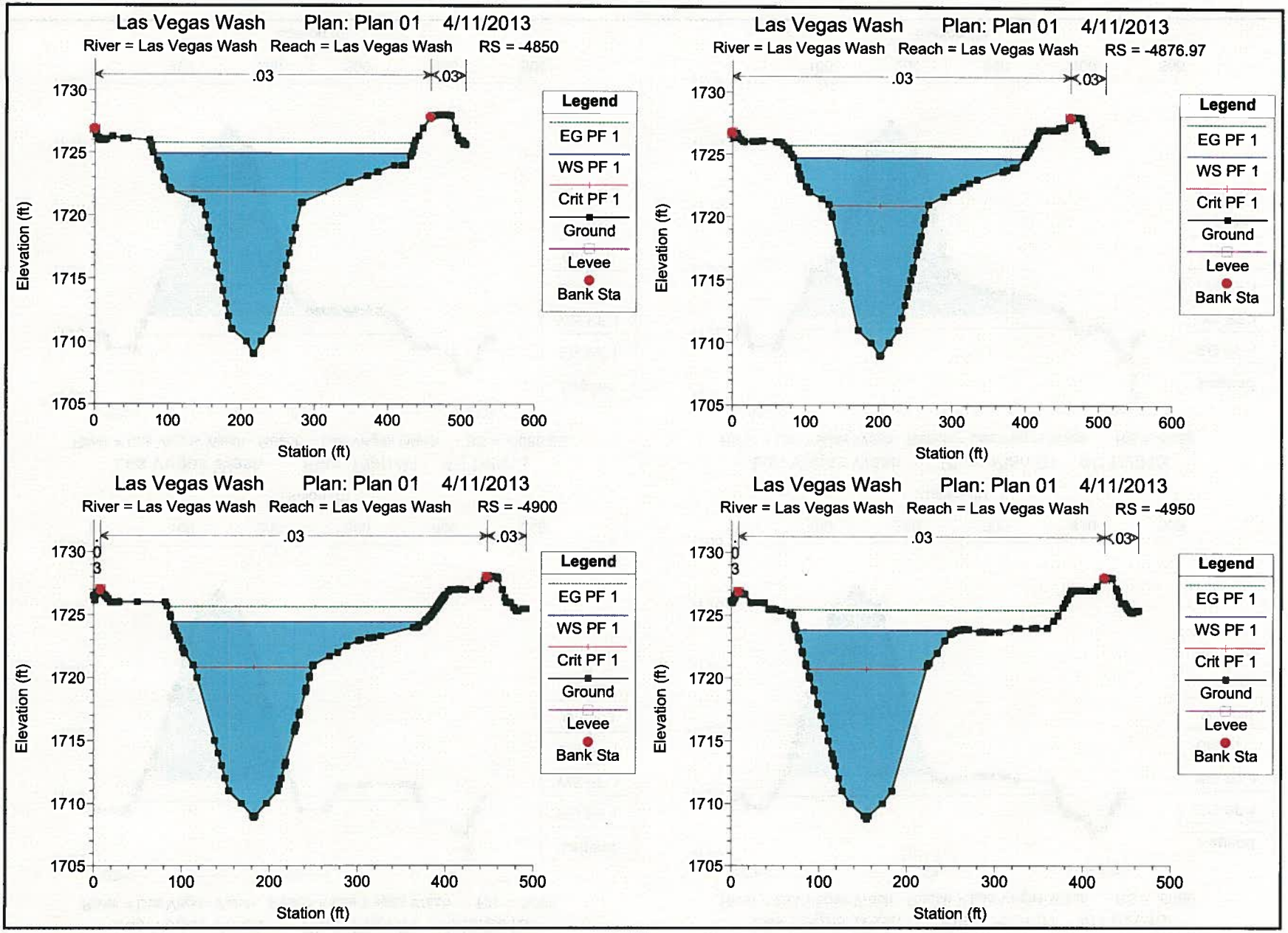

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3850
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3900
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -3950
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4000
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

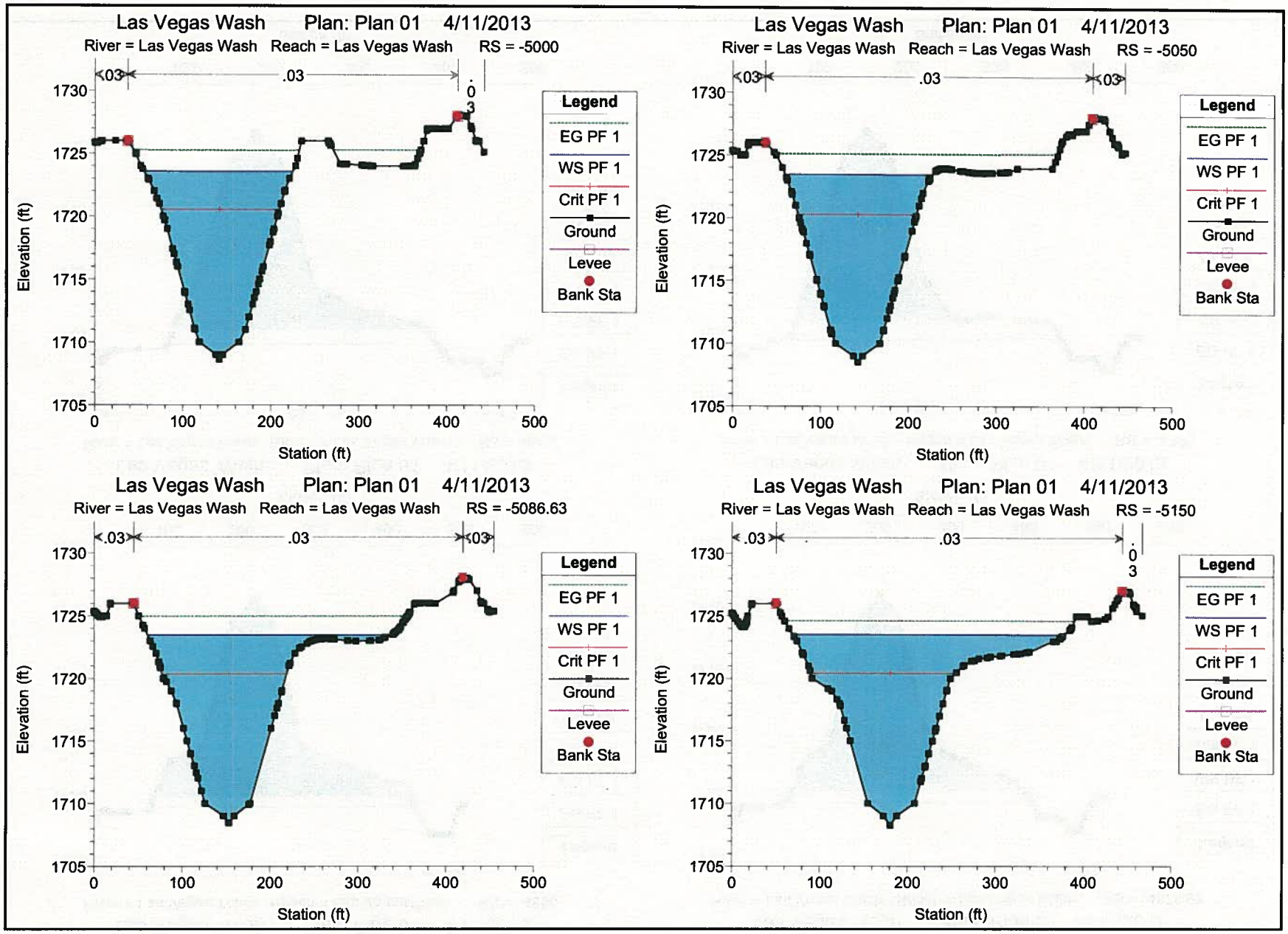

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4044.66
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4100
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4150
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4176.51
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1710
1715
1720
1725
1730
1735
0
100
200
300
400
500
600

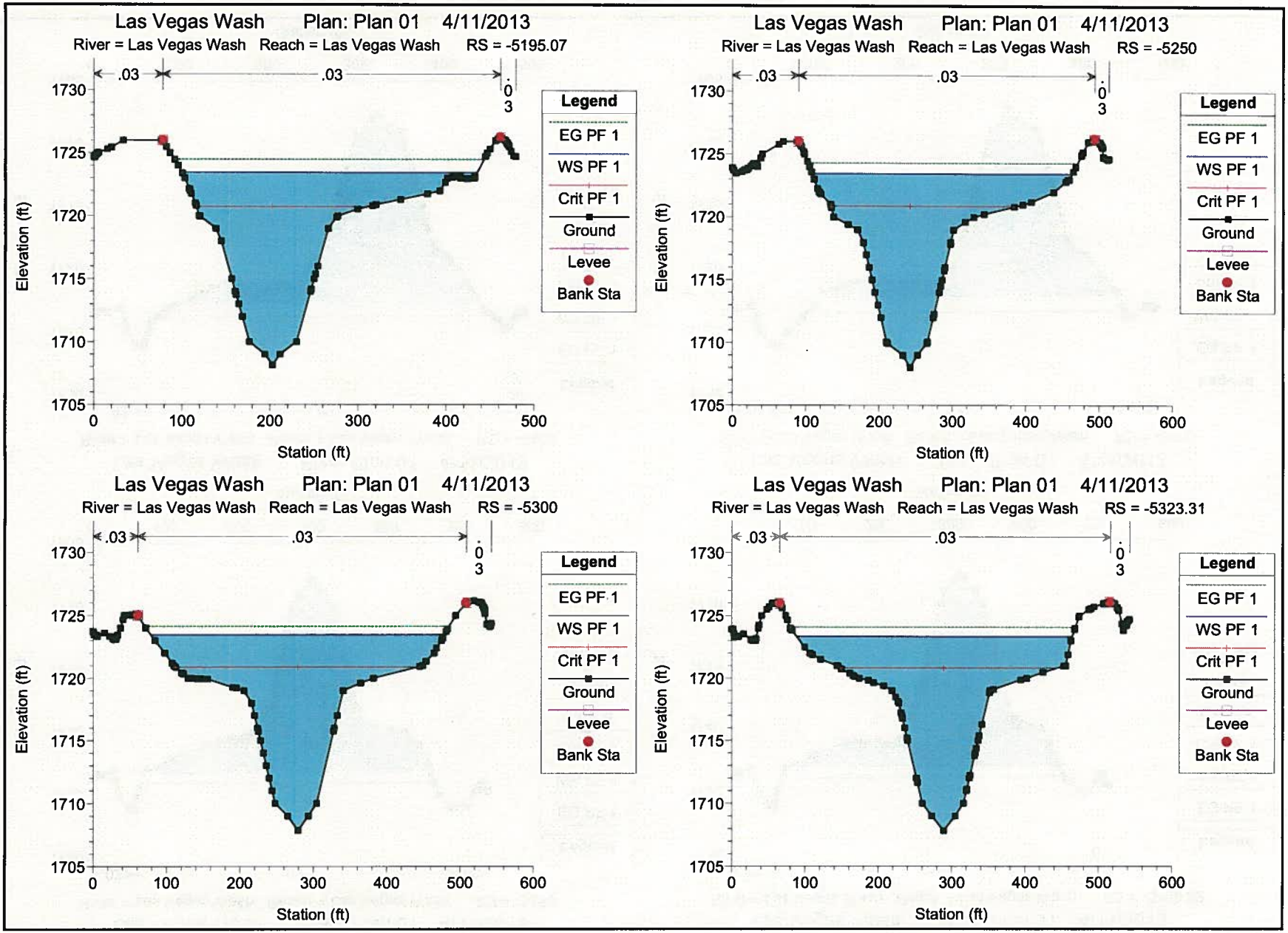

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4203.02
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4237.46
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4271.91
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4325 IS
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

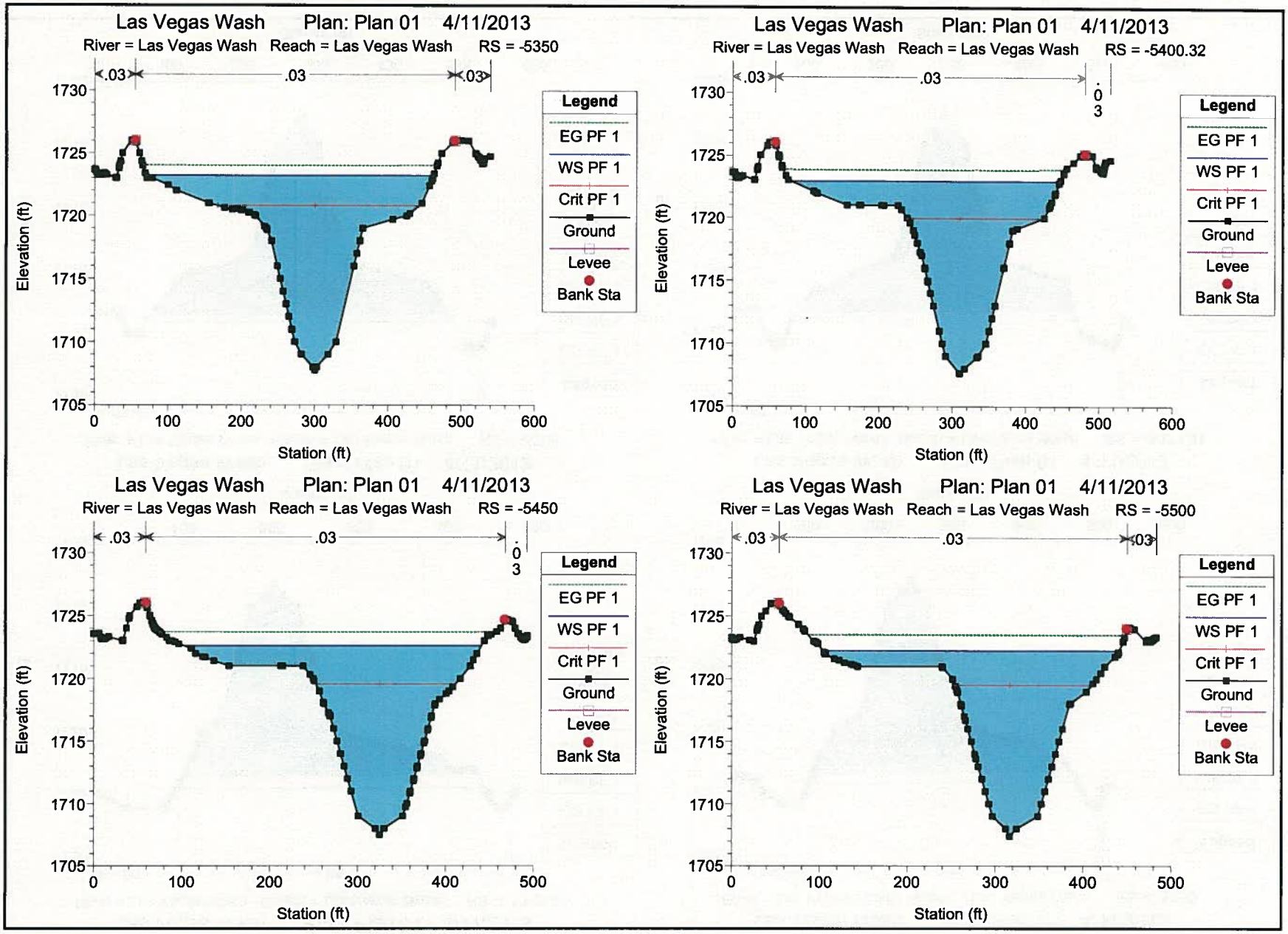

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4506.5
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4555.96
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4591.64
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4627.56
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1705
1710
1715
1720
1725
1730
1735
0
100
200
300
400
500
600

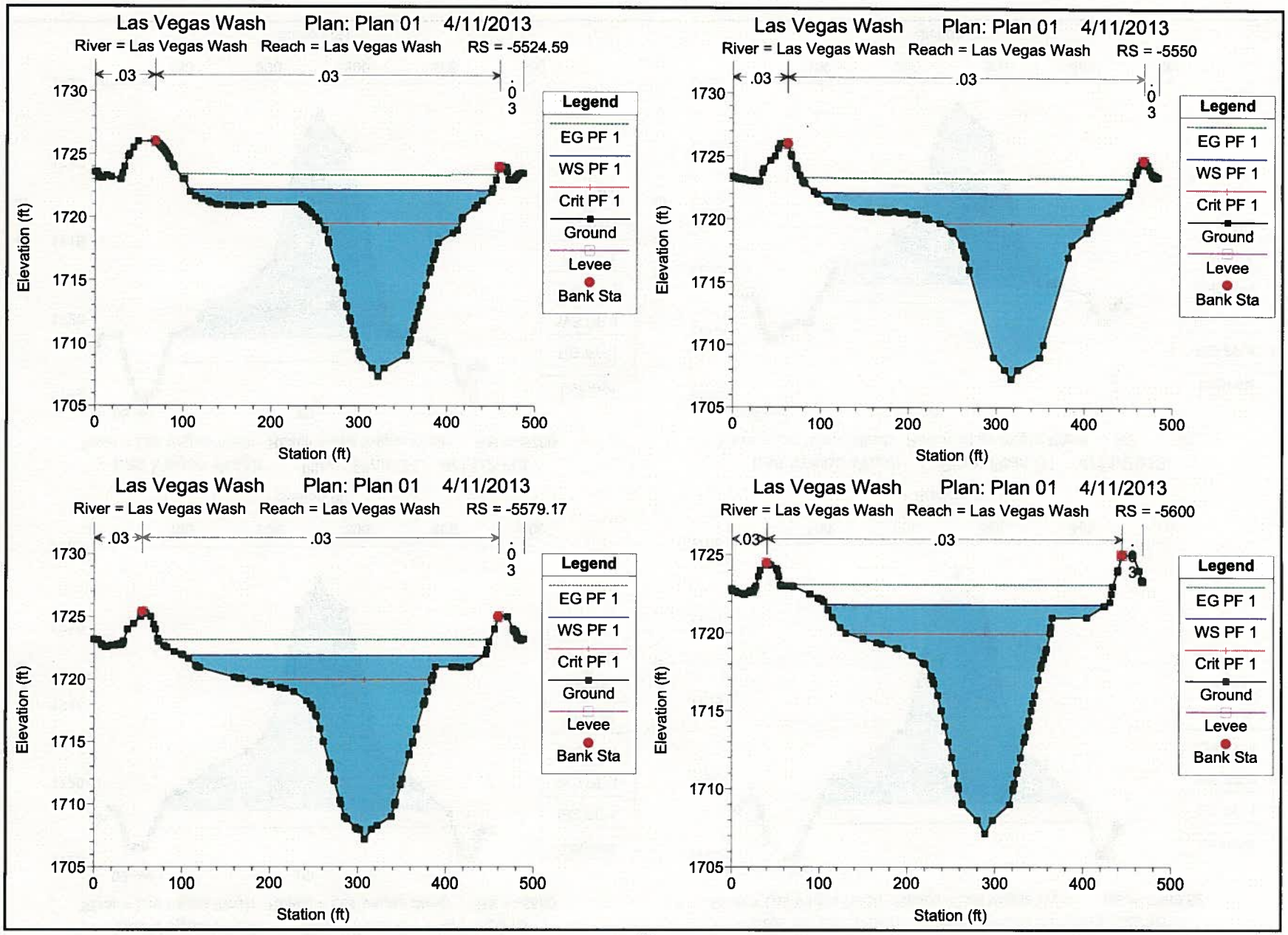

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4650
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4700
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4763.19
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4800
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
.03
.03
.03
1705
1710
1715
1720
1725
1730
0
100
200
300
400
500
600

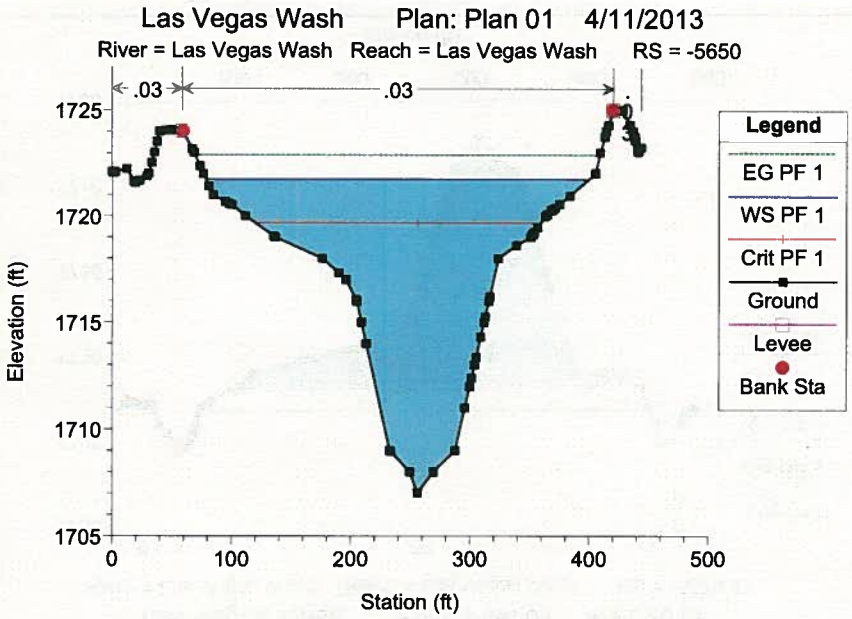

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4850
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4876.97
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4900
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -4950

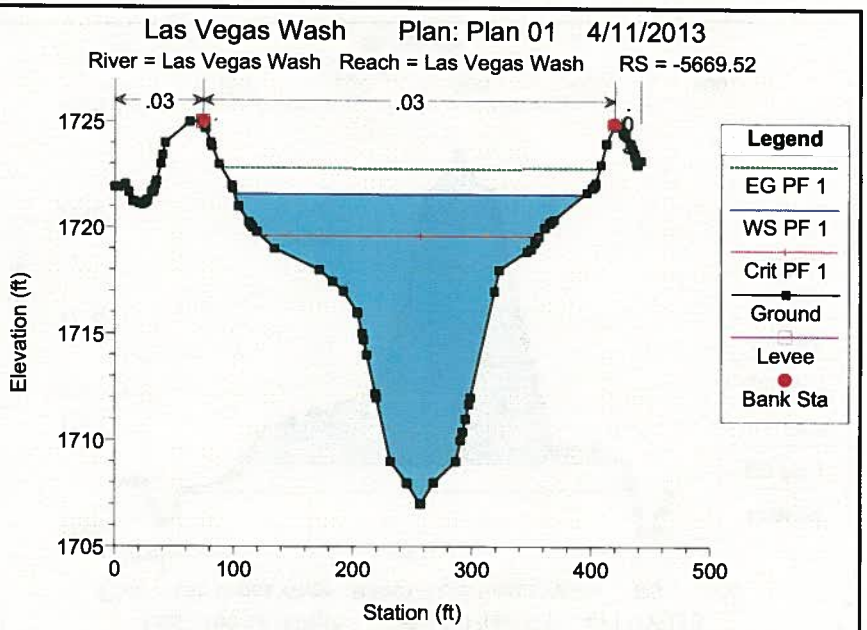

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5000
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5050
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5086.63
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5150
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.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

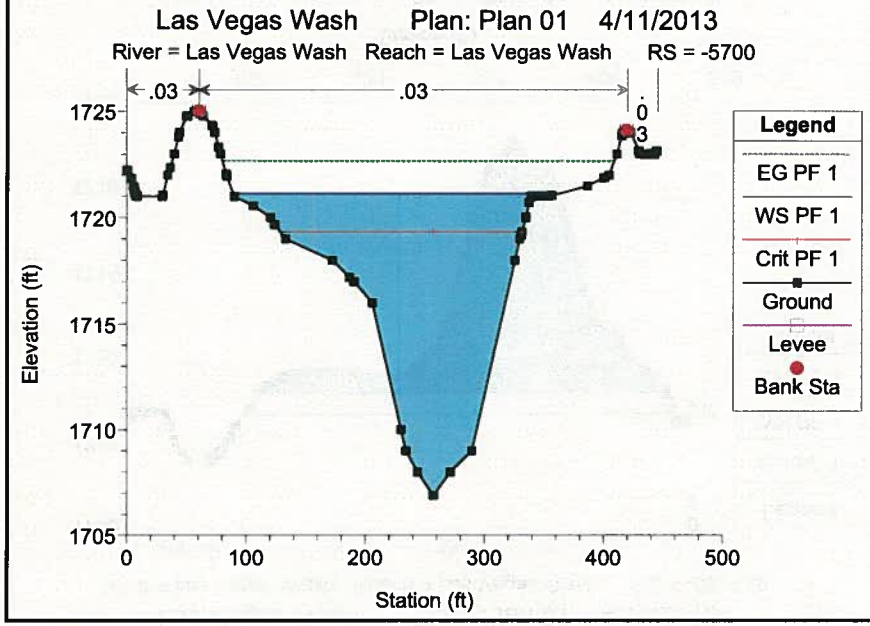

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5195.07
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5250
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5300
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5323.31
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
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200
300
400
500
600

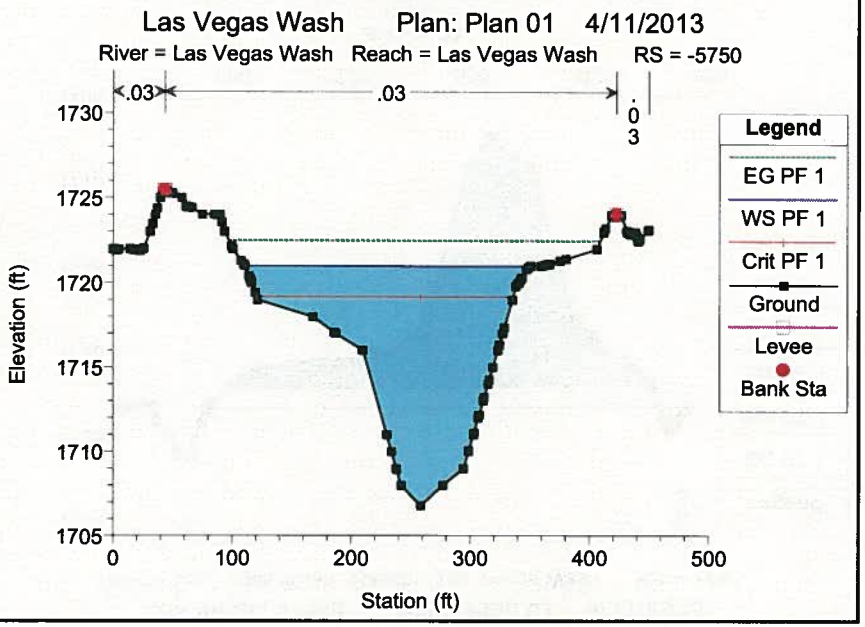

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5350
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500
600
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5400.32
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500
600
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5450
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5500
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
1730
1725
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1715
1710
1705
0
100
200
300
400
500
Station (ft)

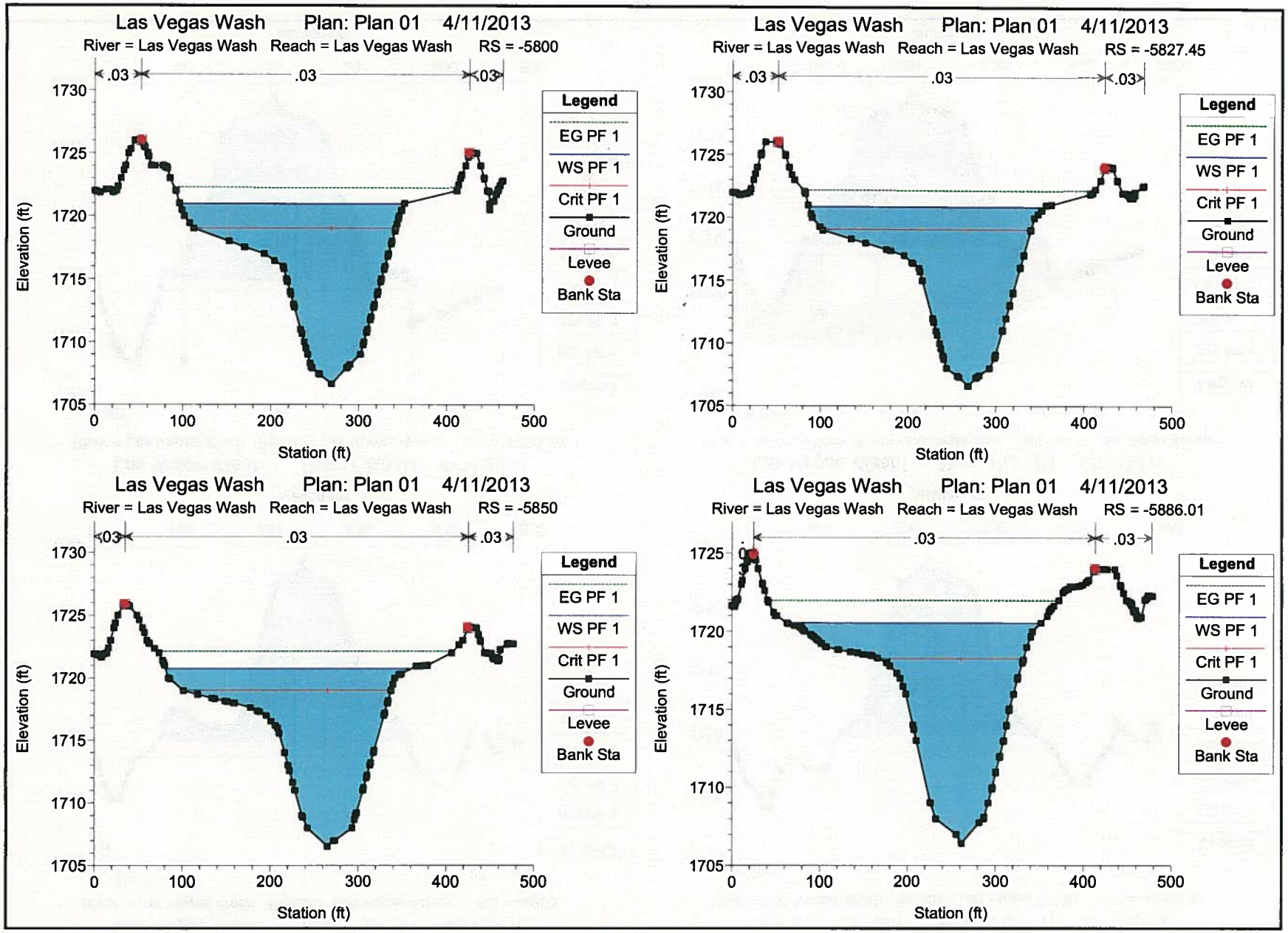

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5524.59
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5550
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5579.17
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5600

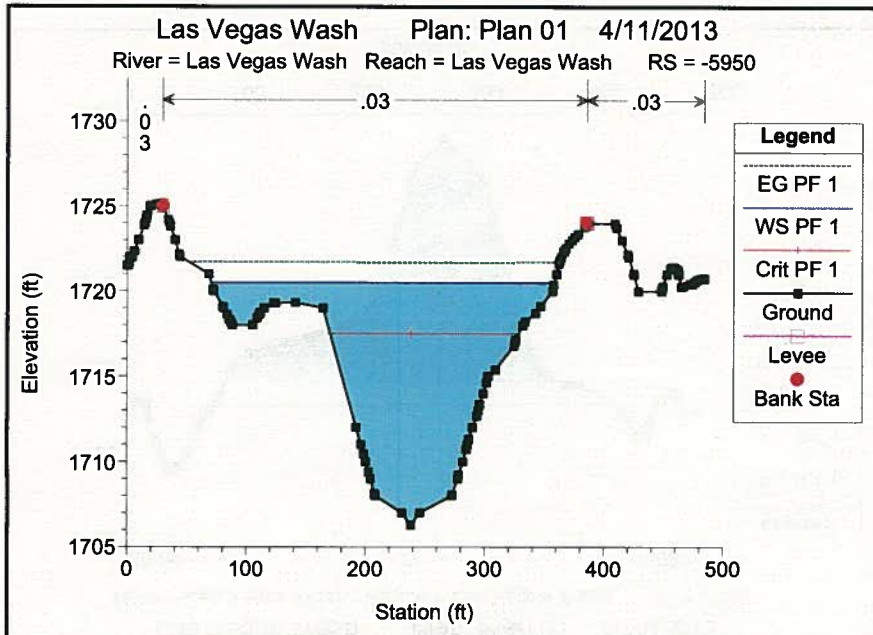

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5650
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1725
1720
1715
1710
1705
0
100
200
300
400
500

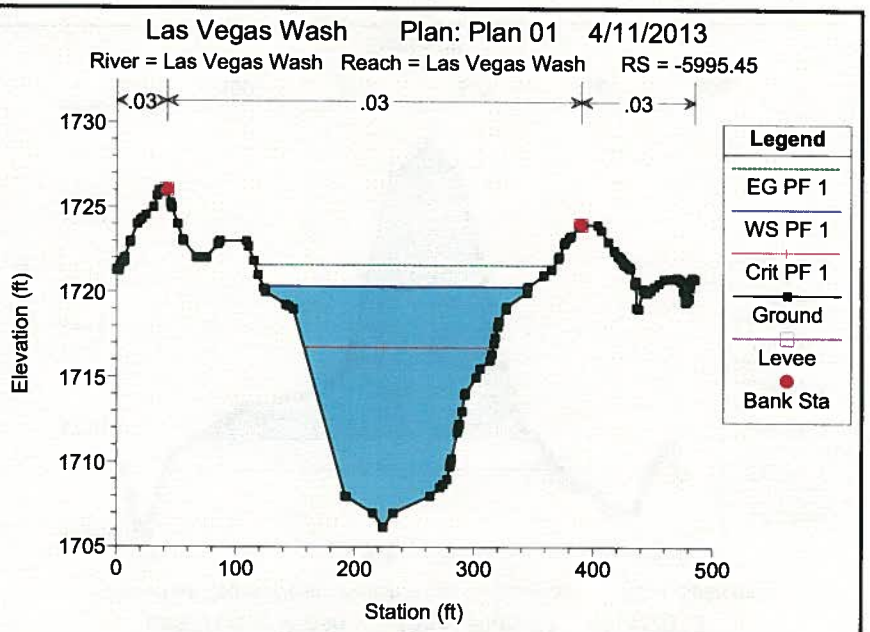

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5669.52
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1725
1720
1715
1710
1705
0
100
200
300
400
500

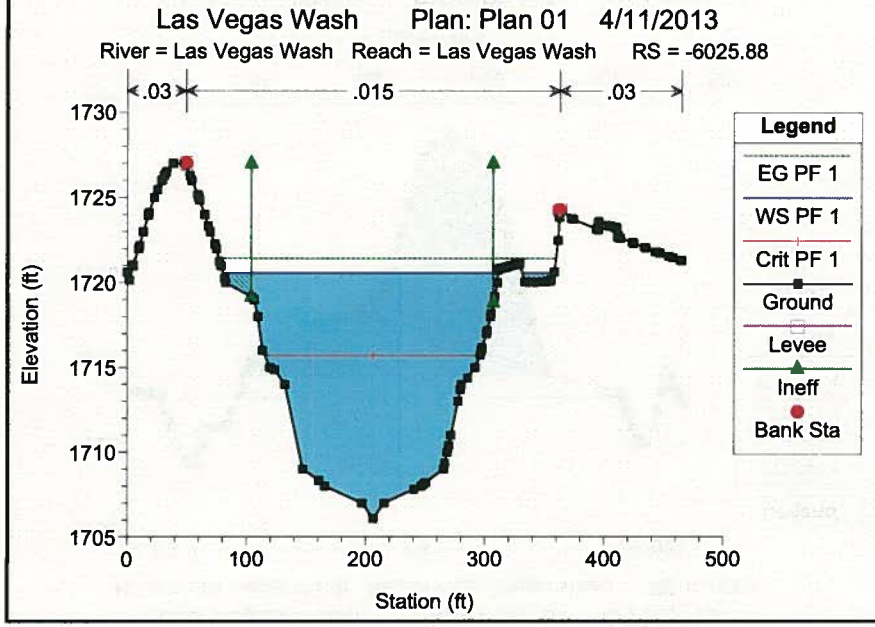

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5700
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1725
1720
1715
1710
1705
0
100
200
300
400
500

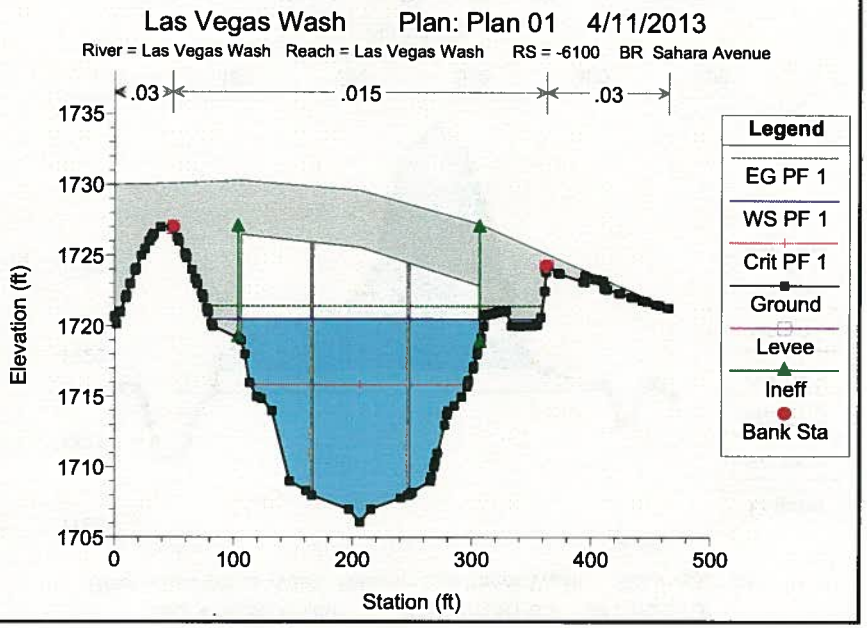

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5750
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500

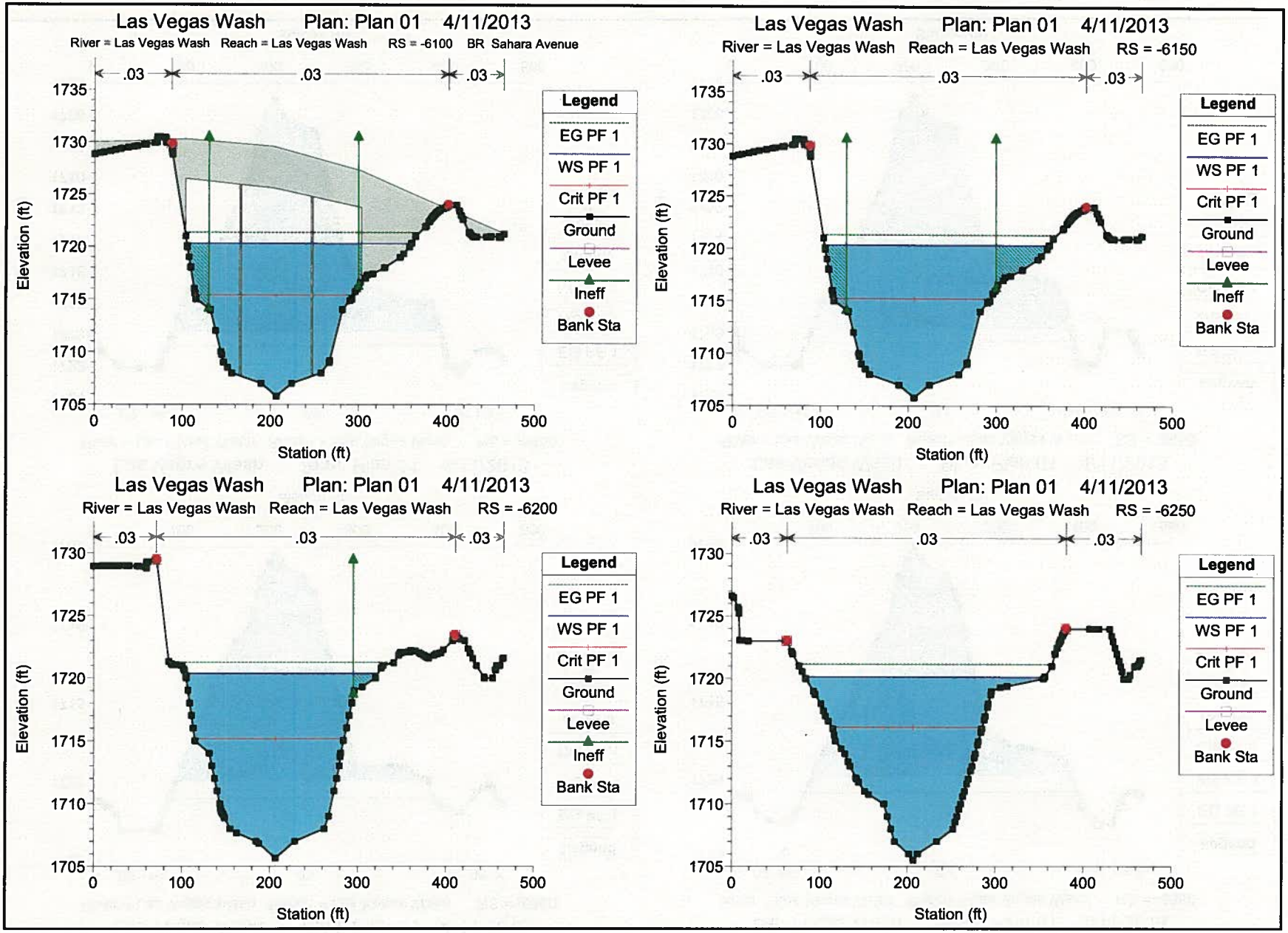

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5800
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5827.45
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5850
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5886.01

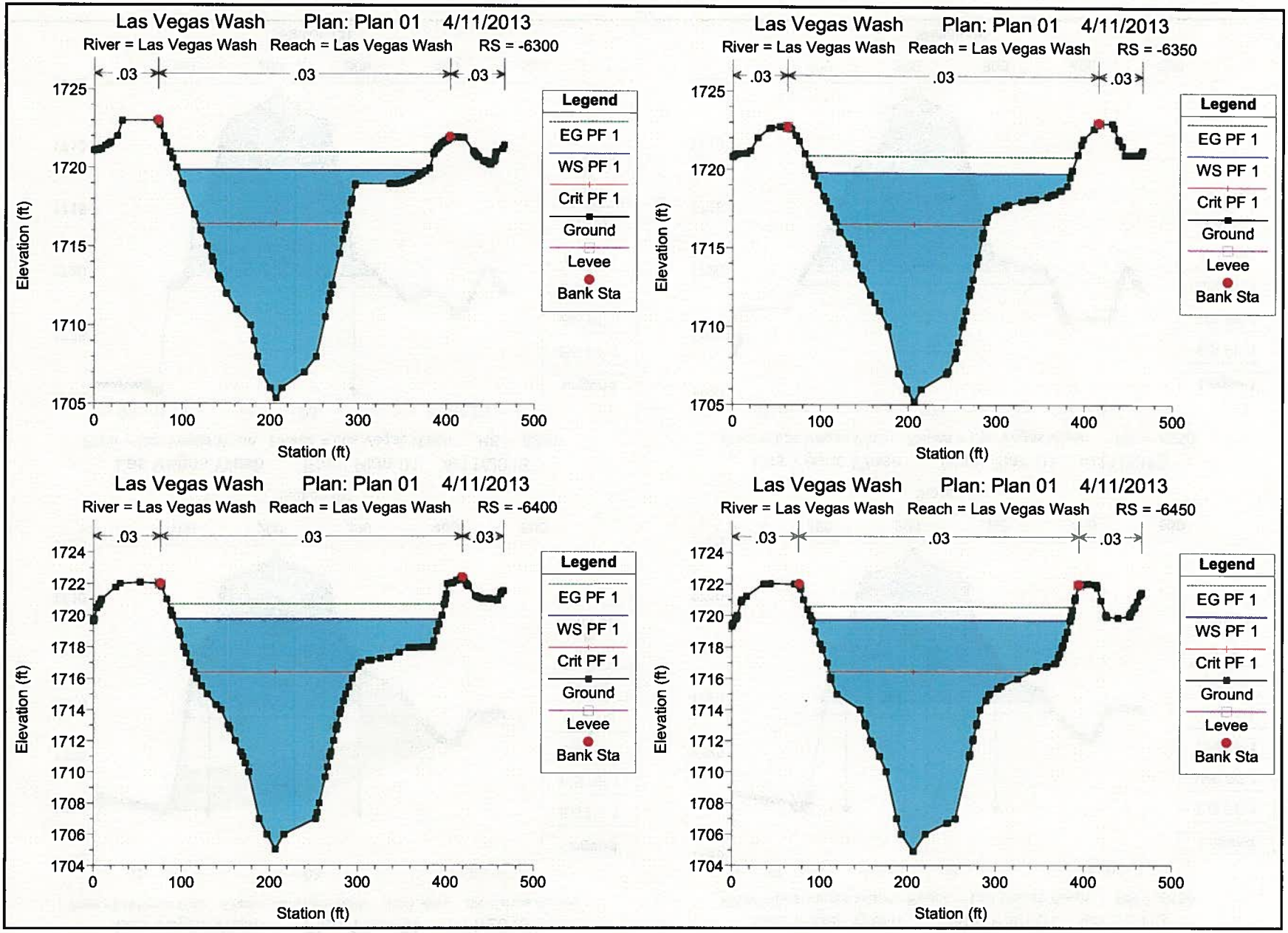

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5950
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500

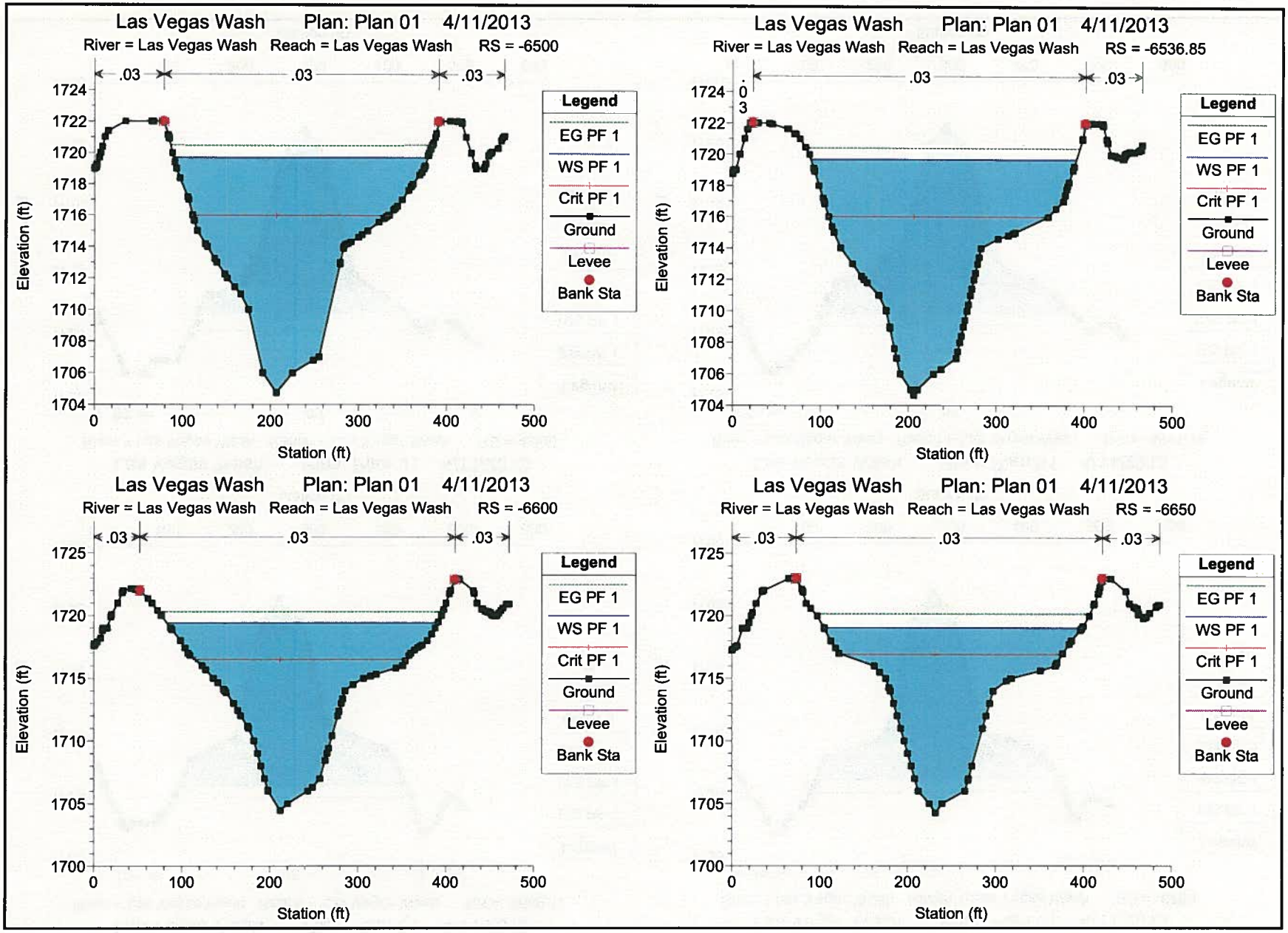

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -5995.45
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500

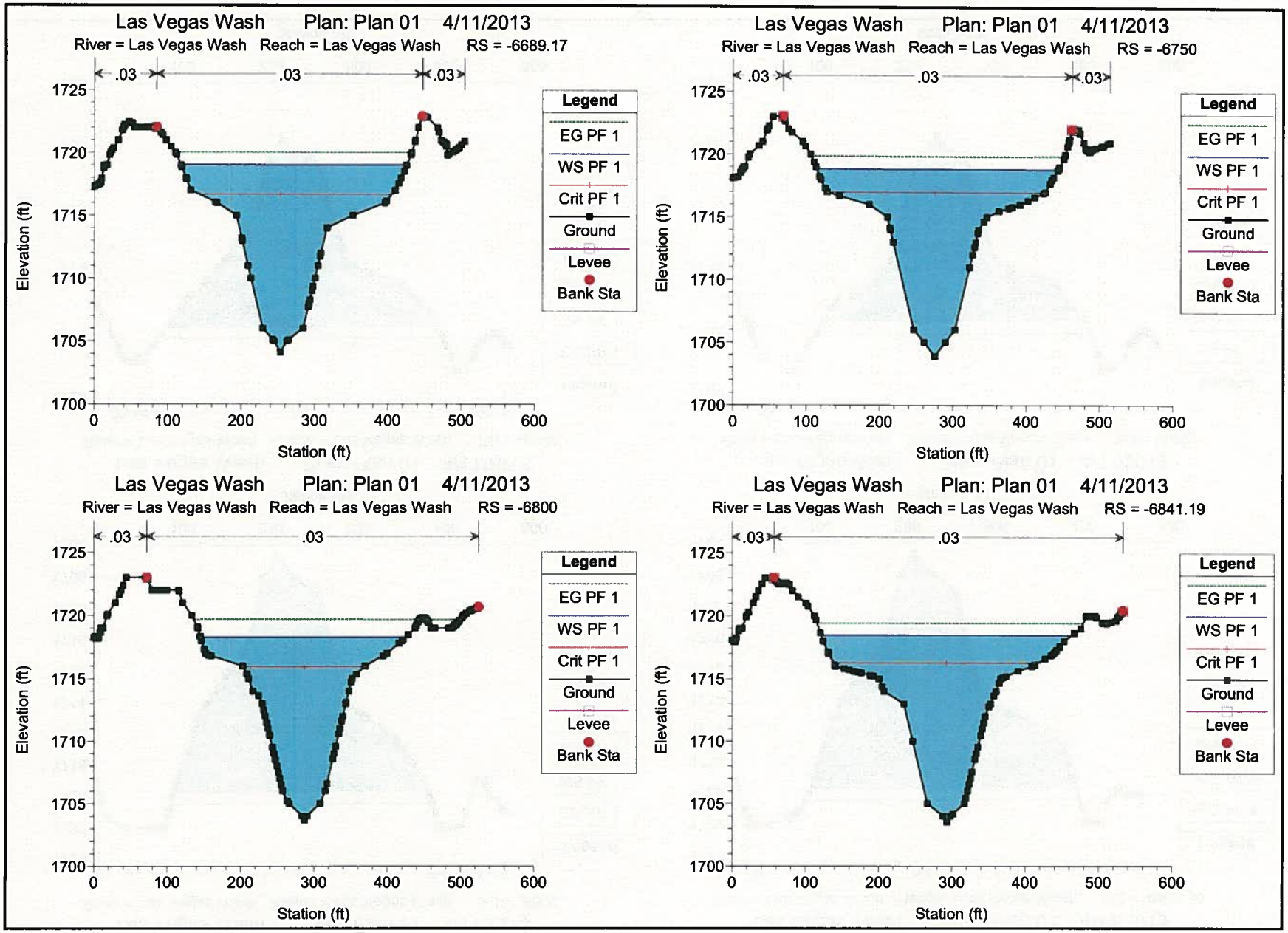

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6025.88
.03
.015
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500

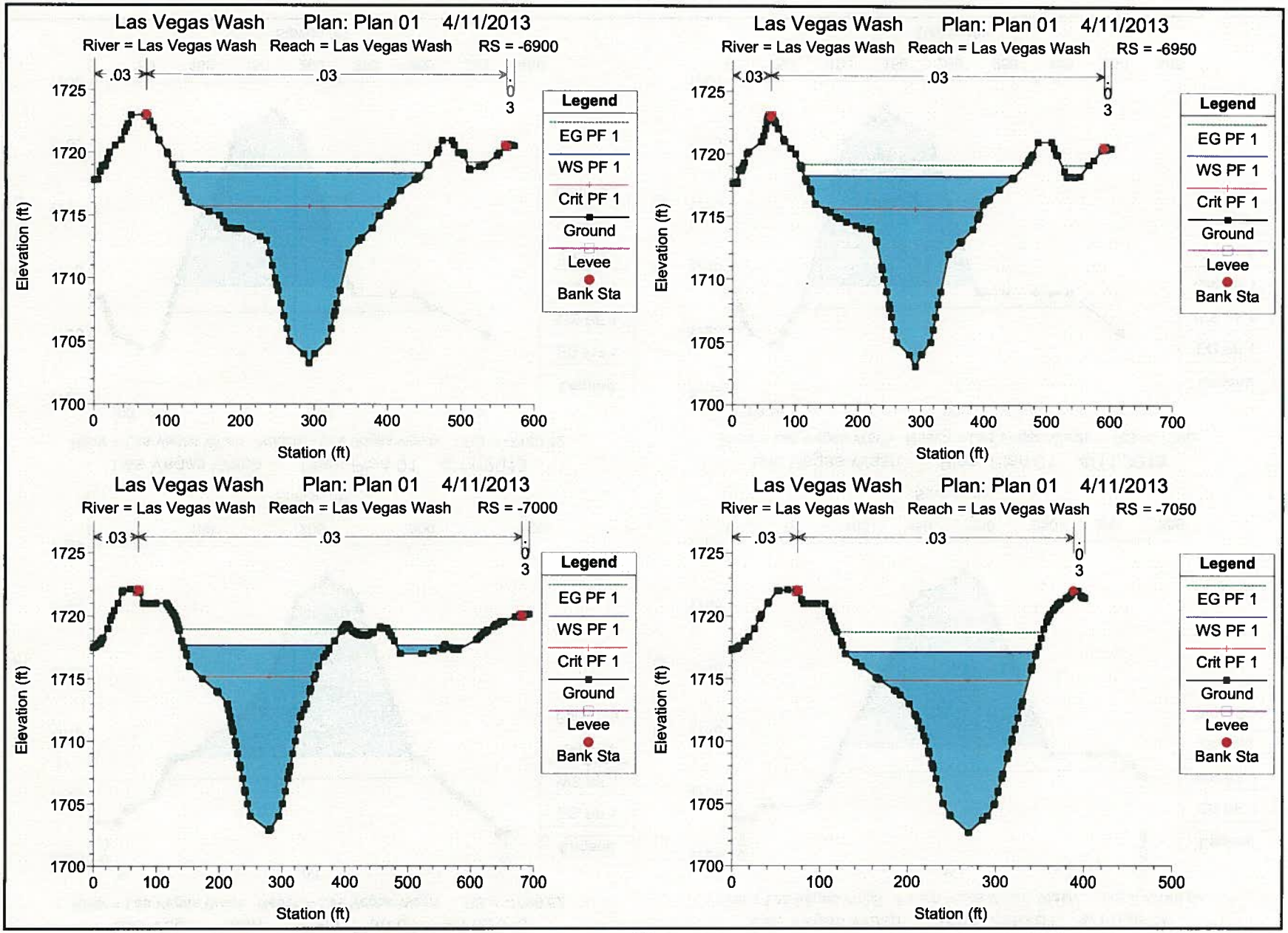

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6100 BR Sahara Avenue
.03
.015
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
Station (ft)
1735
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500

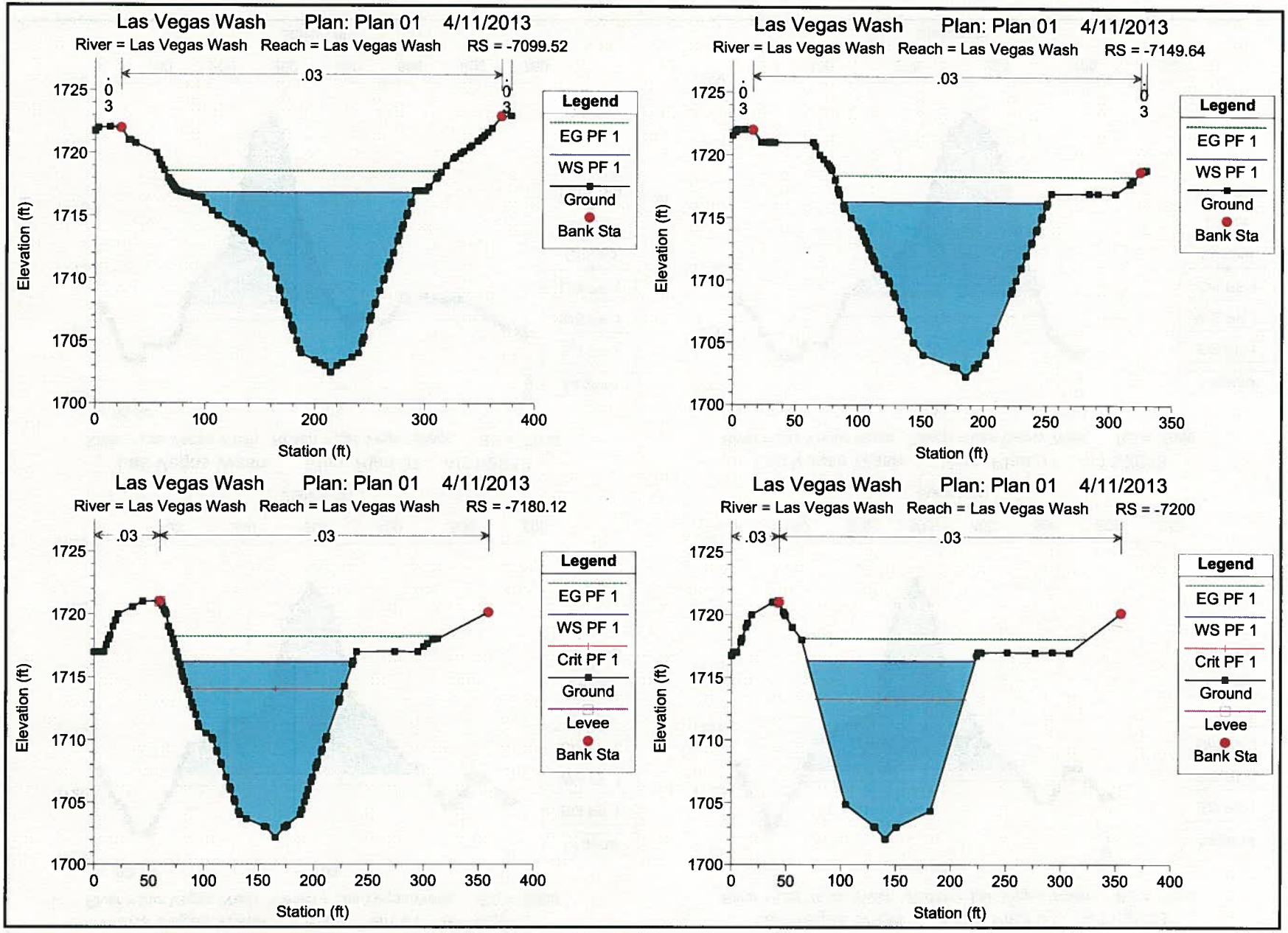

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6100 BR Sahara Avenue
.03
.03
.03
Elevation (ft)
1735
1730
1725
1720
1715
1710
1705
0
100
200
300
400
500
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Ineff
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6150
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6200
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6250

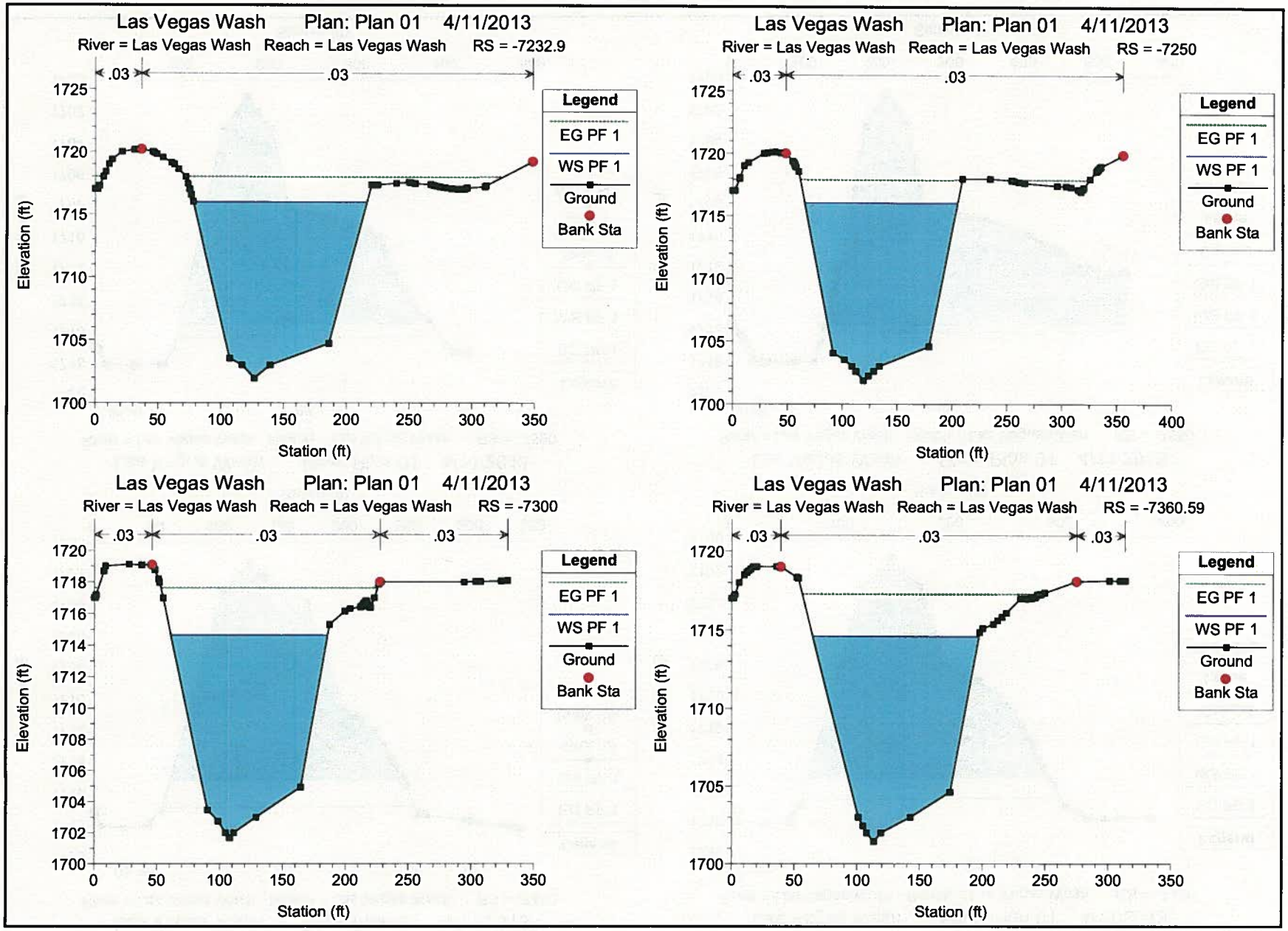

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6300
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6350
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6400
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6450

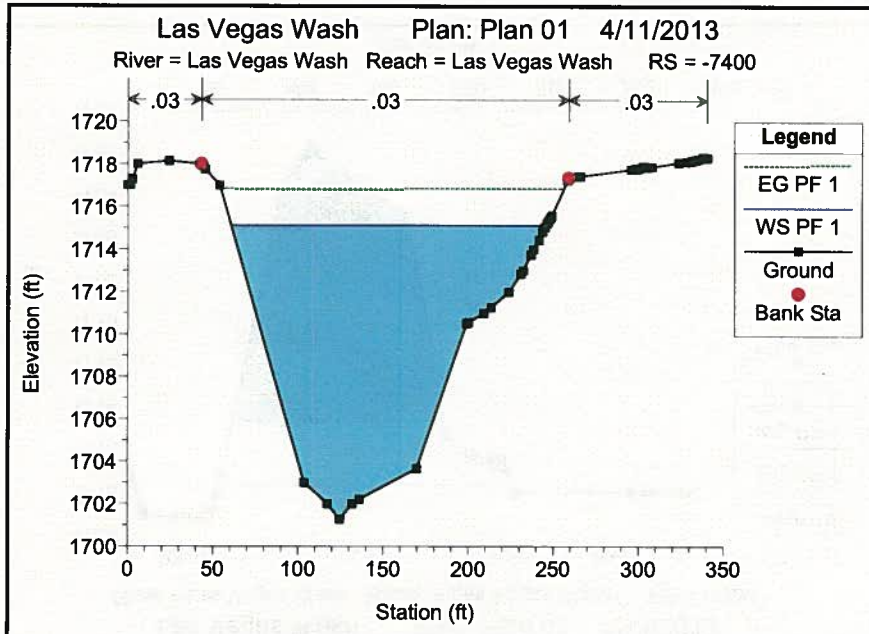

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6500
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6536.85
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6600
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6650

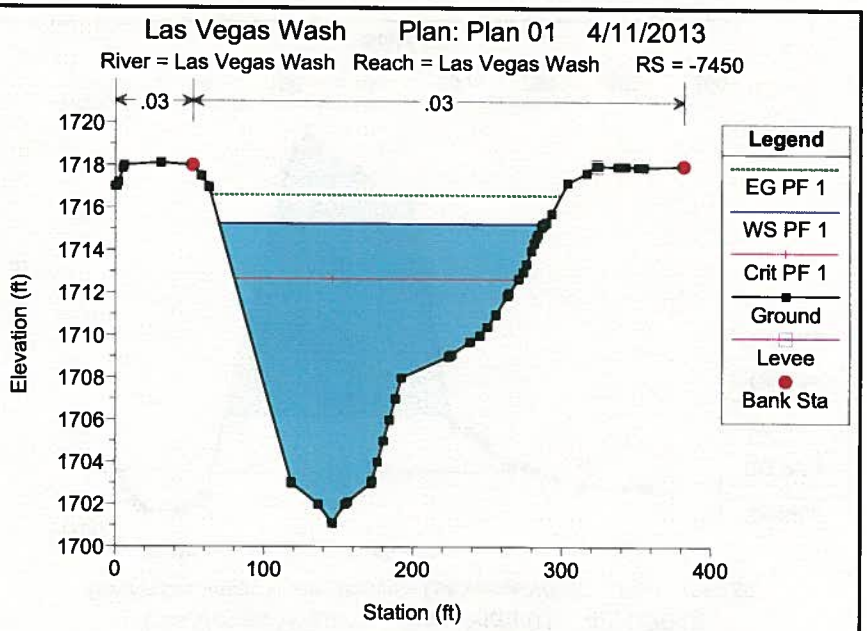

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6689.17
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6750
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6800
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6841.19
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta

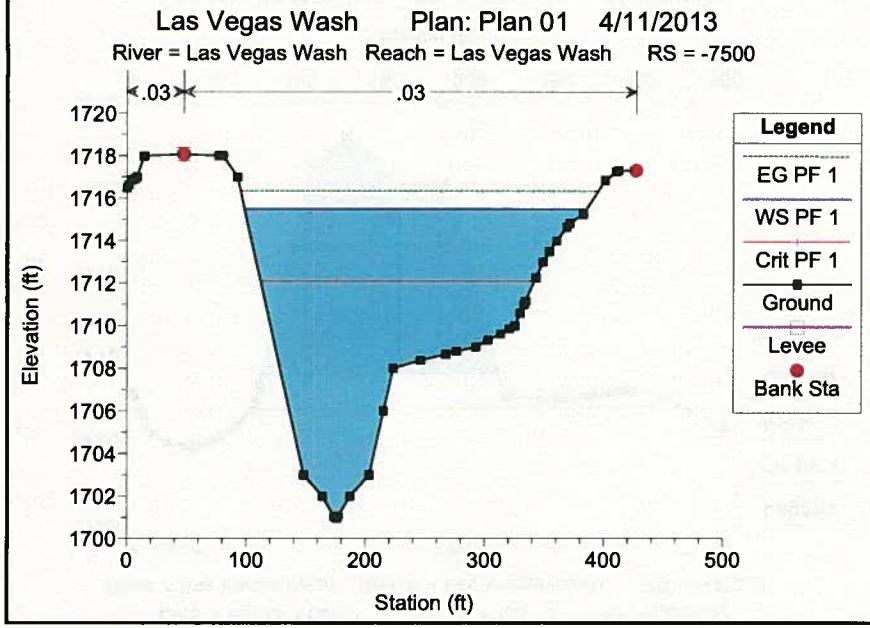

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6900
.03
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -6950
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7000
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7050

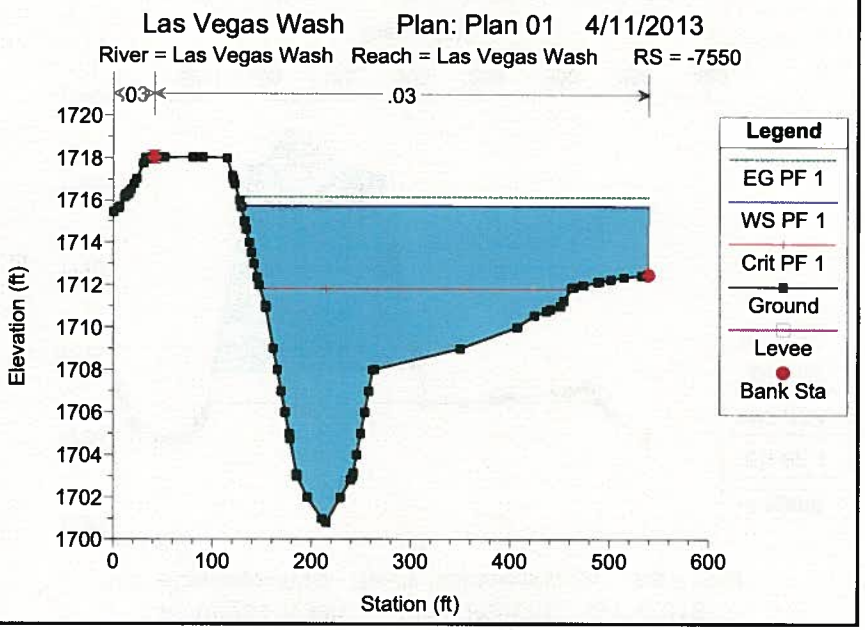

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7099.52
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7149.64
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7180.12
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7200
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

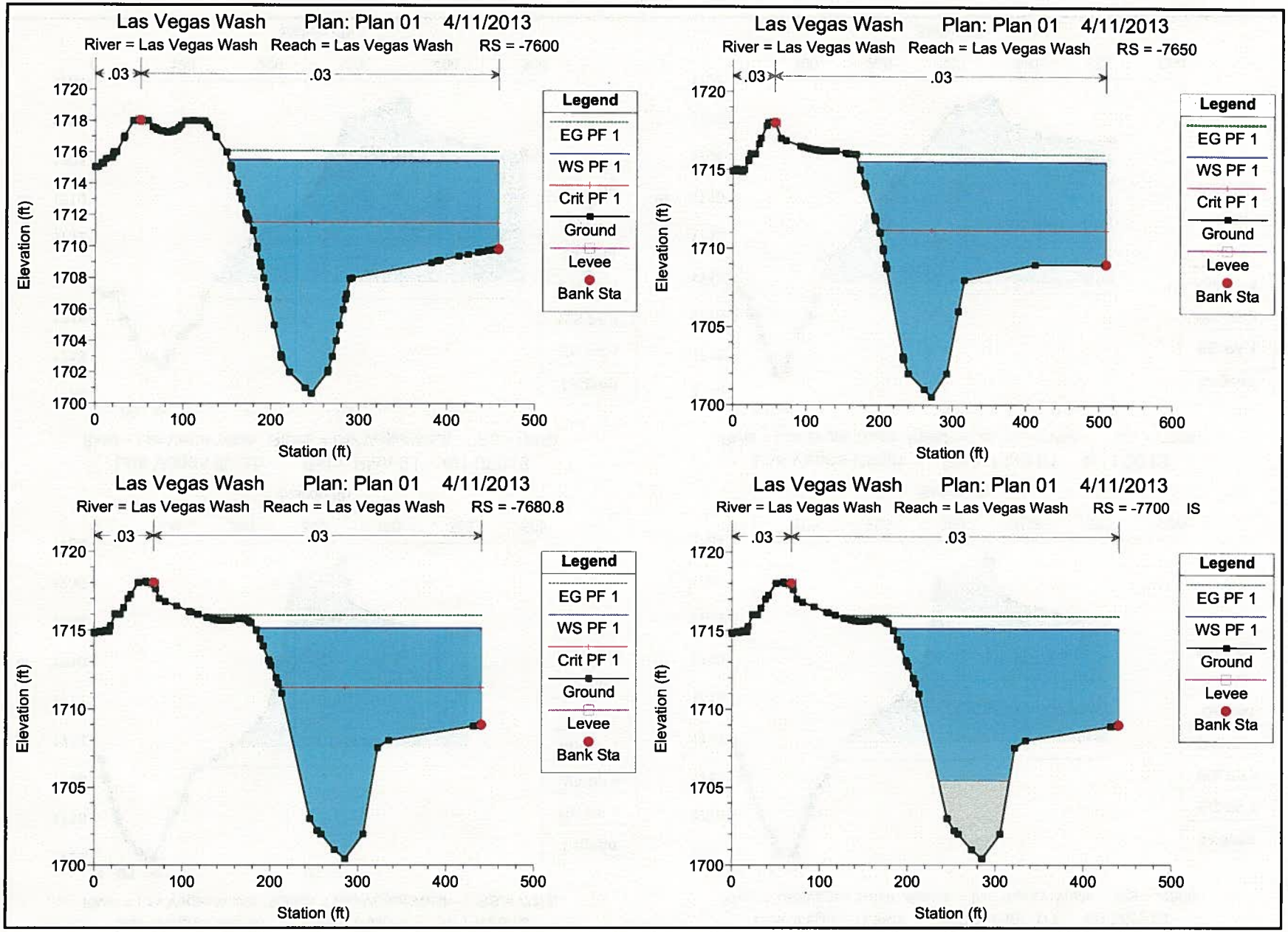

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7232.9
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7250
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7300
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7360.59
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

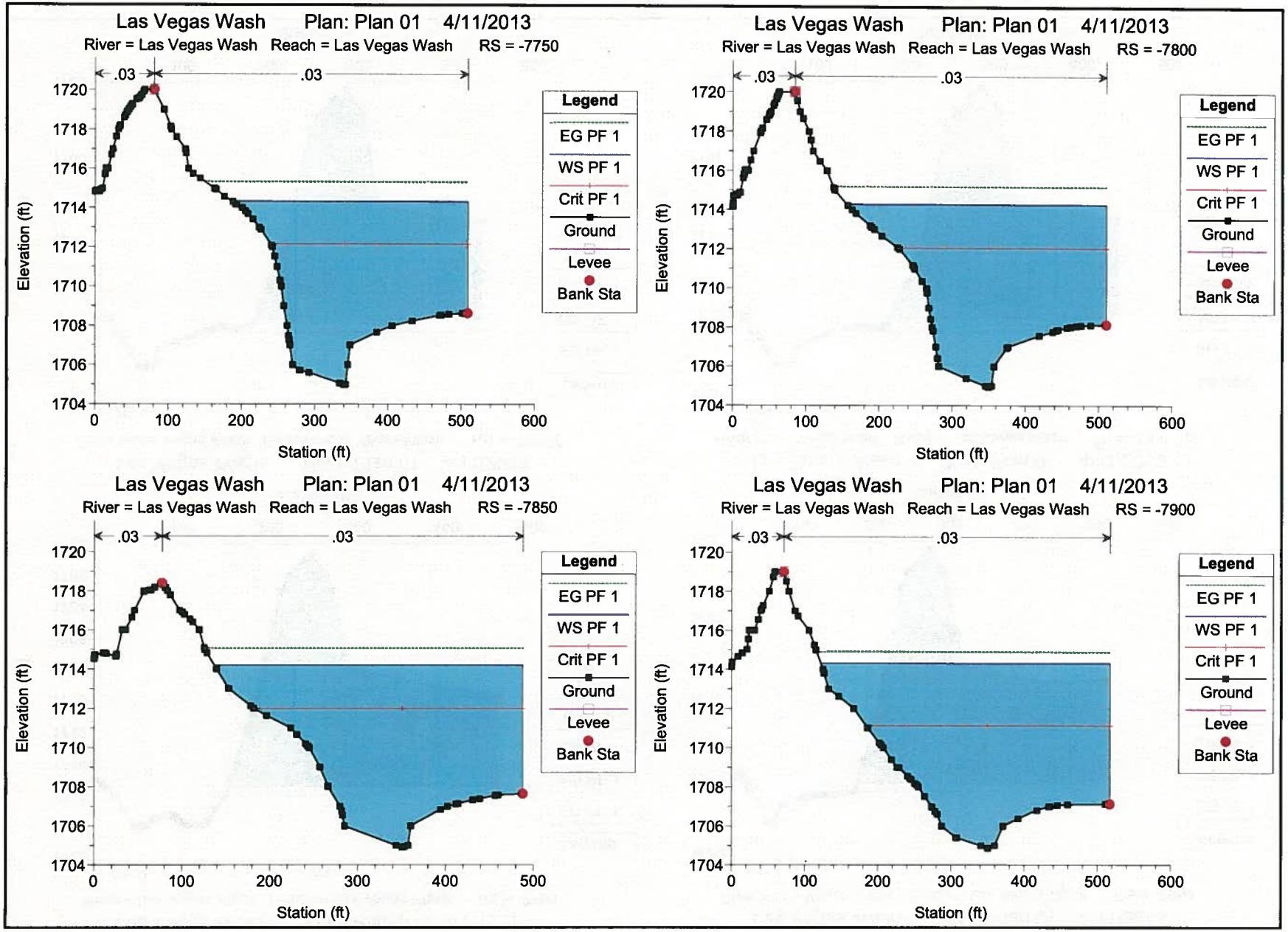

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7400
.03
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

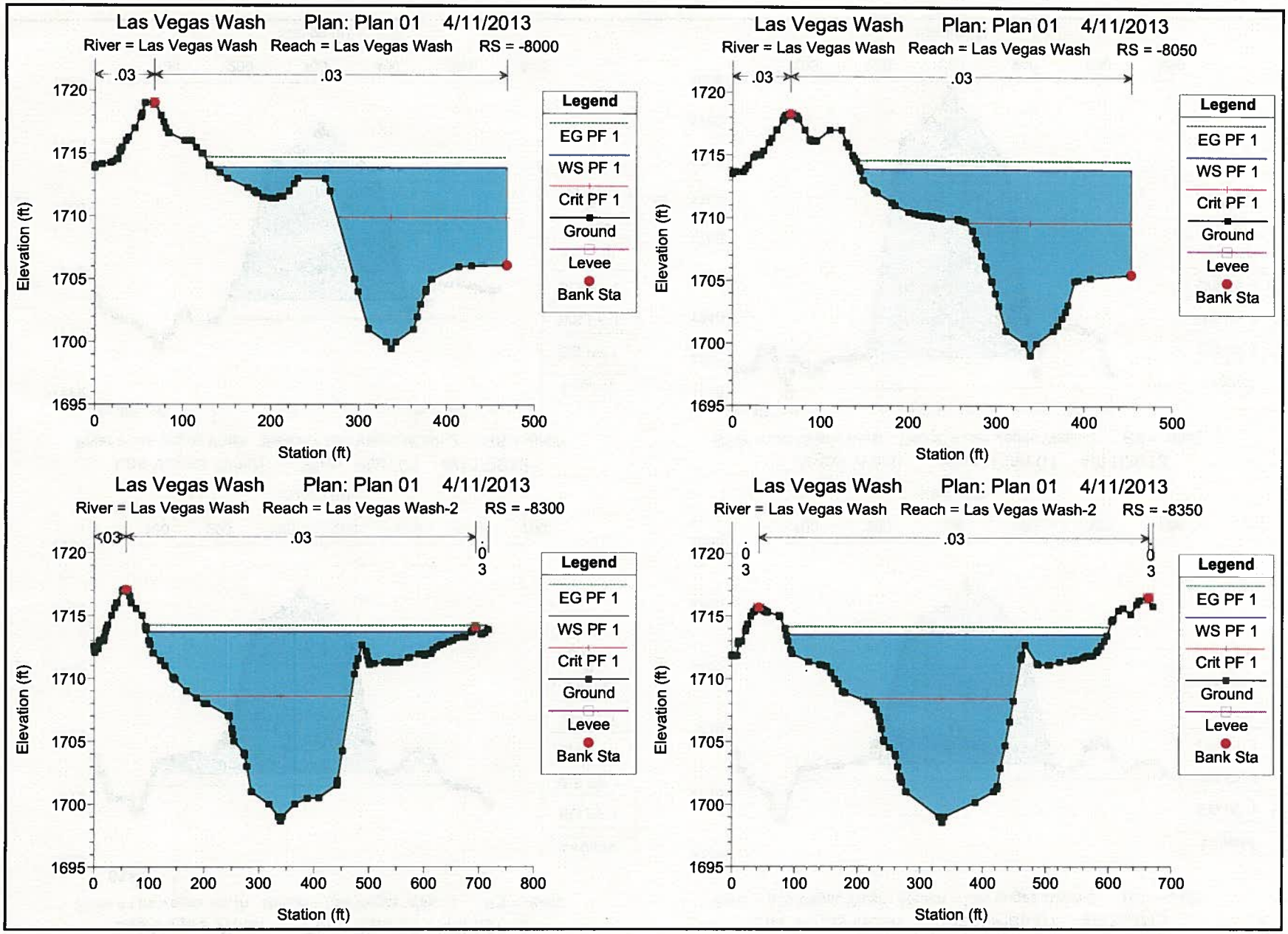

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7450
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

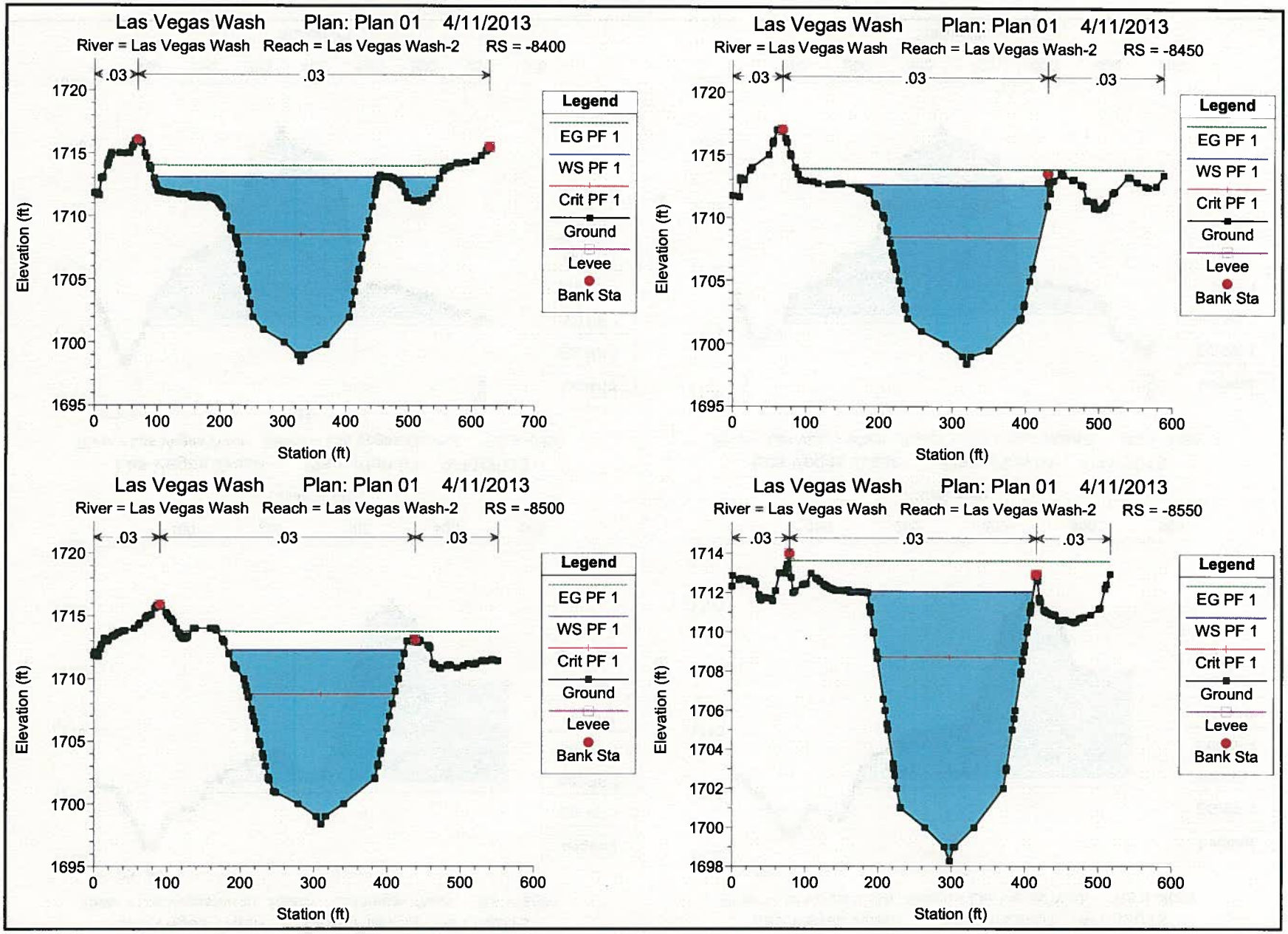

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7500
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

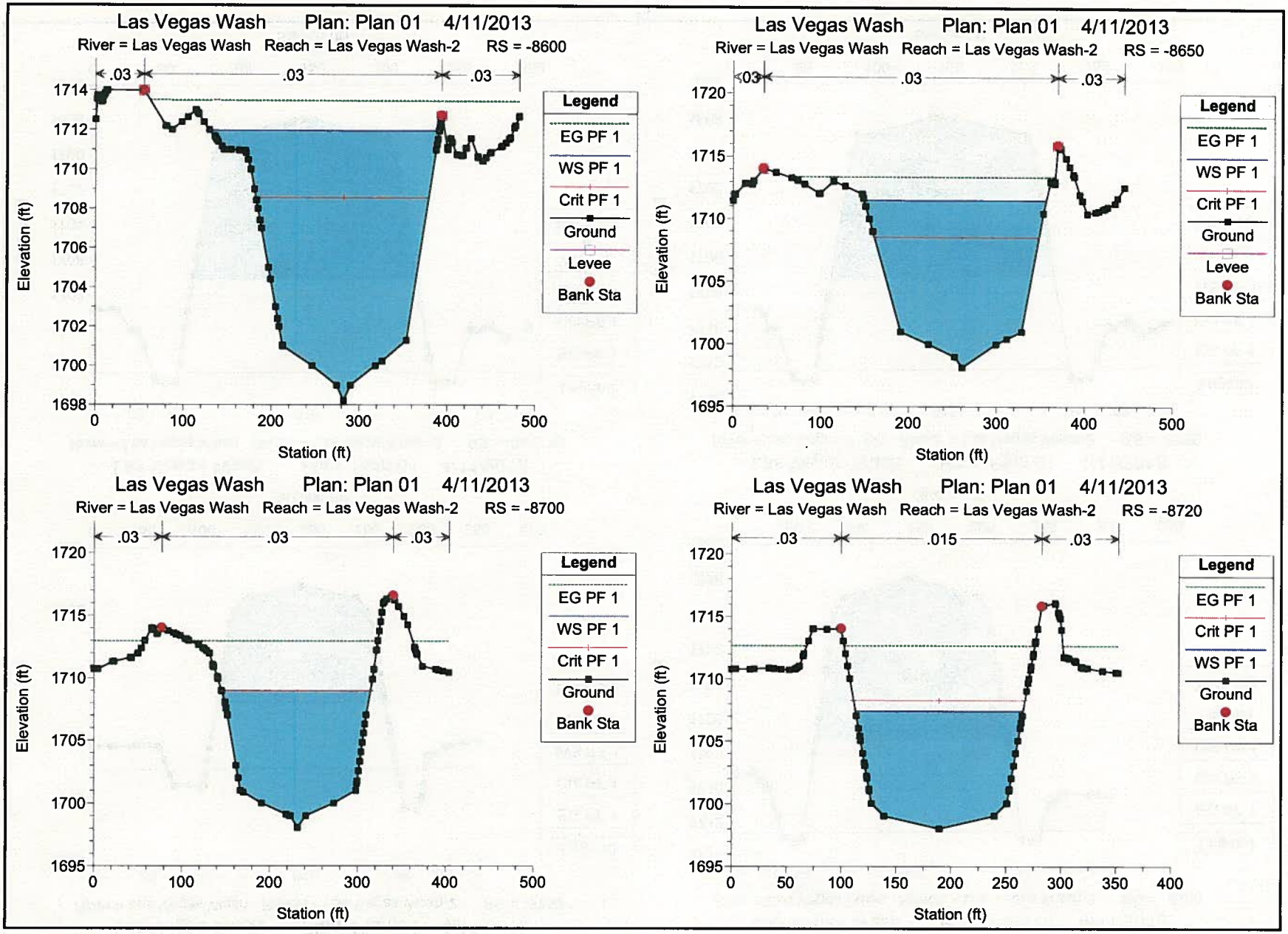

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7550
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

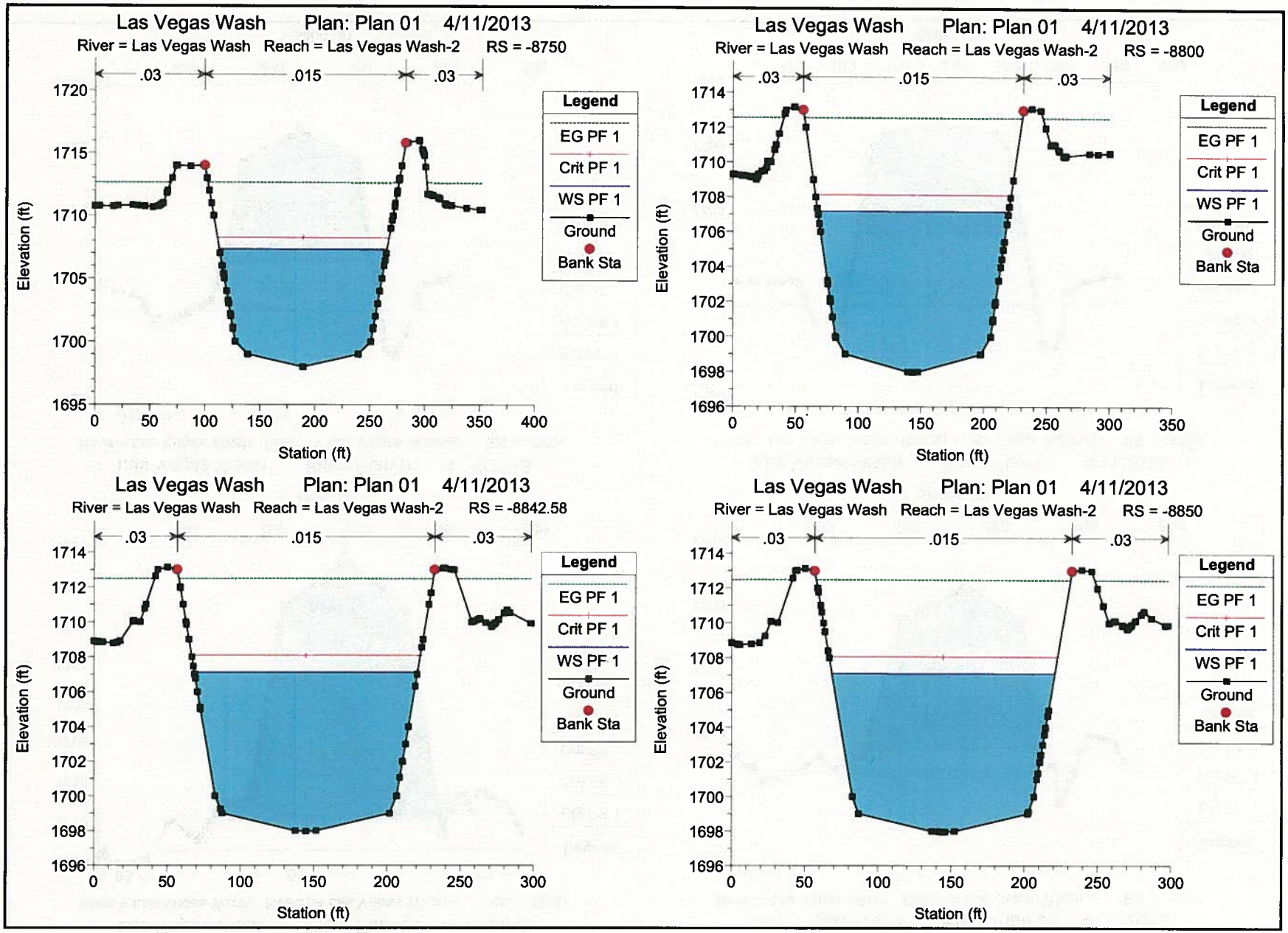

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7600
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7650
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7680.8
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7700 IS

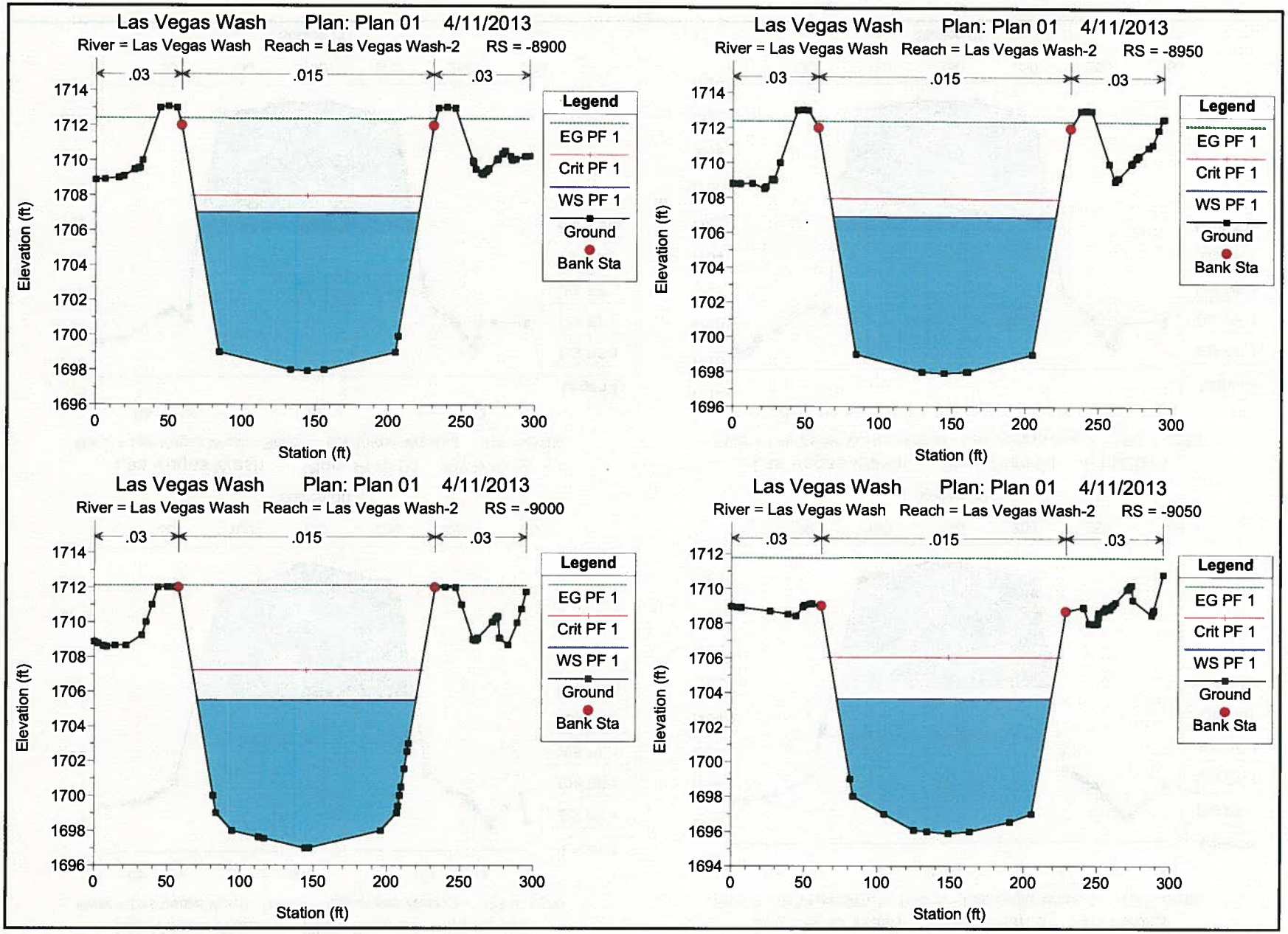

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7750
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7800
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7850
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -7900

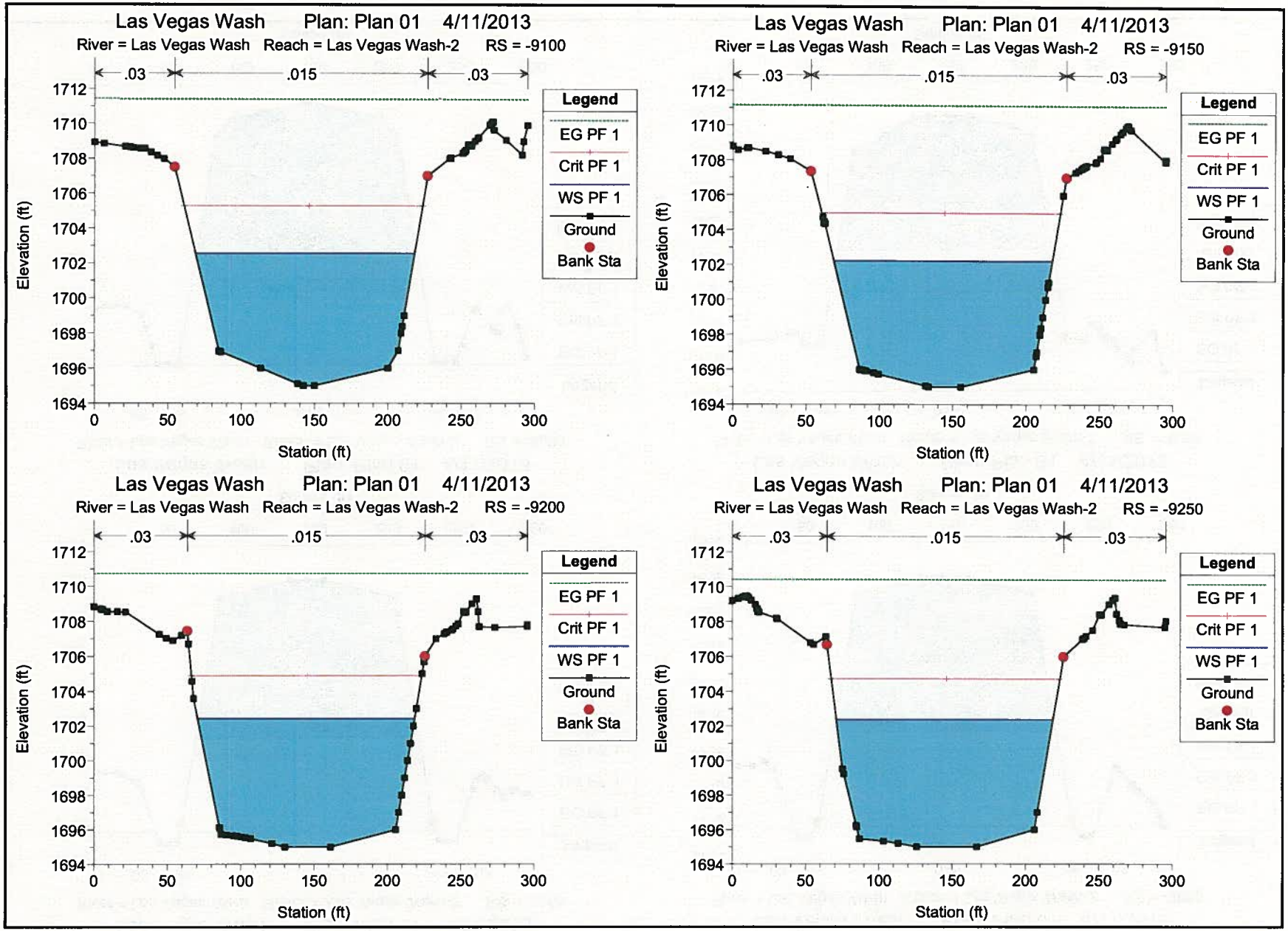

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -8000
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash RS = -8050
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8300
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8350
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta

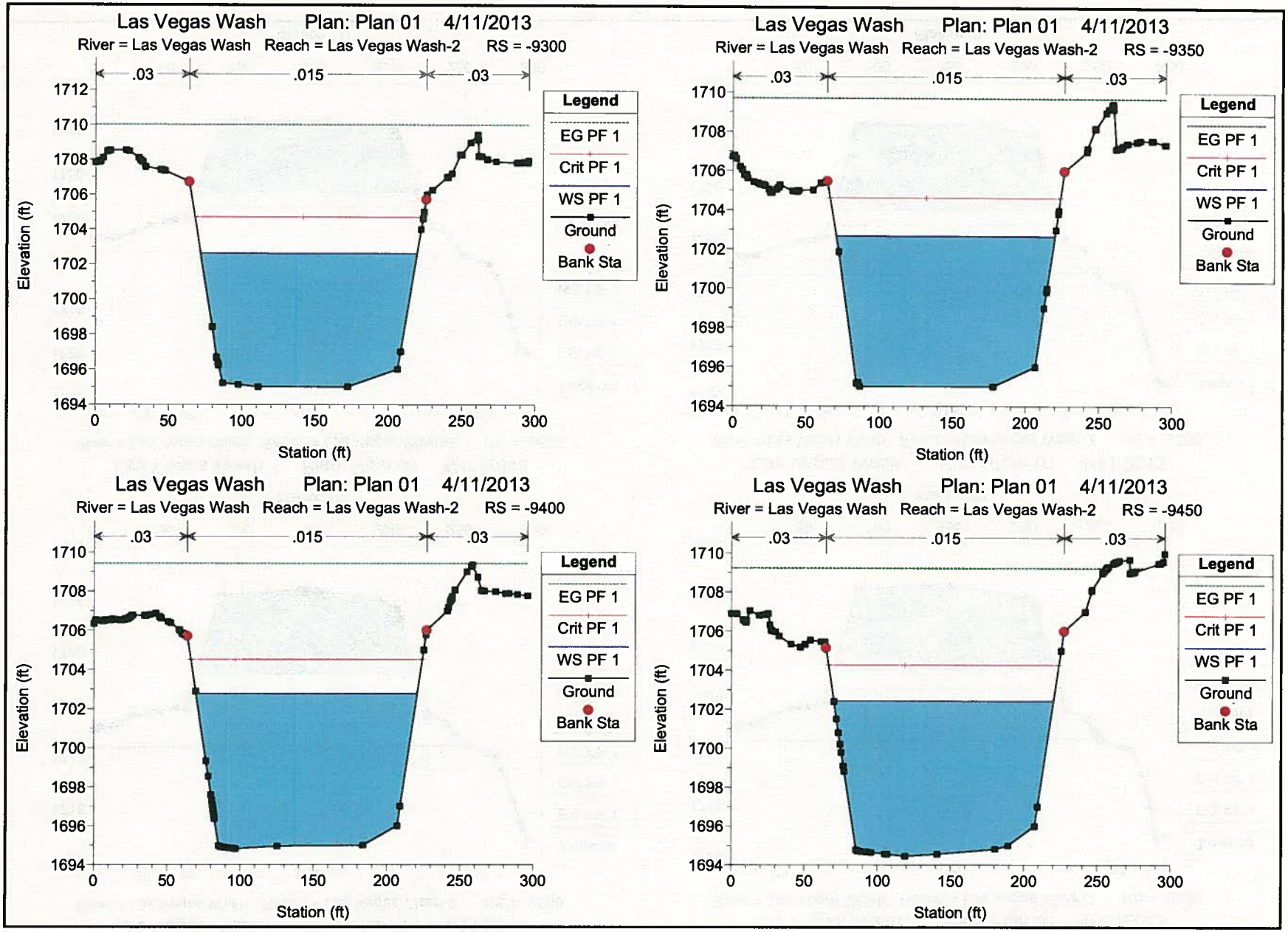

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8400
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8450
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8500
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8550
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta

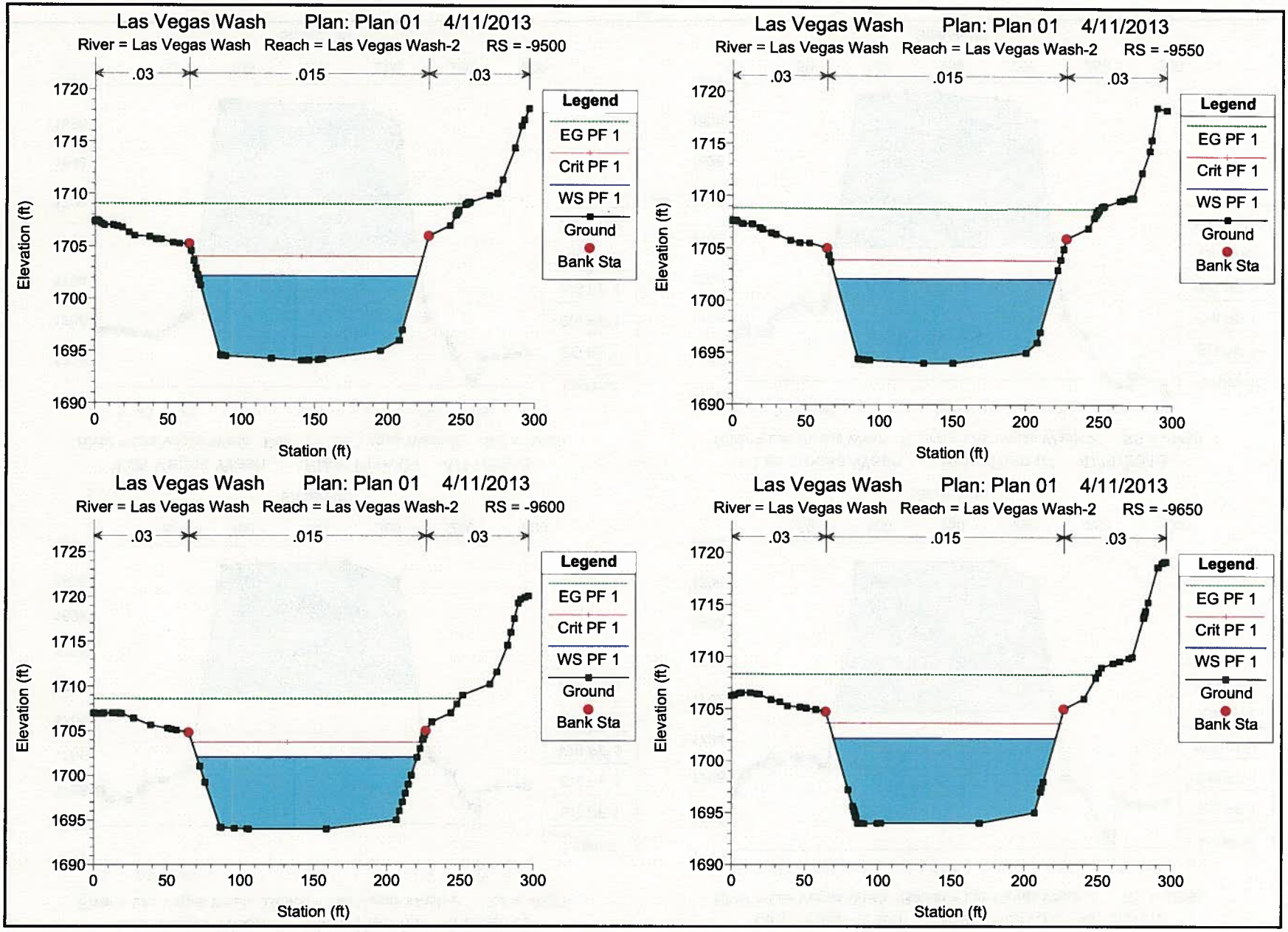

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8600
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8650
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8700
.03
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8720
.03
.015
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

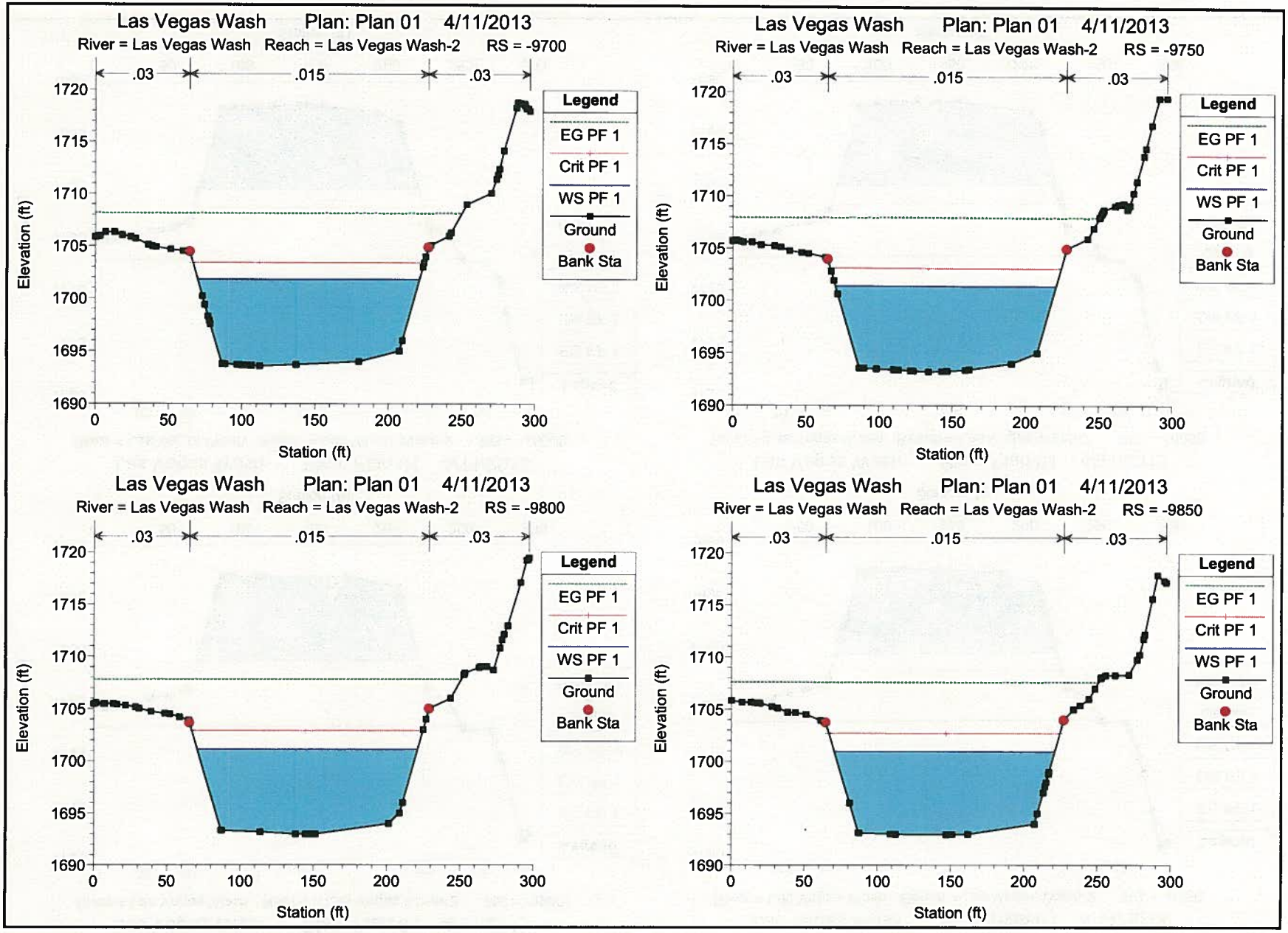

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8750
.03 .015 .03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8800
.03 .015 .03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8842.58
.03 .015 .03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8850
.03 .015 .03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

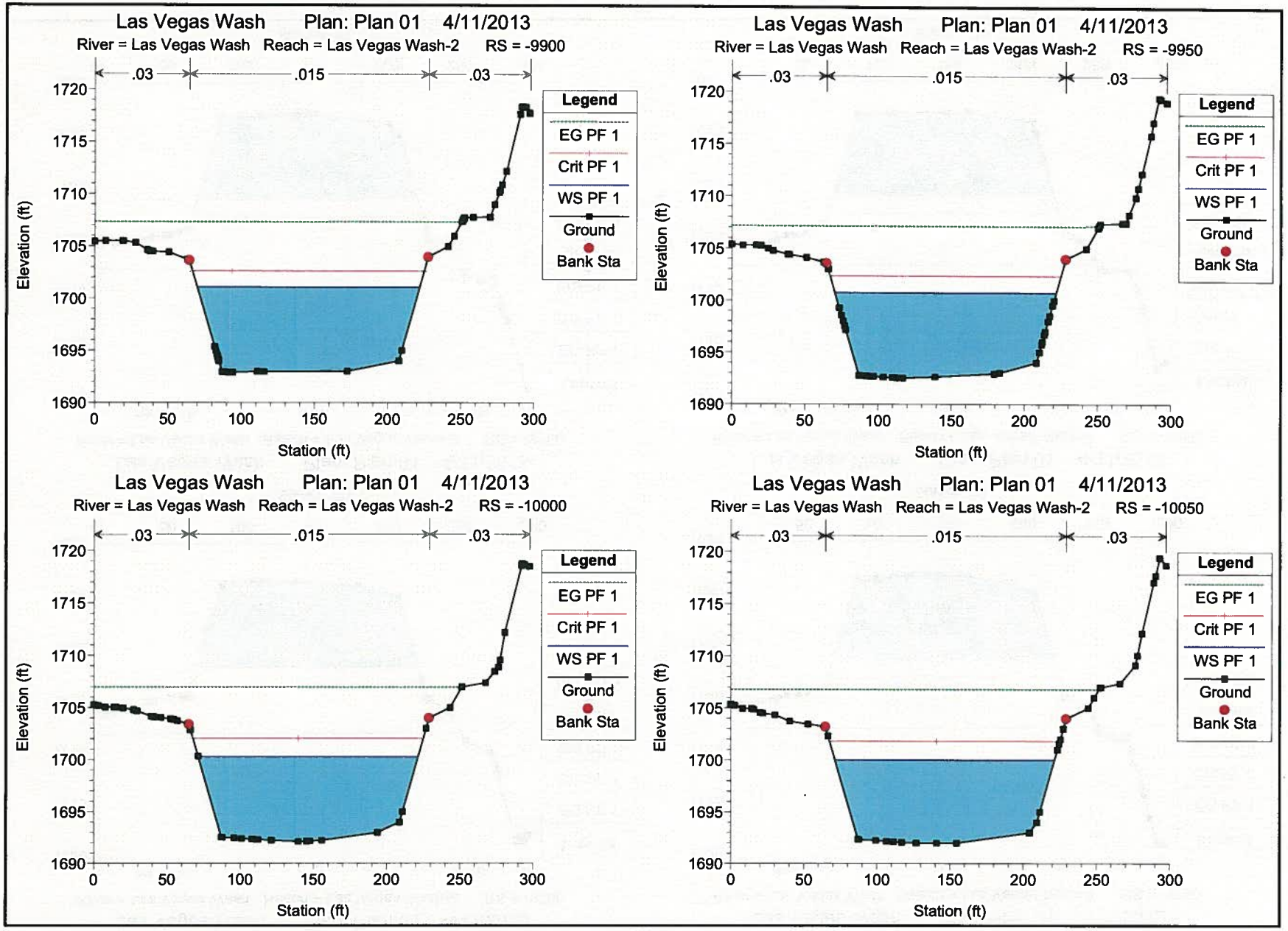

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8900
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -8950
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9000
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9050

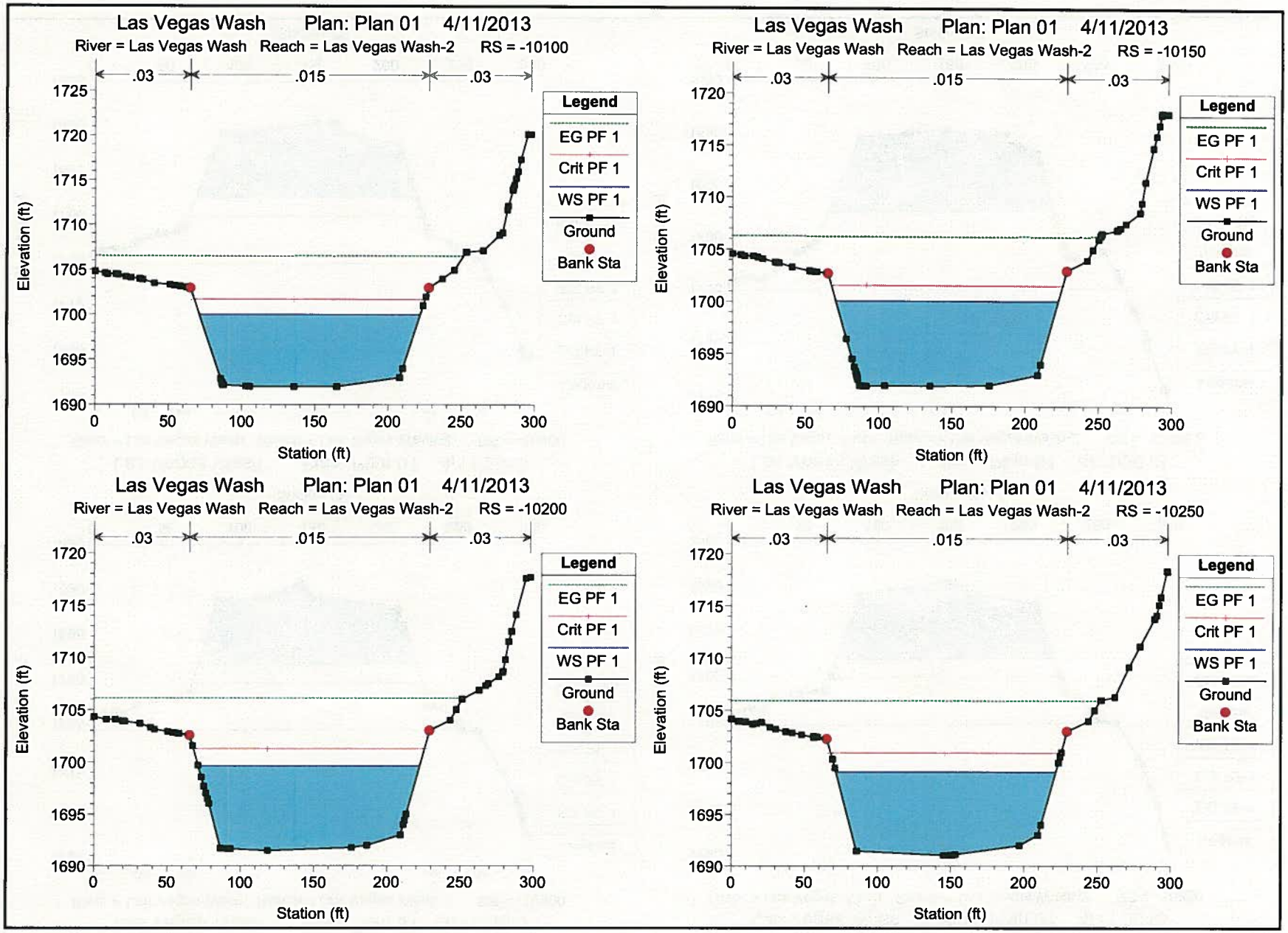

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9100
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9150
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9200
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9250

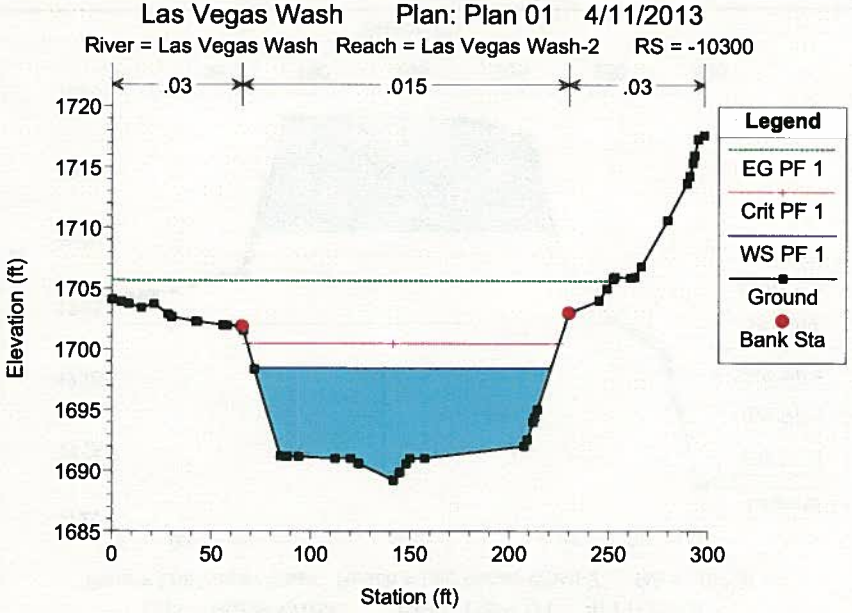

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9300
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9350
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9400
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9450

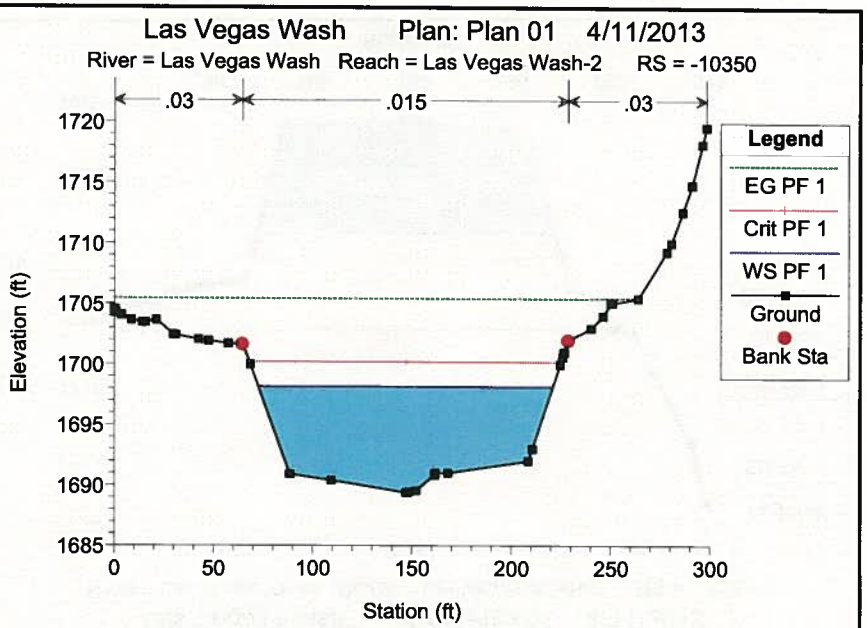

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9500
.03
.015
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9550
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9600
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9650

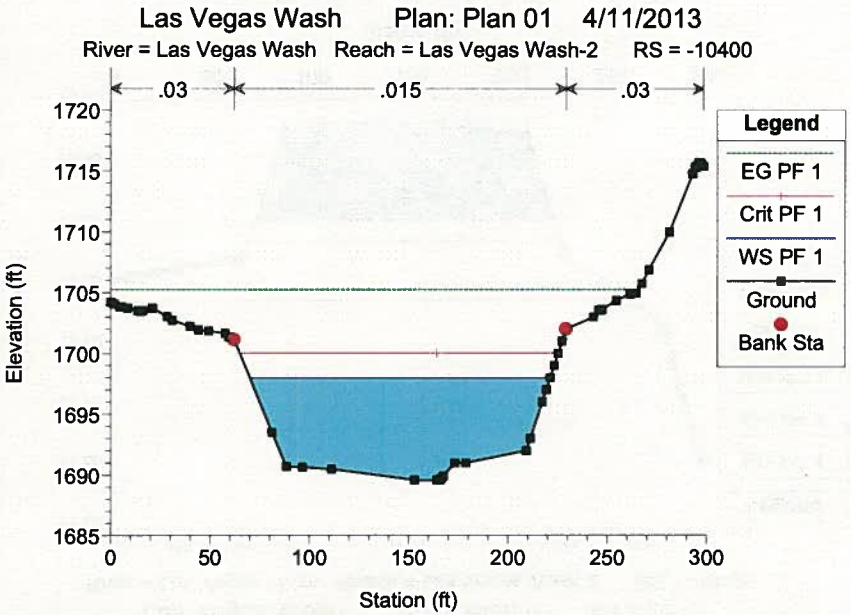

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9700
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9750
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9800
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9850

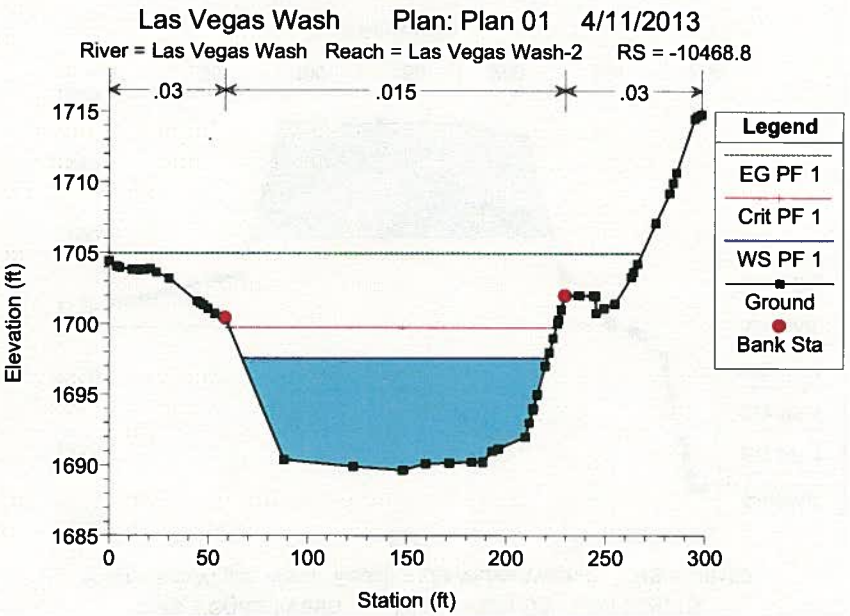

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9900
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -9950
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10000
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10050

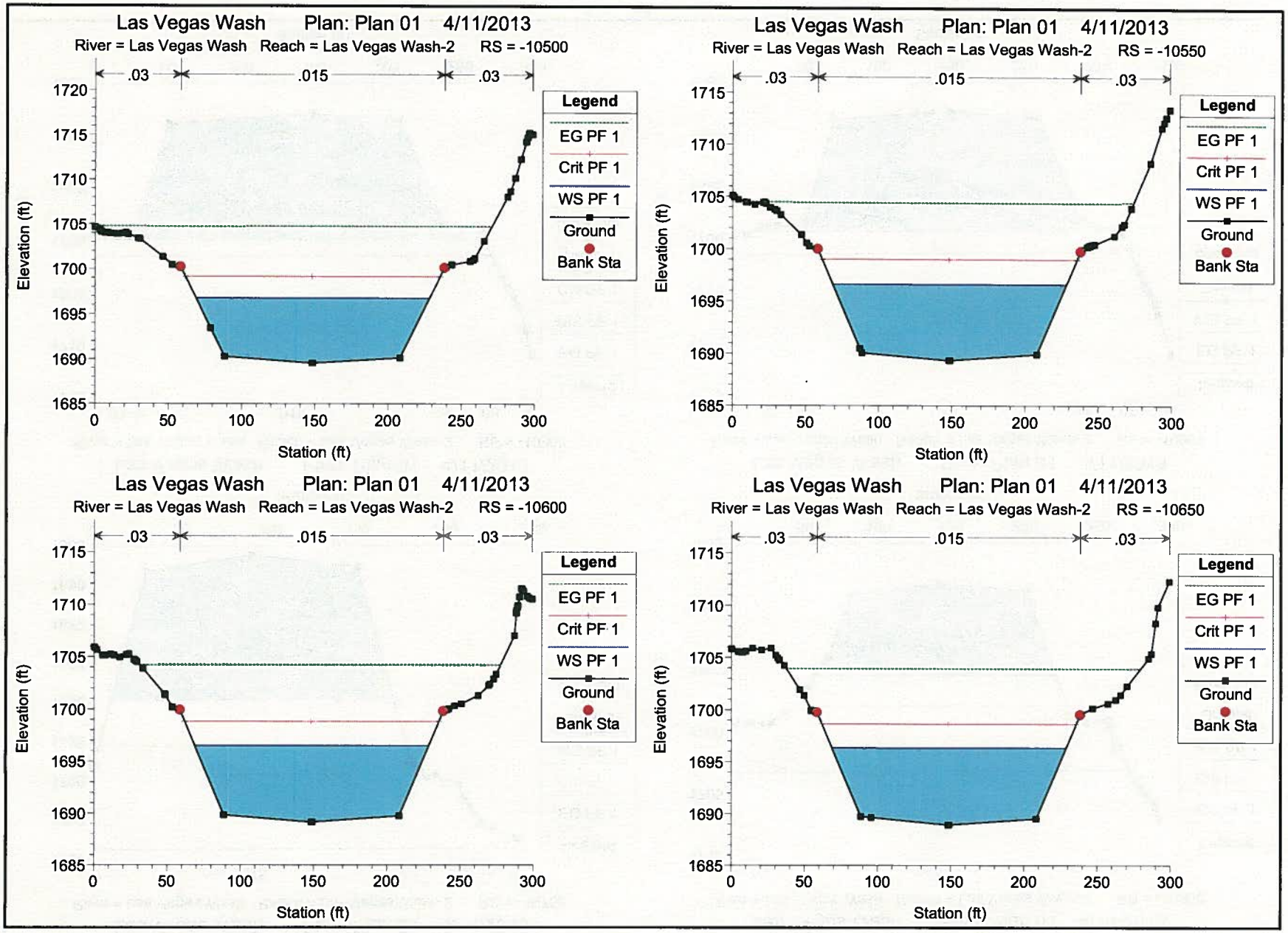

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10100
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10150
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10200
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10250

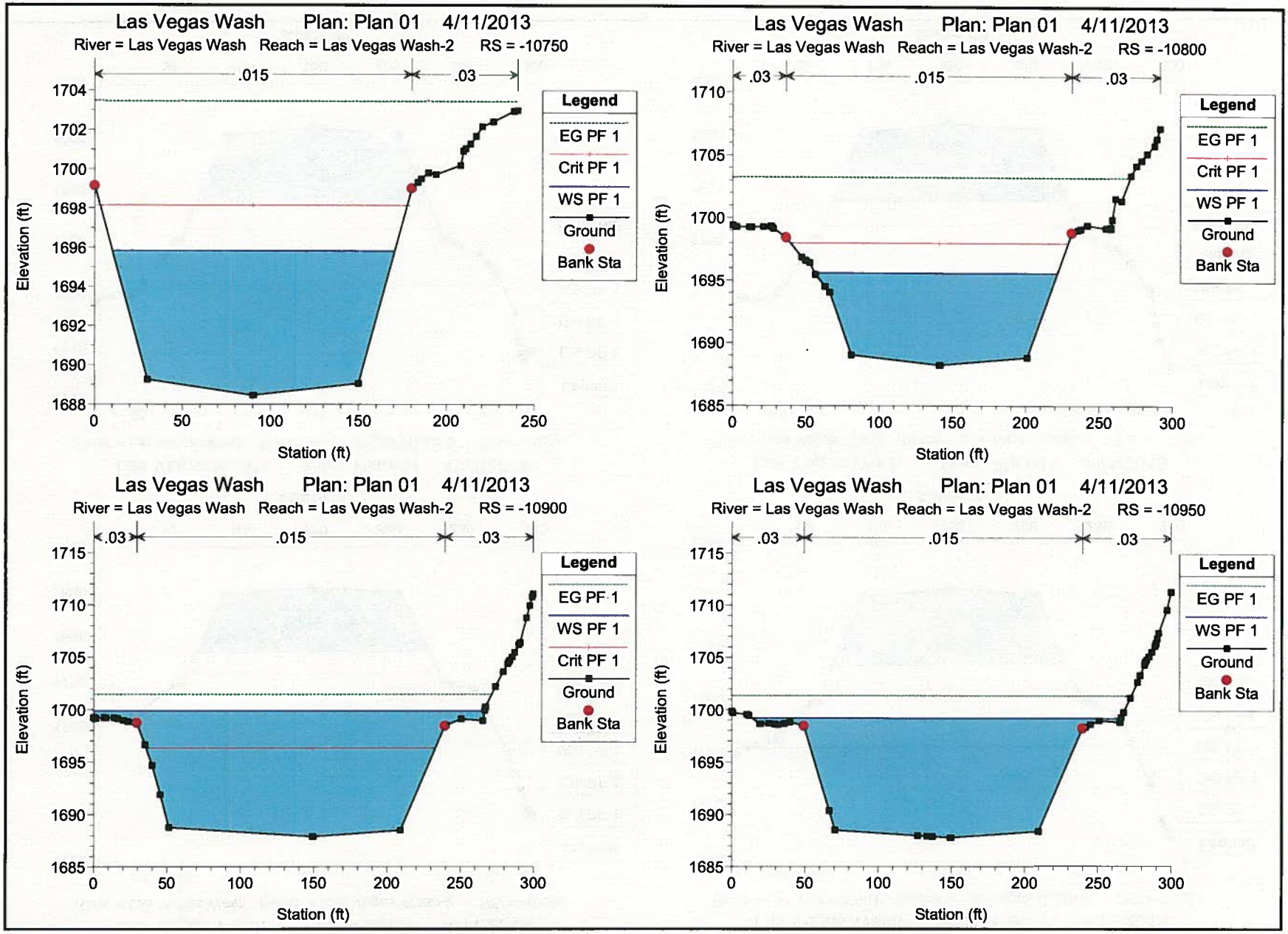

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10300
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

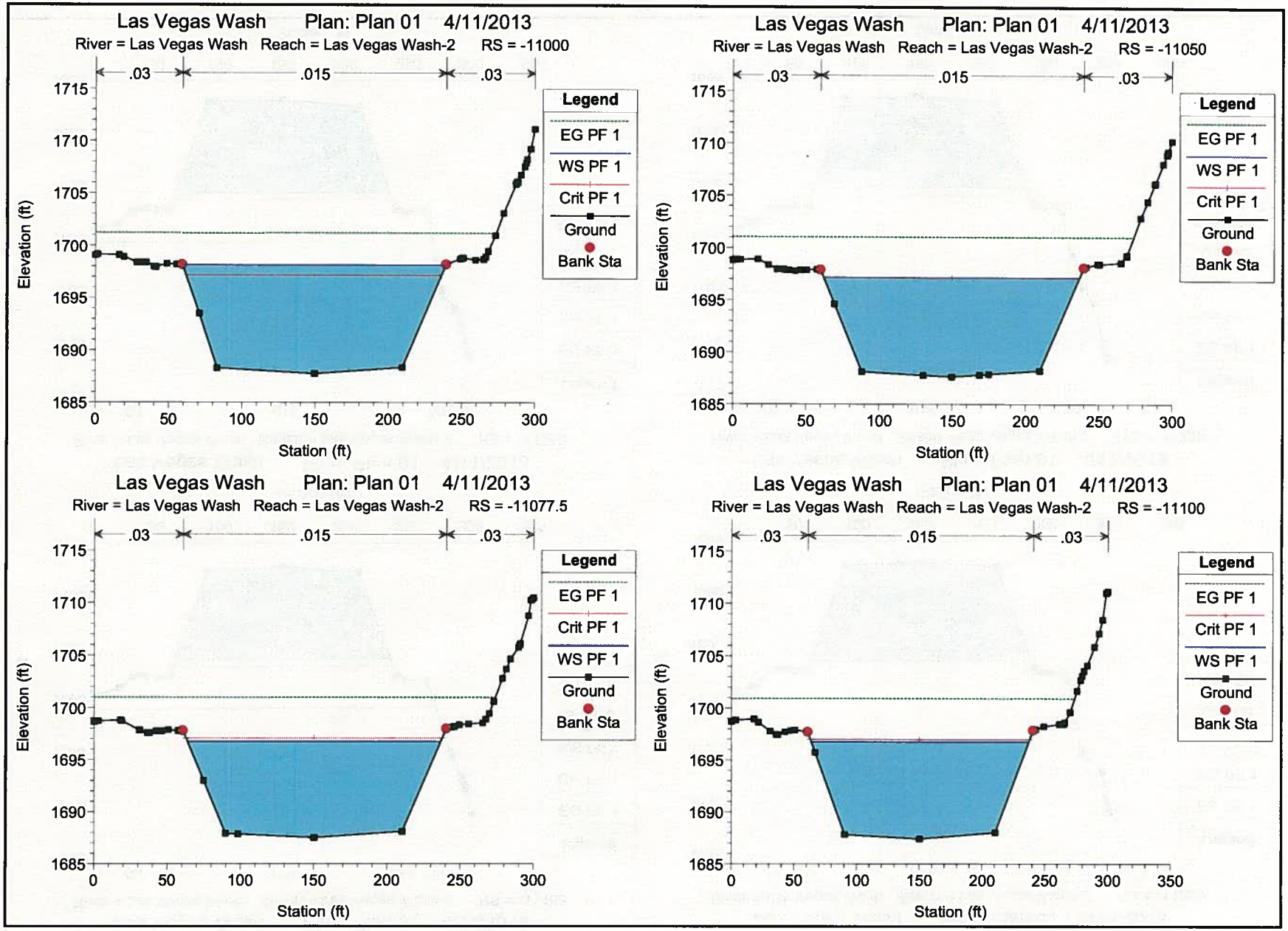

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10350
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

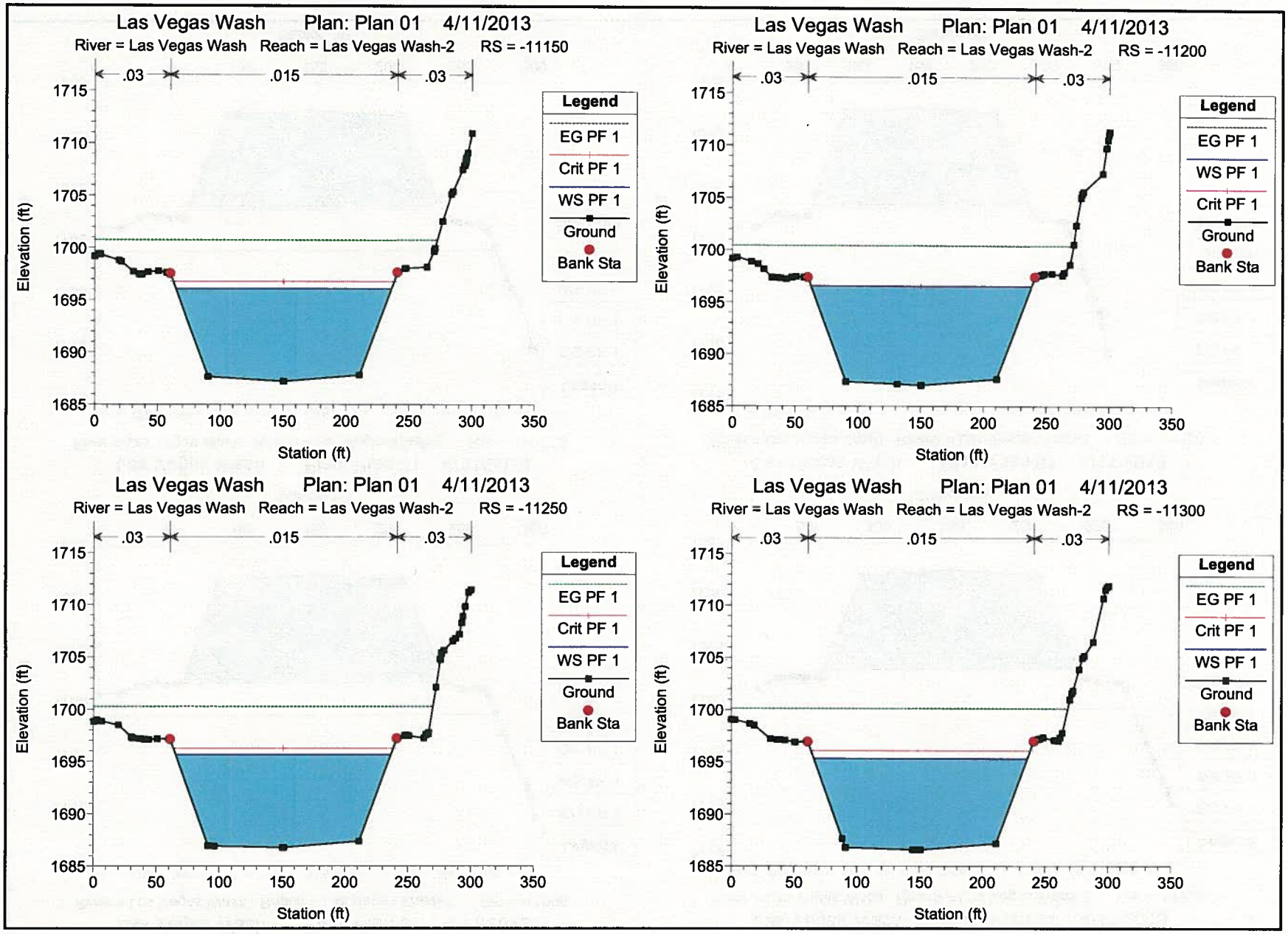

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10400
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

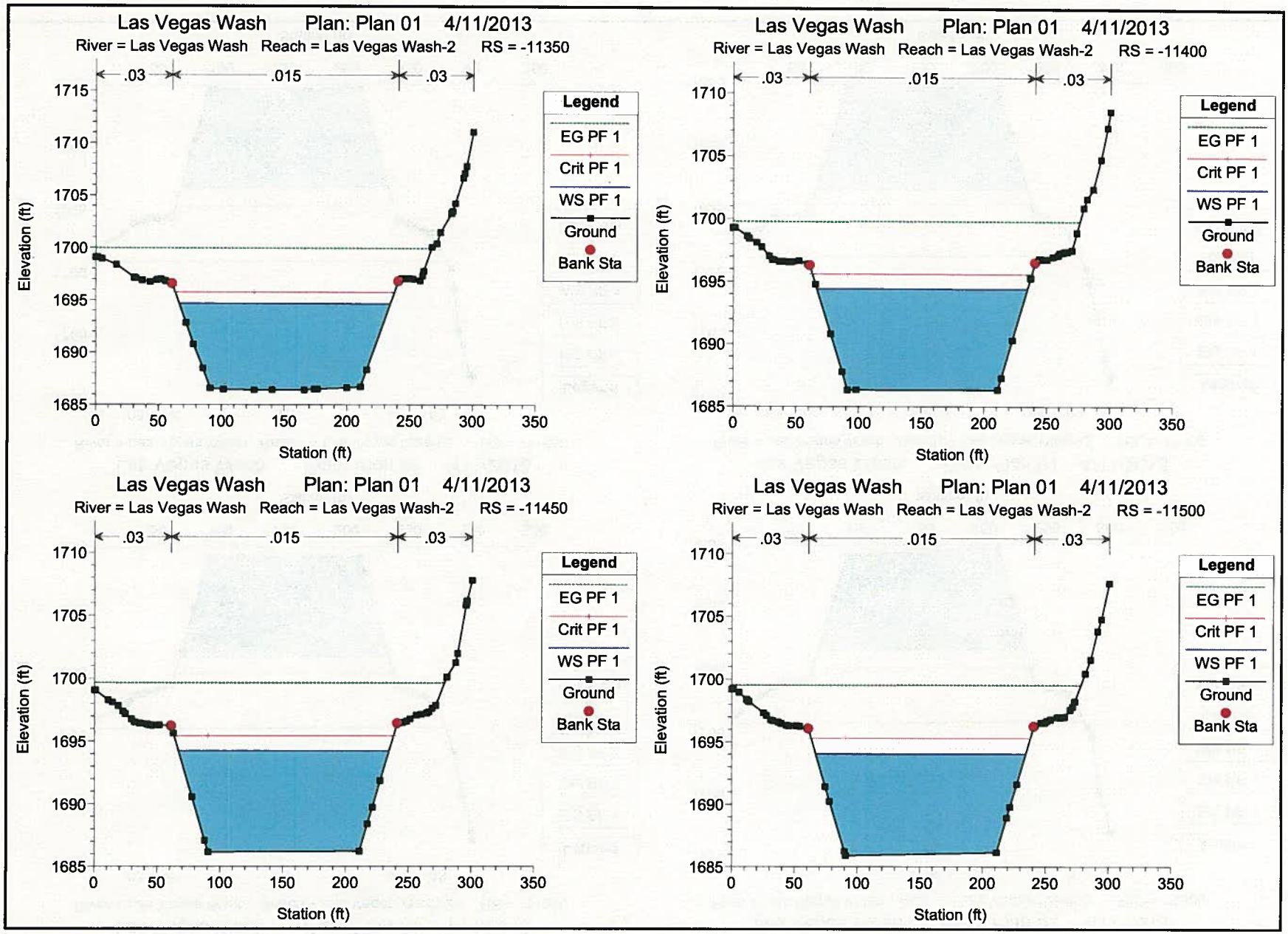

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10468.8
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

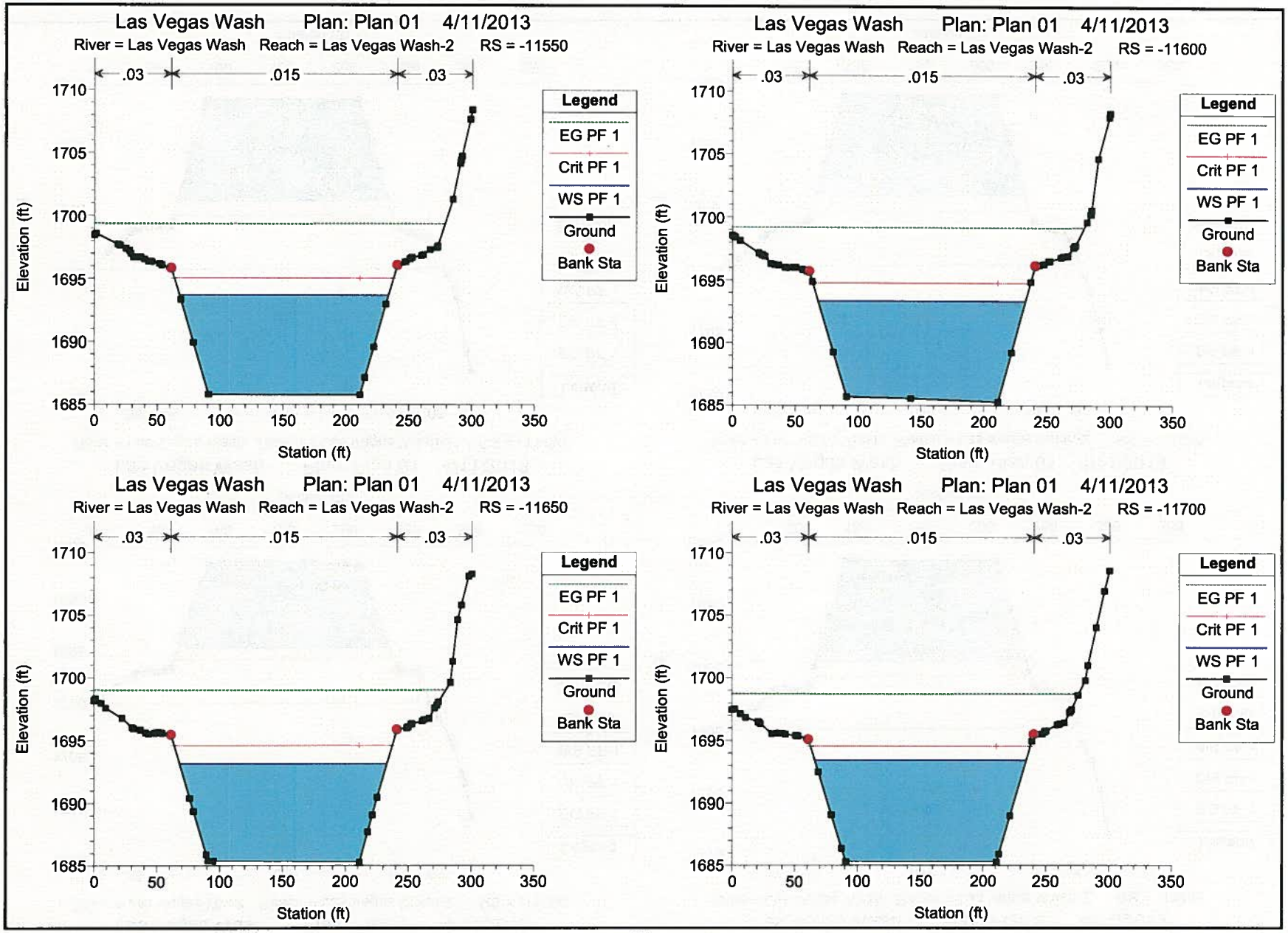

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10500
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10550
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10600
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10650

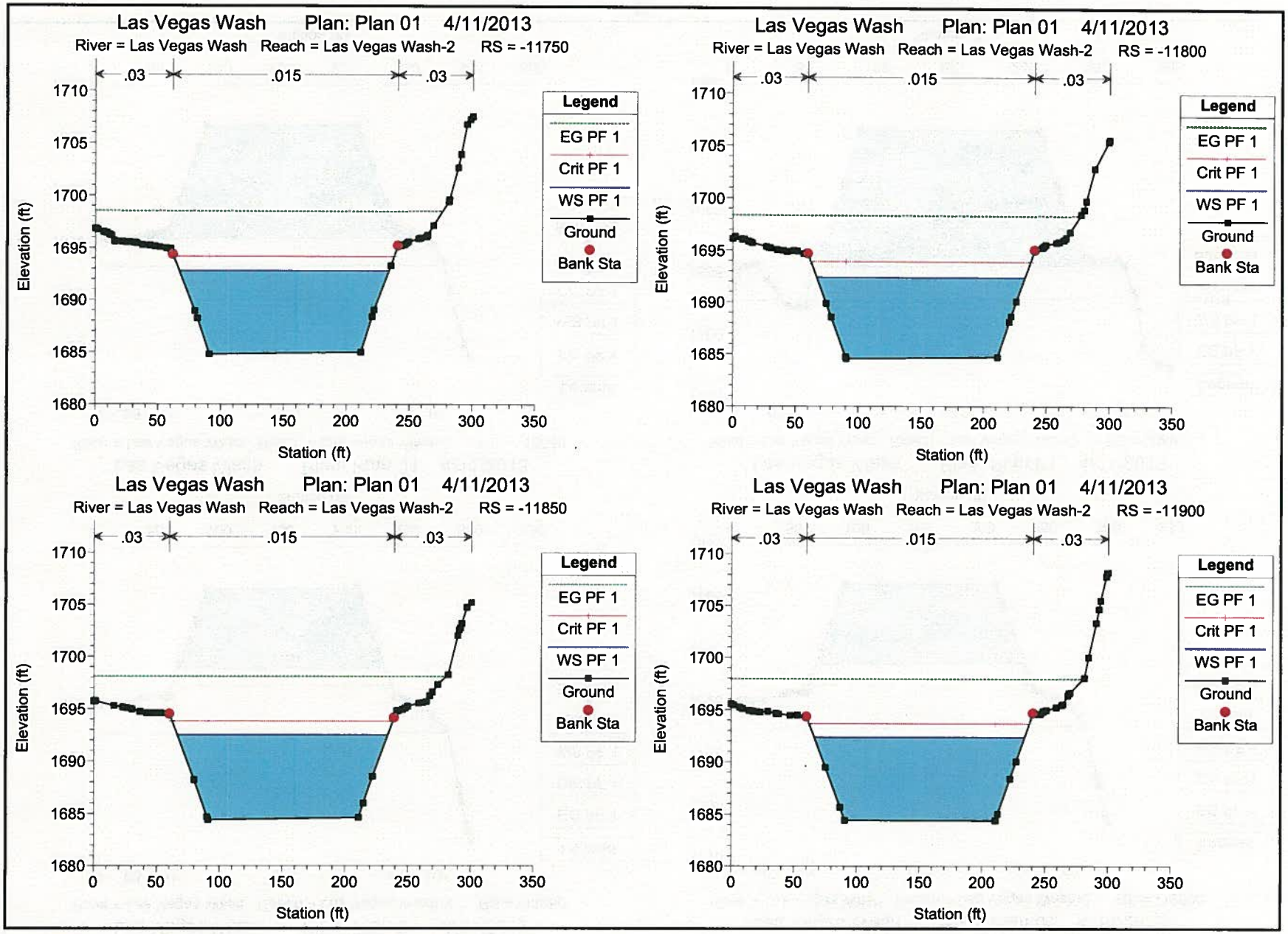

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10750
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10800
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10900
.03
.015
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -10950
.03
.015
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

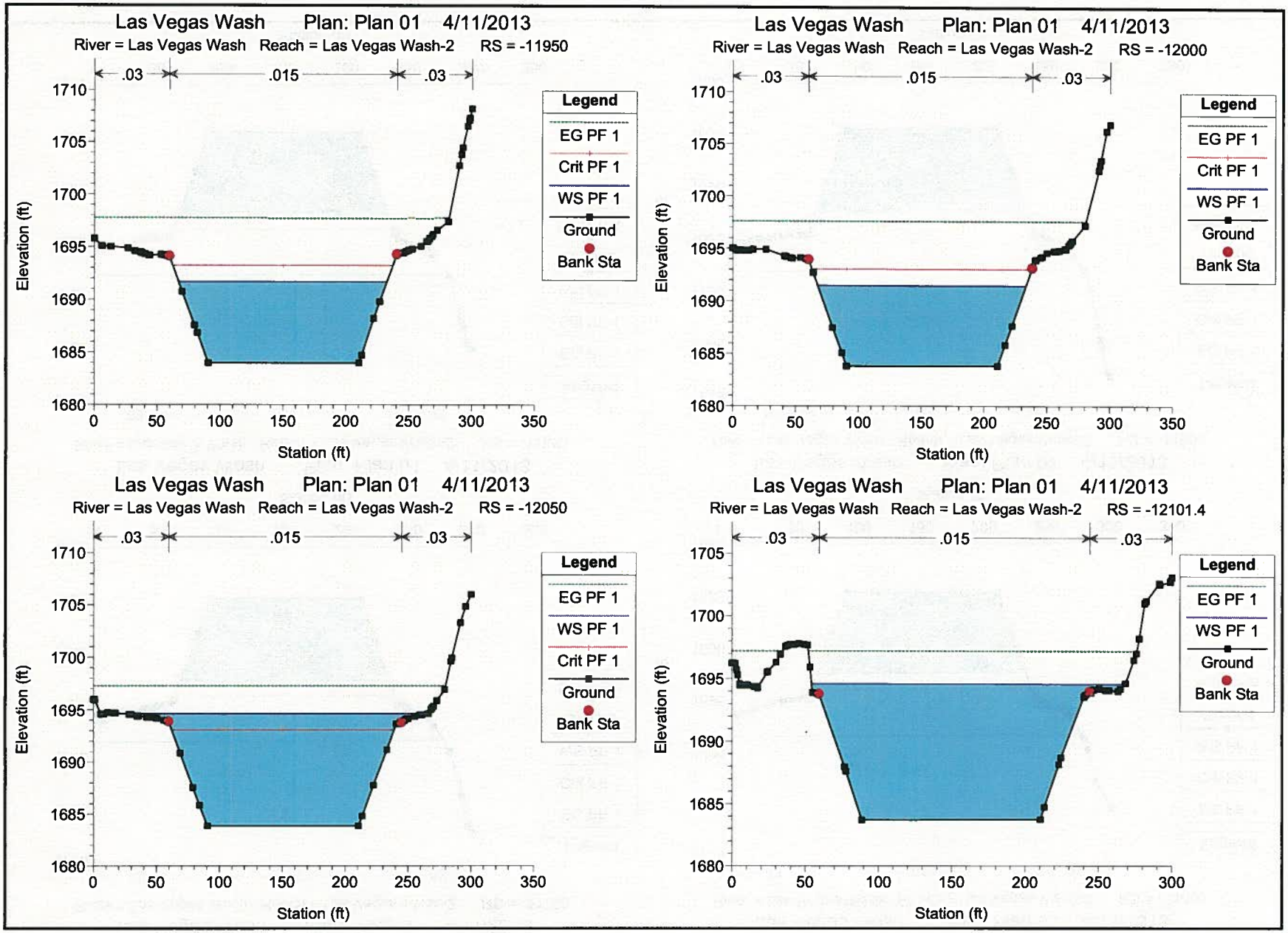

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11000
.03
.015
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11050
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11077.5
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11100

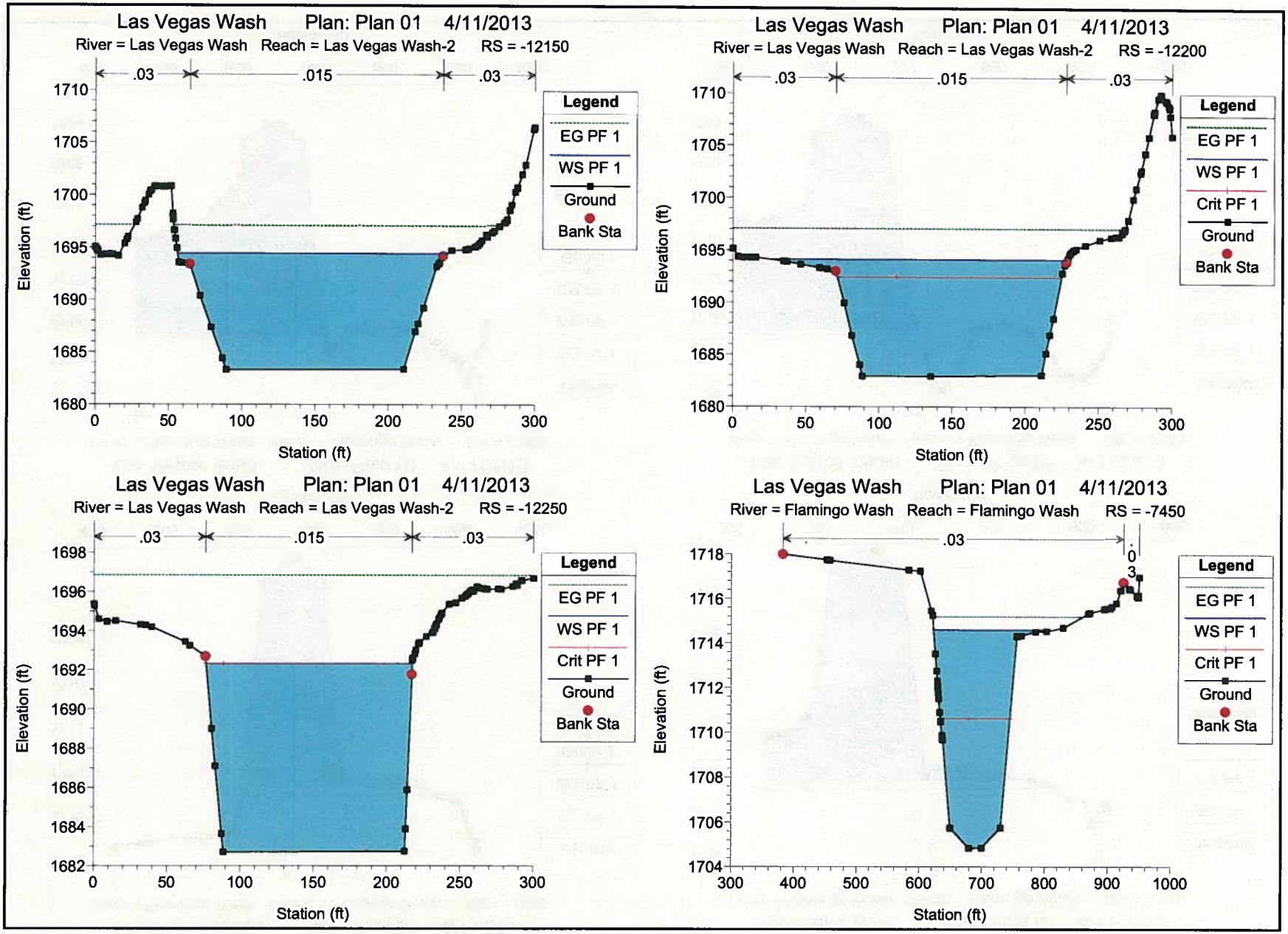

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11150
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11200
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11250
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11300

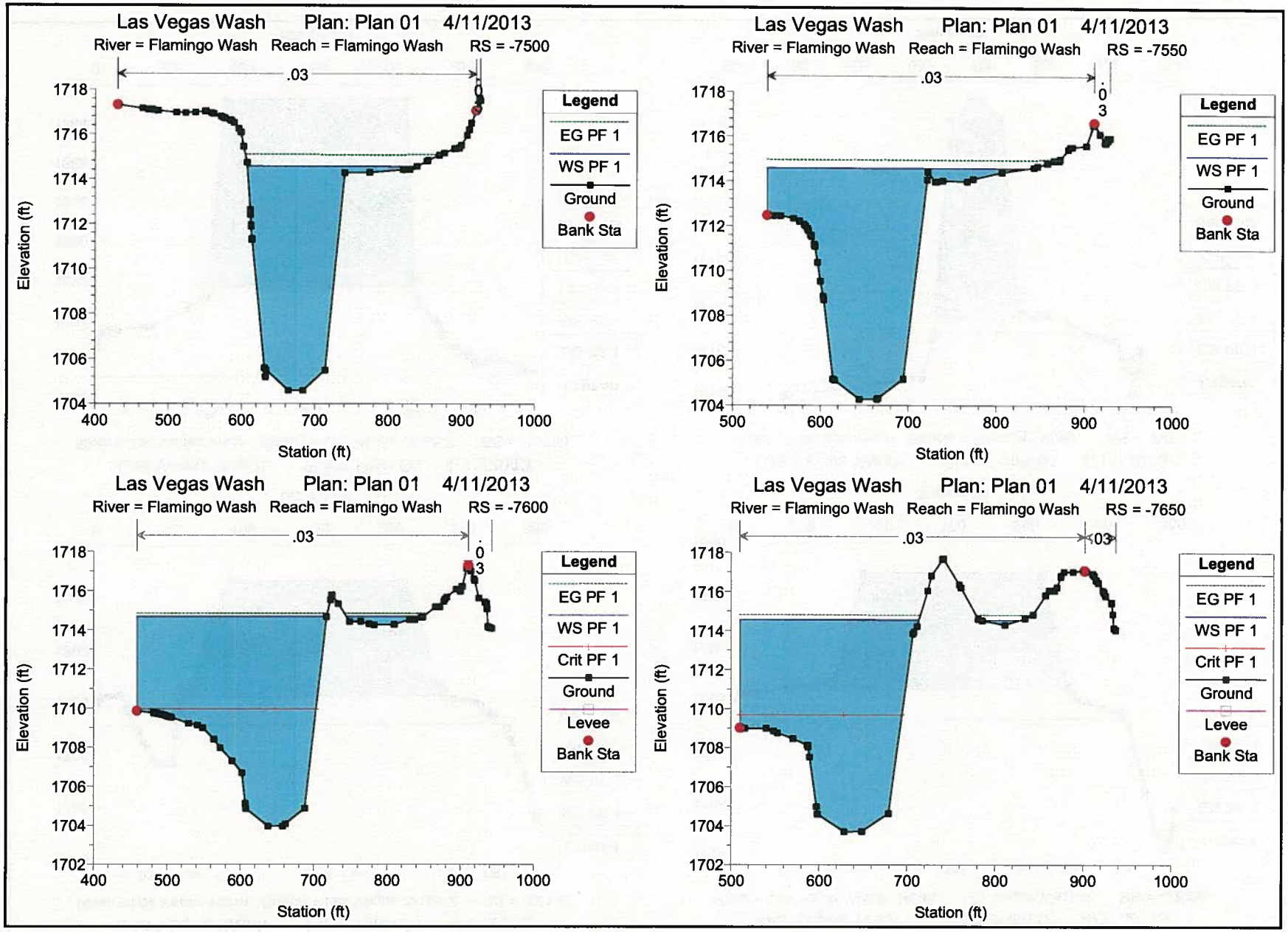

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11350
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11400
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11450
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11500

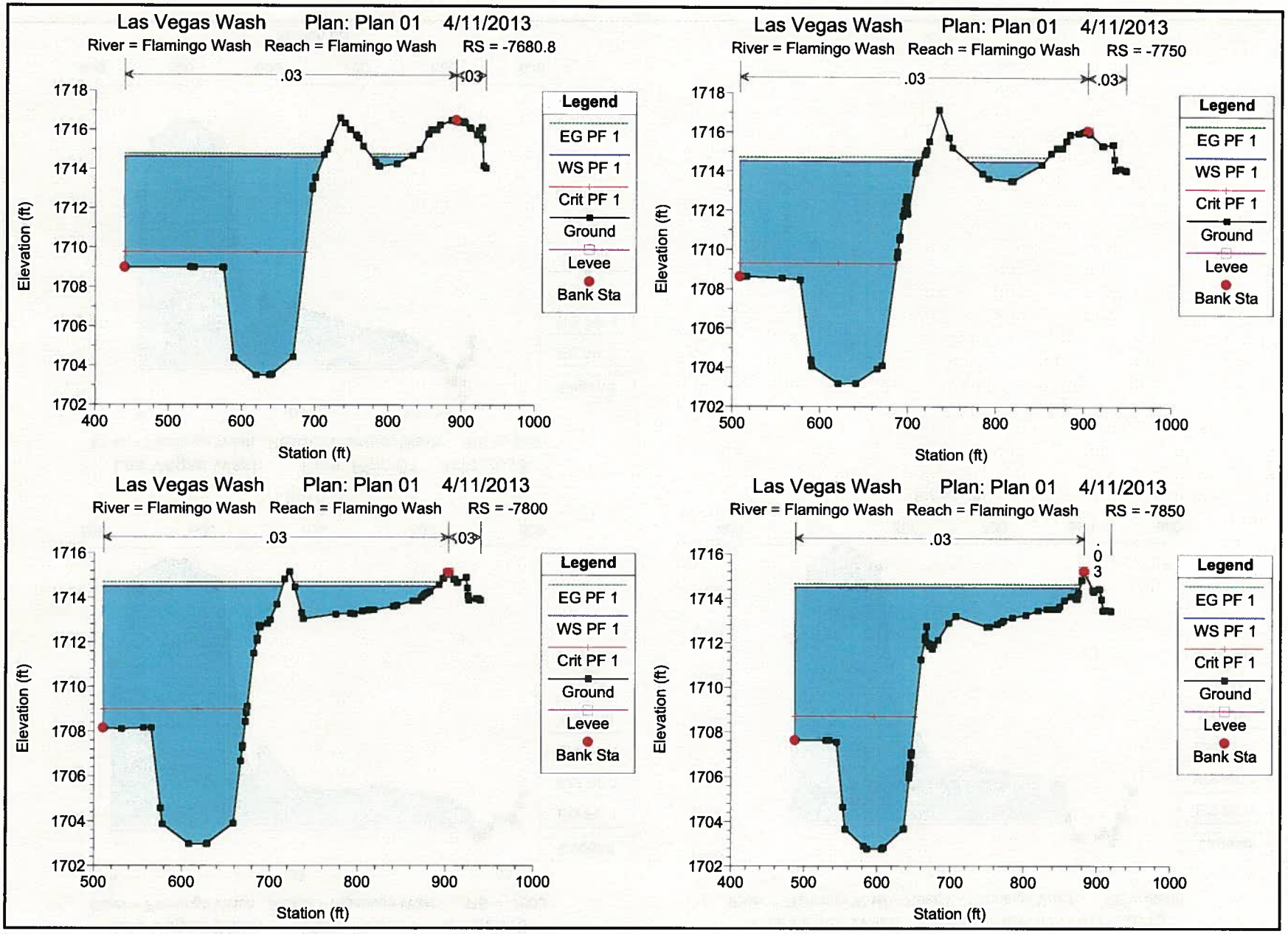

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11550
.03
.015
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11600
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11650
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11700

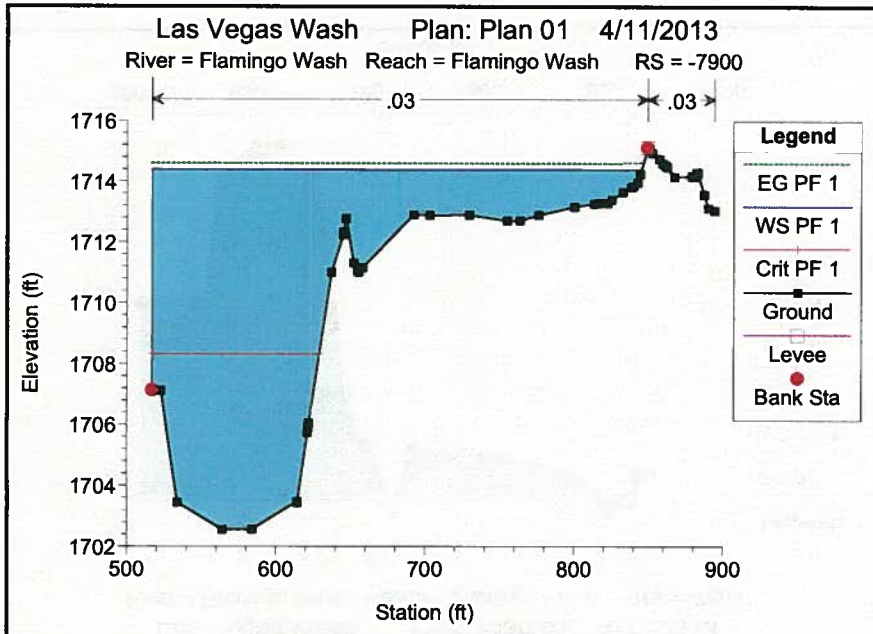

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11750
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11800
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11850
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11900

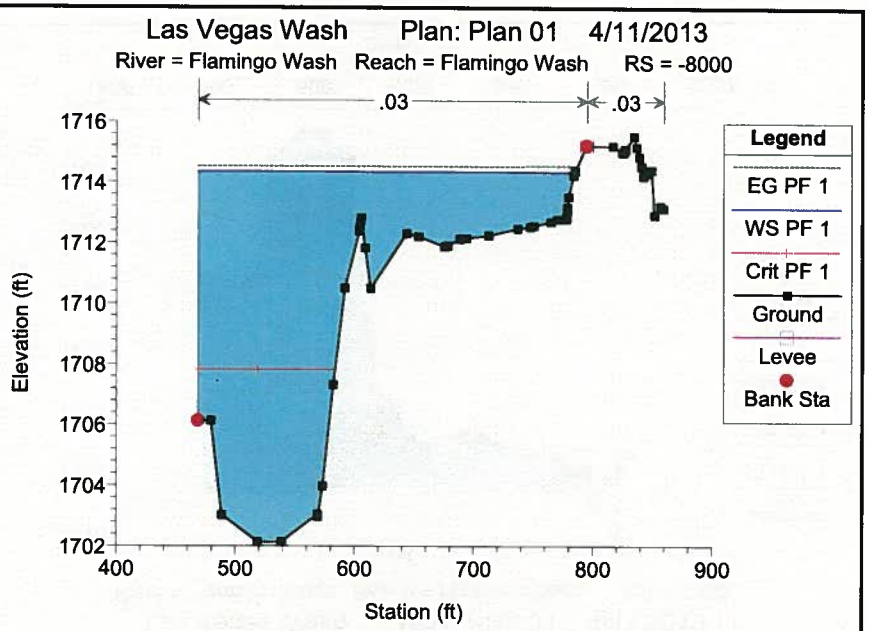

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -11950
.03
.015
.03
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -12000
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -12050
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -12101.4

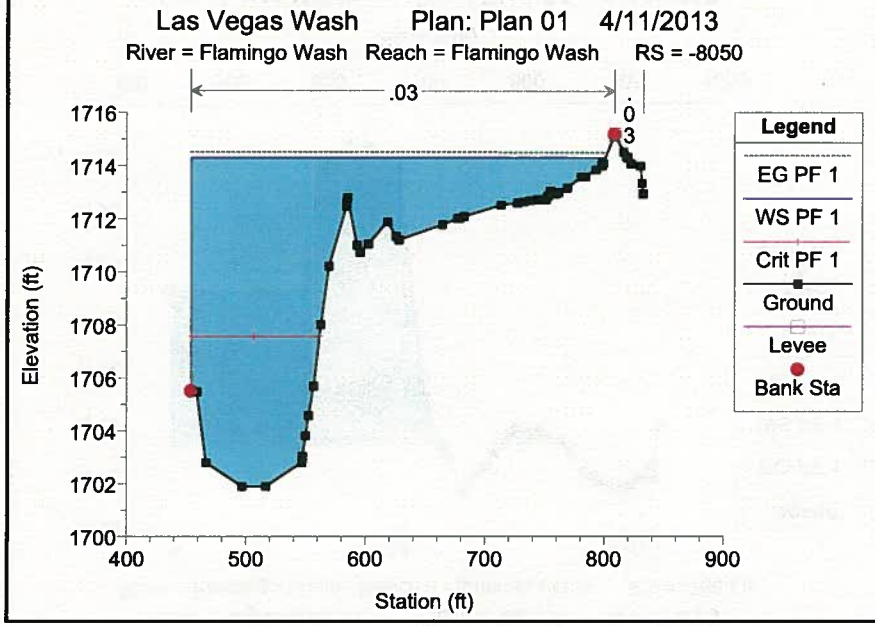

Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -12150
.03
.015
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -12200
.03
.015
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Las Vegas Wash Reach = Las Vegas Wash-2 RS = -12250
.03
.015
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7450
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)


Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7500
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7550
.03
.03
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7600
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7650
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7680.8
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7750
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7800
.03
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7850
.03
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -7900
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta


Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -8000
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta


Las Vegas Wash Plan: Plan 01 4/11/2013
River = Flamingo Wash Reach = Flamingo Wash RS = -8050
.03
.03
Elevation (ft)
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Levee
Bank Sta



Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix B-2

WSPG ANALYSIS – ULITIMATE CONDITION – NELLIS BOULEVARD TO CEDAR AVENUE

Las Vegas Wash - Cedar to Nellis
WSPG Profile Main Channel
30% Submittal - Ultimate condition with bulked bridge piers
April 9, 2013

STATION	LOCATION	TOE OF WALL ELEV, FT	CHANNEL CENTER ELEV, FT	ADJACENT GROUND ELEV, FT	W.S. ELEV, FT	DEPTH, FT	Q, CFS	VELOC., FT/S	VELOC. HEAD, FT	ENERGY GRADE LINE, FT	CRITICAL DEPTH, FT	FROUDE NUMBER	SLOPE AT WALL, FT/FT	CHANNEL SLOPE, FT/FT	NORMAL DEPTH, FT	BEND RADIUS, FT	CHANNEL WIDTH, FT	SUPER ELEVATION (SE), FT	HGL (WSE + SE) ELEVATION, FT	FREEBOARD (FB), FT	WSE+FB+SE, ELEVATION, FT	MIN WALL HEIGHT, FT
78+74.24	End Rectangular Channel	16.90	16.05	38.60	32.42	15.52	15156	11.49	2.05	34.47	9.96	0.00	0.0000	0.0014	0.00		85	0.000	32.42			
73+32.16	CH2M Hill Tie In Point	17.66	16.81	38.10	32.55	14.89	15156	11.98	2.23	34.77	9.96	0.55	0.0014	0.0014	11.22	600	85	0.316	32.86	2.73	35.59	17.93
70+91.17	PC: R= 600'	18.05	17.20	38.10	32.58	14.53	15156	12.27	2.34	34.92	9.96	0.57	0.0016	0.0016	10.67	600	85	0.331	32.92	2.84	35.75	17.70
69+73.72		18.22	17.37	38.00	32.62	14.40	15156	12.38	2.38	35.00	9.96	0.58	0.0014	0.0016	11.21		85	0.000	32.62	2.88	35.50	17.28
69+73.72	Nellis Bridge Exit	18.22	17.37	38.00	31.94	13.72	15156	13.98	3.04	34.98	10.46	0.00	0.0000	0.0016	0.00		85	0.000	31.94			
68+71.18	Nellis Bridge	18.41	17.56	37.40	32.08	13.66	15156	14.04	3.06	35.14	10.46	0.67	0.0019	0.0016	12.80		85	0.000	32.08	3.56	35.64	17.22
68+71.18	Nellis Bridge Entrance	18.41	17.56	37.40	33.29	14.87	15156	11.99	2.23	35.52	9.96	0.00	0.0000	0.0016	0.00		85	0.000	33.29			
68+69.18		18.41	17.56	37.40	33.29	14.87	15156	11.99	2.23	35.52	9.96	0.55	0.0010	0.0016	12.53		85	0.000	33.29	2.73	36.02	17.61
68+54.18	Junction - Nellis Wyoming Channel	18.44	17.59	37.40	33.35	14.91	15083	11.90	2.20	35.55	9.93	0.00	0.0017	0.0016	0.00		85	0.000	33.35			
68+49.29	PT	18.45	17.60	38.00	33.35	14.90	15083	11.91	2.20	35.55	9.93	0.54	0.0016	0.0016	10.63	1000	85	0.000	33.35	2.70	36.05	17.60
67+20.09		18.66	17.81	38.00	33.37	14.71	15083	12.06	2.26	35.63	9.93	0.55	0.0016	0.0016	10.64	1000	85	0.192	33.56	2.76	36.32	17.66
66+60.18	Transition 110' to 85'	19.01	17.91	38.00	34.55	15.55	15083	8.82	1.21	35.76	8.36	0.39	0.0058	0.0016	0.00	1000	110	0.133	34.69	1.71	36.39	17.39
65+36.64		19.20	18.10	38.80	34.56	15.36	15083	8.93	1.24	35.80	8.36	0.40	0.0016	0.0016	8.99	1407	110	0.097	34.66	1.74	36.40	17.20
65+18.64	Junction - Colorado Stormdrain	19.22	18.12	38.80	34.67	15.45	14811	8.72	1.18	35.85	8.26	0.00	0.0011	0.0016	0.00	1407	110	0.092	34.76			
61+70.40		19.80	18.70	38.70	34.68	14.88	14811	9.05	1.27	35.95	8.26	0.41	0.0017	0.0016	8.70	1407	110	0.099	34.78	1.77	36.55	16.76
60+59.36	GB: 0.93% to 0.16%	19.99	18.89	39.60	34.68	14.69	14811	9.16	1.30	35.99	8.26	0.42	0.0018	0.0016	8.56	1407	110	0.102	34.78	1.80	36.59	16.60
59+97.59		20.57	19.47	40.18	34.57	14.01	14811	9.61	1.43	36.01	8.26	0.45	0.0093	0.0093	5.07	1407	110	0.112	34.69	1.93	36.62	16.05
59+40.47		21.10	20.00	40.71	34.45	13.36	14811	10.08	1.58	36.03	8.26	0.49	0.0093	0.0093	5.07	1407	110	0.123	34.58	2.08	36.65	15.56
58+88.00		21.59	20.49	41.20	34.32	12.73	14811	10.57	1.74	36.06	8.26	0.52	0.0093	0.0093	5.07	1407	110	0.136	34.46	2.23	36.69	15.10
58+59.22	PCC: R= 1407'	21.85	20.75	40.50	34.23	12.38	14811	10.87	1.84	36.07	8.26	0.55	0.0093	0.0093	5.07	1407	110	0.143	34.38	2.33	36.71	14.86
58+14.11		22.27	21.17	40.92	34.08	11.81	14811	11.41	2.02	36.10	8.26	0.59	0.0093	0.0093	5.07	1119.342	110	0.199	34.28	2.52	36.80	14.53
57+78.65		22.60	21.50	41.25	33.93	11.33	14811	11.89	2.19	36.12	8.26	0.62	0.0093	0.0093	5.07	1119.342	110	0.216	34.14	2.70	36.84	14.24
57+78.65		22.60	21.50	41.25	28.41	5.80	14811	23.20	8.36	36.76	8.26	1.70	0.0093	0.0093	5.07	1119.342	110	0.821	29.23	2.04	31.27	8.67
57+09.73		23.24	22.14	41.00	29.17	5.93	14811	22.72	8.01	37.18	8.26	1.64	0.0093	0.0093	5.07	1119.342	110	0.788	29.96	2.03	31.99	8.74
56+97.73	Junction - Charleston 12'x9' RCB	23.35	22.25	41.80	28.86	5.51	14438	23.84	8.83	37.69	8.12	0.00	0.0093	0.0093	0.00	1119.342	110	0.867	29.73			
56+85.45	PC: R= 1119.34'	23.47	22.37	41.80	28.99	5.52	14438	23.77	8.78	37.77	8.12	1.78	0.0095	0.0093	4.95	1119.342	110	0.862	29.85	2.05	31.90	8.43
56+50.67		23.79	22.69	40.60	29.36	5.56	14438	23.59	8.64	38.00	8.12	1.76	0.0093	0.0093	4.99		110	0.000	29.36	2.04	31.40	7.61
56+50.67	Charleston Bridge Exit	23.79	22.69	40.60	30.45	6.66	14438	22.13	7.60	38.06	8.77	0.00	0.0000	0.0093	0.00		110	0.000	30.45			
55+53.35	Charleston Bridge	24.70	23.60	39.60	31.48	6.78	14438	21.73	7.33	38.81	8.77	1.47	0.0093	0.0093	6.29		110	0.000	31.48	2.03	33.51	8.81
55+53.35	Charleston Bridge Entrance	24.70	23.60	39.60	29.53	4.83	14438	27.16	11.46	40.99	8.12	0.00	0.0000	0.0093	0.00		110	0.000	29.53			
54+41.66	GB: 2% to 0.93%	25.74	24.64	44.60	30.54	4.80	14438	27.35	11.61	42.15	8.12	2.20	0.0093	0.0093	4.99		110	0.000	30.54	2.15	32.69	6.95
54+14.80	PI	26.28	25.18	44.60	31.15	4.87	14438	26.96	11.28	42.43	8.12	2.15	0.0200	0.0200	3.94		110	0.000	31.15	2.14	33.29	7.01
53+65.38	Transition 90' to 110'	27.07	26.17	44.60	33.57	6.51	14438	24.66	9.44	43.01	9.28	1.70	0.0160	0.0200	0.00		90	0.000	33.57	2.15	35.72	8.66
53+46.19		27.45	26.55	44.98	34.11	6.66	14438	24.10	9.02	43.13	9.28	1.65	0.0200	0.0200	4.49		90	0.000	34.11	2.13	36.24	8.79
53+12.51		28.12	27.22	45.66	35.10	6.98	14438	22.98	8.20	43.30	9.28	1.53	0.0200	0.0200	4.49		90	0.000	35.10	2.10	37.20	9.08
52+86.30		28.65	27.75	46.18	35.97	7.32	14438	21.91	7.45	43.42	9.28	1.43	0.0200	0.0200	4.49		90	0.000	35.97	2.06	38.03	9.39
52+66.37		29.04	28.14	46.58	36.72	7.68	14438	20.89	6.78	43.50	9.28	1.33	0.0200	0.0200	4.49		90	0.000	36.72	2.03	38.75	9.71
52+51.85		29.33	28.43	46.87	37.39	8.05	14438	19.92	6.16	43.55	9.28	1.24	0.0200	0.0200	4.49		90	0.000	37.39	2.00	39.39	10.05
52+42.08	GB: 0.27% to 2%	29.53	28.63	44.40	37.98	8.45	14438	18.99	5.60	43.58	9.28	1.15	0.0200	0.0200	4.49		90	0.000	37.98	1.97	39.94	10.41
47+36.32	PI	30.89	29.99	45.00	39.34	8.45	14438	18.99	5.60	44.94	9.28	1.15	0.0027	0.0027	8.45		90	0.000	39.34	1.97	41.30	10.42
46+33.80		31.16	30.26	45.28	39.61	8.45	14438	18.99	5.60	45.21	9.28	1.15	0.0027	0.0027	8.45		90	0.000	39.61	1.97	41.58	10.42
38+79.46		33.19	32.29	47.30	41.31	8.12	14438	19.76	6.06	47.37	9.28	1.22	0.0027	0.0027	8.45		90	0.000	41.31	1.99	43.30	10.11

Las Vegas Wash - Cedar to Nellis
WSPG Profile Main Channel
30% Submittal - Ultimate condition with bulked bridge piers
April 9, 2013

STATION	LOCATION	TOE OF WALL ELEV, FT	CHANNEL CENTER ELEV, FT	ADJACENT GROUND ELEV, FT	W.S. ELEV, FT	DEPTH, FT	Q, CFS	VELOC., FT/S	VELOC. HEAD, FT	ENERGY GRADE LINE, FT	CRITICAL DEPTH, FT	FROUDE NUMBER	SLOPE AT WALL, FT/FT	CHANNEL SLOPE, FT/FT	NORMAL DEPTH, FT	BEND RADIUS, FT	CHANNEL WIDTH, FT	SUPER ELEVATION (SE), FT	HGL (WSE + SE) ELEVATION, FT	FREEBOARD (FB), FT	WSE+FB+SE, ELEVATION, FT	MIN WALL HEIGHT, FT
34+99.07		34.21	33.31	48.32	41.95	7.74	14438	20.72	6.67	48.62	9.28	1.31	0.0027	0.0027	8.45		90	0.000	41.95	2.02	43.98	9.77
32+27.86	PI	34.94	34.04	50.30	42.32	7.38	14438	21.73	7.33	49.66	9.28	1.41	0.0027	0.0027	8.45		90	0.000	42.32	2.06	44.38	9.44
31+52.73		35.14	34.24	50.50	42.41	7.27	14438	22.06	7.56	49.97	9.28	1.44	0.0027	0.0027	8.44		90	0.000	42.41	2.07	44.48	9.34
29+38.65	GB: 1% to 0.27%	35.72	34.82	50.40	42.65	6.93	14438	23.14	8.31	50.97	9.28	1.55	0.0027	0.0027	8.44		90	0.000	42.65	2.10	44.76	9.04
29+23.73		35.87	34.97	50.40	42.86	6.99	14438	22.96	8.18	51.04	9.28	1.53	0.0100	0.0100	5.57		90	0.000	42.86	2.10	44.95	9.09
29+23.73	Stewart Bridge Exit	35.87	34.97	50.40	43.83	7.96	14438	21.60	7.24	51.07	9.72	0.00	0.0000	0.0100	0.00		90	0.000	43.83			
29+12.16		35.98	35.08	50.52	44.01	8.02	14438	21.42	7.12	51.13	9.72	1.33	0.0100	0.0100	6.45		90	0.000	44.01	2.07	46.08	10.10
28+61.19	Stewart Bridge	36.49	35.59	53.00	44.91	8.42	14438	20.42	6.48	51.39	9.72	1.24	0.0100	0.0100	6.45		90	0.000	44.91	2.04	46.95	10.45
28+57.19	Junction Stewart Stormdrain	36.53	35.63	53.00	44.73	8.19	14354	20.86	6.76	51.48	9.68	0.00	0.0100	0.0100	0.00		90	0.000	44.73			
28+28.43	Stewart Bridge	36.82	35.92	52.33	45.28	8.46	14354	20.21	6.34	51.62	9.68	1.23	0.0100	0.0100	6.42		90	0.000	45.28	2.03	47.31	10.49
28+28.43	Entrance	36.82	35.92	52.33	43.30	6.47	14354	24.64	9.43	52.72	9.25	0.00	0.0000	0.0100	0.00		90	0.000	43.30			
27+55.20	PT	37.56	36.66	52.18	44.20	6.64	14354	24.02	8.96	53.16	9.25	1.64	0.0100	0.0100	5.55	2420	90	0.333	44.53	2.13	46.66	9.10
27+51.04		37.60	36.70	52.22	44.25	6.65	14354	23.98	8.93	53.18	9.25	1.64	0.0100	0.0100	5.55	2420	90	0.332	44.58	2.13	46.71	9.11
26+48.89		38.62	37.72	53.24	45.60	6.97	14354	22.87	8.12	53.71	9.25	1.53	0.0100	0.0100	5.55	2420	90	0.302	45.90	2.09	47.99	9.37
25+76.61		39.34	38.44	53.97	46.66	7.32	14354	21.80	7.38	54.04	9.25	1.42	0.0100	0.0100	5.55	2420	90	0.274	46.93	2.06	48.99	9.65
25+25.39		39.86	38.96	54.48	47.53	7.67	14354	20.79	6.71	54.24	9.25	1.32	0.0100	0.0100	5.55	2420	90	0.250	47.78	2.03	49.80	9.95
24+90.07		40.21	39.31	54.83	48.26	8.05	14354	19.82	6.10	54.36	9.25	1.23	0.0100	0.0100	5.55	2420	90	0.227	48.48	1.99	50.48	10.27
24+67.37		40.44	39.54	55.06	48.88	8.44	14354	18.90	5.55	54.42	9.25	1.15	0.0100	0.0100	5.55	2420	90	0.206	49.08	1.96	51.04	10.61
24+55.12	GB: 0.23% to 1%	40.56	39.66	55.19	49.41	8.85	14354	18.02	5.04	54.45	9.25	1.07	0.0100	0.0100	5.55	2420	90	0.188	49.60	1.93	51.53	10.97
20+97.60		41.38	40.48	56.01	50.23	8.85	14354	18.02	5.04	55.27	9.25	1.07	0.0023	0.0023	8.85	2420	90	0.188	50.42	1.93	52.35	10.97
19+15.00		41.80	40.90	55.69	51.05	9.25	14354	17.25	4.62	55.67	9.25	1.00	0.0023	0.0023	8.85	2420	90	0.172	51.22	5.12	56.34	14.54
18+15.00	Transition 107.33' to 90'	42.03	41.13	55.54	54.19	12.16	14354	11.00	1.88	56.07	8.22	0.56	0.0023	0.0023	0.00	2420	107.33	0.083	54.28	2.38	56.65	14.62
16+00.00		42.52	41.62	56.65	54.15	11.63	14354	11.50	2.05	56.20	8.22	0.59	0.0023	0.0023	7.85	2420	107.33	0.091	54.24	2.55	56.79	14.27
16+00.00	Junction - Cedar Channel 12'x9' RCB	42.52	41.62	56.65	54.44	11.92	13944	10.90	1.84	56.29	8.07	0.00	0.0000	0.0023	0.00	2420	107.33	0.082	54.52			
15+99.90		42.52	41.62	56.70	54.44	11.92	13944	10.90	1.84	56.29	8.07	0.56	0.0000	0.0023	15.00	2420	107.33	0.082	54.52	2.34	56.87	14.35
15+99.90	Transition 90' to 107.33'	42.52	41.62	56.70	54.44	11.92	13944	13.00	2.62	57.06	9.07	0.00	0.0000	0.0023	0.00	2420	107.33	0.116	54.56			
13+88.12		43.01	42.11	57.19	54.38	11.37	13944	13.63	2.89	57.26	9.07	0.71	0.0023	0.0023	8.67	2420	90	0.107	54.48	3.38	57.87	14.86
13+72.54	PC: R= 2420'	43.05	42.15	58.00	54.37	11.33	13944	13.68	2.91	57.28	9.07	0.72	0.0023	0.0023	8.67	2420	90	0.000	54.37	3.41	57.78	14.73
13+08.12	PT	43.19	42.29	58.00	54.35	11.15	13944	13.89	3.00	57.34	9.07	0.73	0.0023	0.0023	8.69		90	0.000	54.35	3.50	57.84	14.65
11+17.79		43.63	42.73	58.44	54.27	10.63	13944	14.57	3.30	57.56	9.07	0.79	0.0023	0.0023	8.69	1200	90	0.000	54.27	3.80	58.06	14.43
10+01.99	PRC: R= 1200'	43.90	43.00	58.00	54.20	10.30	13944	15.04	3.51	57.71	9.07	0.83	0.0023	0.0023	8.69	1200	90	0.263	54.46	4.01	58.47	14.58
9+55.05		44.00	43.10	58.00	54.17	10.16	13944	15.25	3.61	57.78	9.07	0.84	0.0023	0.0023	8.71	3407.41	90	0.095	54.26	4.11	58.37	14.37
8+88.06		44.16	43.26	58.15	54.13	9.97	13944	15.54	3.75	57.88	9.07	0.87	0.0023	0.0023	8.69	3407.41	90	0.099	54.23	4.25	58.48	14.32
8+88.06		44.16	43.26	58.15	52.38	8.22	13944	18.85	5.52	57.89	9.07	1.16	0.0023	0.0023	8.69	3407.41	90	0.146	52.52	1.95	54.47	10.32
7+00.00		44.59	43.69	58.43	52.57	7.98	13944	19.42	5.85	58.42	9.07	1.21	0.0023	0.0023	8.69	3407.41	90	0.155	52.72	1.97	54.69	10.10
6+14.58		45.37	44.47	59.21	53.62	8.24	13944	18.79	5.48	59.10	9.07	1.15	0.0092	0.0023	7.74	3407.41	90	0.145	53.76	1.95	55.71	10.34
5+70.00		45.78	44.88	59.62	54.43	8.65	13944	17.92	4.99	59.41	9.07	1.07	0.0092	0.0023	7.74	3407.41	90	0.132	54.56	1.92	56.48	10.70
5+60.00		45.87	44.97	56.43	54.94	9.07	13944	17.08	4.53	59.47	9.07	1.00	0.0092	0.0023	7.74	3407.41	90	0.120	55.06	5.03	60.09	14.22
5+49.52		45.89	44.99	56.45	55.41	9.51	13944	16.29	4.12	59.53	9.07	0.93	0.0023	0.0023	12.15	3407.41	90	0.109	55.52	4.62	60.14	14.24
5+09.04		45.99	45.09	56.55	55.96	9.98	13944	15.53	3.75	59.71	9.07	0.87	0.0023	0.0023	12.15	3407.41	90	0.099	56.06	4.25	60.31	14.32
4+50.00	Start 90 Rectangular Channel	46.12	46.12	58.00	56.44	10.32	13944	15.01	3.50	59.94	9.07	0.82	0.0023	0.0023	12.15	3407.41	90	0.092	56.54	4.00	60.53	14.41
4+50.00		46.12	46.12	58.00	56.44	10.32	13944	15.01	3.50	59.94	9.07	0.00	0.0000	0.0023	0.00	3407.41	90	0.092	56.54			

Las Vegas Wash - Cedar to Nellis
30% Ultimate Condition WSPG Profile

CEDAR CHANNEL

STEWART BRIDGE

CHARLESTON BRIDGE & CHANNEL

COLORADO SD

NELLIS WY CHANNEL & NELLIS BRIDGE

WSE+FB+SE, ELEVATION,
W.S. ELEV,
Nellis Bridge
Charleston Bridge
Stewart Bridge
Lowest Adj. Grade
TOE OF WALL
Channel Invert

NOTE: BRIDGE LOCATIONS SHOW THE LOW CORD AND PILE CAP ELEVATIONS. GREY LINES SHOW JUNCTION LOCATIONS.

70.00
60.00
50.00
40.00
30.00
20.00
10.00

Elevation, ft

4+50
14+50
24+50
34+50
44+50
54+50
64+50
74+50

Station

```
[TITLE]
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL
 INVERT ELEVATION  SET AT TOE OF CHANNEL WALL FOR MODELING PURPOSES


[REPORT]
COMPOSITE_ONLY

[NETWORK]
**TYPE          NAME
**-----         -------
Outlet          "END 85 REC"
Reach           "GB 6"
Reach           "PC 7091.17"
Reach           "Link41"
BridgeExit      "NLS BX"
Reach           "Link40"
BridgeEntrance  "NLS BE"
Reach           "Link67"
Junction        "NLWY SD"
Reach           "PT 6849.29"
Reach           "Link53"
Transition      "Link58"
Reach           "Link37"
Junction        "LVCO SD"
Reach           "Link36"
Reach           "GB 5"
Reach           "PCC 5859.2"
Reach           "Link33"
Junction        "LVCA SD"
Reach           "PC 5685.45"
Reach           "Link31"
BridgeExit      "CH BX"
Reach           "Link30"
BridgeEntrance  "CH BE"
Reach           "GB 4"
Reach           "PI 5414.80"
Transition      "Transition"
Reach           "GB 3"
Reach           "PI 4736.32"
Reach           "PI 3227.86"
Reach           "GB 2"
Reach           "Link61"
BridgeExit      "STW BX"
Reach           "Link13"
Junction        "STW SD"
Reach           "Link12"
BridgeEntrance  "STW BE"
Reach           "PT 2755.20"
Reach           "GB 1"
Reach           "Link47"
Transition      "Link5"
Reach           "Link62"
Junction        "CACH"
Reach           "Link45"
WallExit        "WX"
Reach           "PC 1372.54"
Reach           "PT 1308.12"
Reach           "PRC 1008.9"
Reach           "Link64"
Reach           "Link1"
Reach           "Link65"
Reach           "Link66"
```

Headwork "Headworks"

**BRANCH DEFINITIONS

[OUTLET]

**NAME	STATION	INVERT ELEV	GROUND ELEV	CHANNEL ID	WATER SURFACE ELEV (opt.)
"END 85 REC"	-7874.24	16.9	38.6	"85x15"	32.42

[HEADWORK]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	FLOW	WATER SURFACE ELEV (opt.)
"Headworks"	46.12	58	"90x15"	13944	0

[WALLENTRANCE]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LOSS COEFFICIENT(opt.)

[WALLEXIT]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LOSS COEFFICIENT(opt.)
"WX"	42.52	56.7	"90x15"	0

[BRIDGEENTRANCE]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	REDUCTION FACTOR(opt.)
"STW BE"	36.823	52.33	"90x15"	1
"CH BE"	24.7	39.6	"110x15"	1
"NLS BE"	18.413	37.4	"85x15"	1

[BRIDGEEXIT]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	REDUCTION FACTOR(opt.)
"STW BX"	35.869	50.4	"90 Bridge"	0
"CH BX"	23.794	40.6	"110 Bridge"	0
"NLS BX"	18.219	38	"85 Bridge"	0

[JOIN]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	NUMBER OF BRANCHES	CONFLUENCE ANGLE

[JUNCTION]

**Name	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	NUMBER OF LATERALS	CONFLUENCE ANGLE	FLOW
"CACH"	42.52	56.65	"Junction 107"	0	0.015	1		
"CACH_Lateral1"	42.86		"CACH"				0	410
"STW SD"	36.535	53	"90 Bridge"	4	0.015	1		
"STW SD_Lateral1"	40.8		"STW SD"				90	84
"LVCA SD"	23.354	41.8	"110x15"	12	0.015	1		
"LVCA SD_Lateral1"	23.36		"LVCA"				90	373
"LVCO SD"	19.219	38.8	"110x15"	18	0.015	1		
"LVCO SD_Lateral0"	23.446		"LVCO"				90	272

"NLWY SD"	18.441	37.4	"85x15"	15	0.015	1		
"NLWY SD_Lateral1"	25		"NLWY"				90	73

[TRANSITION]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n
"Link5"	42.03	55.54	"Junction 107"	100	0.015
"Link58"	19.008	38	"110x15"	59.91	0.015
"Transition"	27.066	44.6	"90x15"	49.42	0.015

[REACH]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	CURVE (opt)	ANGLE POINT(opt)	NUMBER MANHOLES(opt)
"Link1"	44.59	58.43	"90x15"	255.05	0.015	0	0	0
"PC 1372.54"	43.046	58	"90x15"	227.36	0.015	0	0	0
"Link12"	36.823	52.33	"90 Bridge"	28.76	0.015	0	0	0
"Link13"	36.495	53	"90 Bridge"	62.54	0.015	0	0	0
"PI 3227.86"	34.94	50.3	"90x15"	1508.46	0.015	0	0	0
"GB 3"	29.53	44.4	"90x15"	123.3	0.015	0	0	0
"GB 4"	25.74	44.6	"110x15"	111.69	0.015	0	0	0
"Link30"	24.7	39.6	"110 Bridge"	97.32	0.015	0	0	0
"Link31"	23.794	40.6	"110x15"	34.78	0.015	0	0	0
"PC 5685.45"	23.471	41.8	"110x15"	12.28	0.015	0	0	0
"Link33"	23.243	41	"110x15"	149.49	0.015	0	0	0
"PCC 5859.2"	21.853	40.5	"110x15"	200.14	0.015	0	0	0
"GB 5"	19.99	39.6	"110x15"	111.04	0.015	0	0	0
"Link36"	19.796	38.7	"110x15"	348.24	0.015	0	0	0
"Link37"	19.2	38.8	"110x15"	123.54	0.015	0	0	0
"Link40"	18.413	37.4	"85 Bridge"	102.54	0.015	0	0	0
"Link41"	18.219	38	"85x15"	117.45	0.015	0	0	0
"PC 7091.17"	18.054	38.1	"85x15"	240.99	0.015	0	0	0
"Link45"	42.52	56.7	"Junction 107"	0.1	0.015	0	0	0
"GB 1"	40.56	55.19	"90x15"	300.08	0.015	0	0	0
"Link47"	41.8	55.69	"90x15"	540.12	0.015	0	0	0
"PT 2755.20"	37.556	52.18	"90x15"	73.23	0.015	0	0	0
"PI 4736.32"	30.889	45	"90x15"	505.76	0.015	0	0	0
"PRC 1008.9"	43.897	58	"90x15"	306.13	0.015	0	0	0
"PI 5414.80"	26.276	44.6	"110x15"	26.86	0.015	0	0	0
"PT 6849.29"	18.449	38	"85x15"	4.89	0.015	0	0	0
"Link53"	18.66	38	"85x15"	129.2	0.015	0	0	0
"GB 6"	17.66	38.1	"85x15"	542.08	0.015	0	0	0
"GB 2"	35.72	50.4	"90x15"	289.21	0.015	0	0	0
"Link61"	35.869	50.4	"90x15"	14.92	0.015	0	0	0
"Link62"	42.52	56.65	"Junction 107"	215	0.015	0	0	0
"PT 1308.12"	43.194	58	"90x15"	64.42	0.015	0	0	0
"Link64"	44.004	58	"90x15"	46.94	0.015	0	0	0
"Link65"	45.871	56.43	"90x15"	140	0.025	0	0	0
"Link66"	46.12	58	"90x15"	110	0.025	0	0	0
"Link67"	18.415	37.4	"85x15"	2	0.015	0	0	0

[CHANNEL]
**REGULAR TYPES 1-4

**ID	TYPE	HEIGHT	WIDTH	LEFT SLOPE	RIGHT SLOPE	NUMBER PIERS	AVG PIER WIDTH	INVERT CROSS FALL
"85x15"	2	16.5	85			0	0	0
"90x15"	2	15	90			0	0	0
"110x15"	2	16.5	110			0	0	0
"90 Bridge"	2	15	90			2	3	0

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"110 Bridge"  2   16.5      110                              4          3          0
"85 Bridge"   2   16.5      85                               2          3          0
"Junction 107"2   15        107.33                           0          0          0
"CACH"        3   9         15          0          0         0          0          0
"STW SD"      4   5.5       5.5
"LVCA"        3   9         12          0          0         0          0          0
"LVCO"        3   8         18          0          0         0          0          0
"NLWY"        3   6         15          0          0         0          0          0

**IRREGULAR TYPES 5-6
**ID       TYPE NUMBER     AVG PIER   PIER1      PIER2      PIER3      PIER4      PIER5      PIER6      PIER7      PIER8      PIER9      PIER10
**              PIERS      WIDTH      ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV
**------    ---- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------


[POINT]
**ID          XCOORD     YCOORD
**----------- ---------- ----------
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************************************
Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 1.3          06/09/2010
XP Software        www.xpsoftware.com
************************************

INPUT FILE
************************************
R:\24523-LV Wash\06-Studies\01-30DesignDocumentationReport\Hydraulics-WSPG\Las Vegas Wash Main Channel 30Ultimate Condition Submittal.wsx
Computed  04/10/13  10:28:44

TITLE INFORMATION
************************************
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL
 INVERT ELEVATION  SET AT TOE OF CHANNEL WALL FOR MODELING PURPOSES

WARNING SUMMARY
************************************
 WARNING 25: Link type element Link13 has different invert elevation than its upstream node.
 WARNING 25: Link type element Link33 has different invert elevation than its upstream node.
 WARNING 25: Link type element Link37 has different invert elevation than its upstream node.
 WARNING 25: Link type element Link67 has different invert elevation than its upstream node.
 WARNING 36: D/S processing stopped in junction NLWY SD because critical momentum is greater than maximum momentum.

RESULTS
************************************


================================================================
   Main Line
================================================================
 Composite Profile:
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ELEMENT NAME	TYPE	STATION	INVERT ELEV	GROUND ELEV	W.S. ELEV	DEPTH	Q	VELOC.	VELOC. HEAD	ENERGY GRADE LN	SUPER ELEV	CRITICAL DEPTH	FROUDE NUMBER	SLOPE	NORMAL DEPTH	CROSS SECTION
###																
"END 85 R"	Outlet	-7874.24	16.90	38.60	32.420	15.520	15156.00	11.49	2.05	34.47	0.000	9.960	0.000	0.00000	0.000	Rect.open
"GB 6"	Reach	-7332.16	17.66	38.10	32.546	14.886	15156.00	11.98	2.23	34.77	0.000	9.960	0.547	0.00140	11.215	Rect.open
"PC 7091."	Reach	-7091.17	18.05	38.10	32.584	14.530	15156.00	12.27	2.34	34.92	0.000	9.960	0.567	0.00163	10.666	Rect.open
"Link41"	Reach	-6973.72	18.22	38.00	32.618	14.399	15156.00	12.38	2.38	35.00	0.000	9.960	0.575	0.00140	11.208	Rect.open
"NLS BX"	BriExit	-6973.72	18.22	38.00	31.940	13.721	15156.00	13.98	3.04	34.98	0.000	10.458	0.000	0.00000	0.000	Rect.open
"Link40"	Reach	-6871.18	18.41	37.40	32.077	13.664	15156.00	14.04	3.06	35.14	0.000	10.458	0.669	0.00189	12.797	Rect.open
"NLS BE"	BriEntr	-6871.18	18.41	37.40	33.287	14.874	15156.00	11.99	2.23	35.52	0.000	9.960	0.000	0.00000	0.000	Rect.open
"Link67"	Reach	-6869.18	18.41	37.40	33.288	14.873	15156.00	11.99	2.23	35.52	0.000	9.960	0.548	0.00100	12.532	Rect.open
"NLWY SD"	Junction	-6854.18	18.44	37.40	33.351	14.910	15083.00	11.90	2.20	35.55	0.000	9.928	0.000	0.00173	0.000	Rect.open
"PT 6849."	Reach	-6849.29	18.45	38.00	33.351	14.902	15083.00	11.91	2.20	35.55	0.000	9.928	0.544	0.00164	10.630	Rect.open
"Link53"	Reach	-6720.09	18.66	38.00	33.371	14.711	15083.00	12.06	2.26	35.63	0.000	9.928	0.554	0.00163	10.636	Rect.open
"Link58"	Transition	-6660.18	19.01	38.00	34.554	15.546	15083.00	8.82	1.21	35.76	0.000	8.360	0.394	0.00581	0.000	Rect.open
"Link37"	Reach	-6536.64	19.20	38.80	34.561	15.361	15083.00	8.93	1.24	35.80	0.000	8.360	0.401	0.00155	8.985	Rect.open
"LVCO SD"	Junction	-6518.64	19.22	38.80	34.667	15.448	14811.00	8.72	1.18	35.85	0.000	8.259	0.000	0.00106	0.000	Rect.open
"Link36"	Reach	-6170.40	19.80	38.70	34.680	14.884	14811.00	9.05	1.27	35.95	0.000	8.259	0.413	0.00166	8.703	Rect.open
"GB 5"	Reach	-6059.36	19.99	39.60	34.682	14.692	14811.00	9.16	1.30	35.99	0.000	8.259	0.421	0.00175	8.558	Rect.open
	"i.p."	-5997.59	20.57	40.18	34.573	14.008	14811.00	9.61	1.43	36.01	0.000	8.259	0.453	0.00931	5.065	Rect.open
	"i.p."	-5940.47	21.10	40.71	34.453	13.356	14811.00	10.08	1.58	36.03	0.000	8.259	0.486	0.00931	5.065	Rect.open
	"i.p."	-5888.00	21.59	41.20	34.320	12.734	14811.00	10.57	1.74	36.06	0.000	8.259	0.522	0.00931	5.065	Rect.open
"PCC 5859"	Reach	-5859.22	21.85	40.50	34.234	12.381	14811.00	10.87	1.84	36.07	0.000	8.259	0.545	0.00931	5.065	Rect.open
HYDRAULIC	JUMP at -5778.65 of length 0.18															
	"i.p."	-5814.11	22.27	40.92	34.078	11.805	14811.00	11.41	2.02	36.10	0.000	8.259	0.585	0.00930	5.067	Rect.open
	"i.p."	-5778.65	22.60	41.25	33.929	11.326	14811.00	11.89	2.19	36.12	0.000	8.259	0.622	0.00930	5.067	Rect.open
	"i.p."	-5778.65	22.60	41.25	28.406	5.804	14811.00	23.20	8.36	36.76	0.000	8.259	1.697	0.00930	5.067	Rect.open
"Link33"	Reach	-5709.73	23.24	41.00	29.170	5.927	14811.00	22.72	8.01	37.18	0.000	8.259	1.644	0.00930	5.067	Rect.open
"LVCA SD"	Junction	-5697.73	23.35	41.80	28.859	5.505	14438.00	23.84	8.83	37.69	0.000	8.120	0.000	0.00925	0.000	Rect.open
"PC 5685."	Reach	-5685.45	23.47	41.80	28.992	5.521	14438.00	23.77	8.78	37.77	0.000	8.120	1.783	0.00953	4.950	Rect.open

"Link31"	Reach	-5650.67	23.79	40.60	29.358	5.564	14438.00	23.59	8.64	38.00	0.000	8.120	1.762	0.00929	4.989	Rect.open
"CH BX"	BriExit	-5650.67	23.79	40.60	30.451	6.657	14438.00	22.13	7.60	38.06	0.000	8.770	0.000	0.00000	0.000	Rect.open
"Link30"	Reach	-5553.35	24.70	39.60	31.481	6.781	14438.00	21.73	7.33	38.81	0.000	8.770	1.470	0.00931	6.294	Rect.open
"CH BE"	BriEntr	-5553.35	24.70	39.60	29.532	4.832	14438.00	27.16	11.46	40.99	0.000	8.120	0.000	0.00000	0.000	Rect.open
"GB 4"	Reach	-5441.66	25.74	44.60	30.540	4.800	14438.00	27.35	11.61	42.15	0.000	8.120	2.200	0.00931	4.985	Rect.open
"PI 5414."	Reach	-5414.80	26.28	44.60	31.145	4.869	14438.00	26.96	11.28	42.43	0.000	8.120	2.153	0.01996	3.938	Rect.open
"Transiti"	Transition	-5365.38	27.07	44.60	33.573	6.507	14438.00	24.66	9.44	43.01	0.000	9.282	1.703	0.01599	0.000	Rect.open
	"i.p."	-5346.19	27.45	44.98	34.106	6.656	14438.00	24.10	9.02	43.13	0.000	9.282	1.646	0.01998	4.487	Rect.open
	"i.p."	-5312.51	28.12	45.66	35.104	6.981	14438.00	22.98	8.20	43.30	0.000	9.282	1.533	0.01998	4.487	Rect.open
	"i.p."	-5286.30	28.65	46.18	35.968	7.322	14438.00	21.91	7.45	43.42	0.000	9.282	1.427	0.01998	4.487	Rect.open
	"i.p."	-5266.37	29.04	46.58	36.724	7.679	14438.00	20.89	6.78	43.50	0.000	9.282	1.328	0.01998	4.487	Rect.open
	"i.p."	-5251.85	29.33	46.87	37.389	8.054	14438.00	19.92	6.16	43.55	0.000	9.282	1.237	0.01998	4.487	Rect.open
"GB 3"	Reach	-5242.08	29.53	44.40	37.977	8.447	14438.00	18.99	5.60	43.58	0.000	9.282	1.151	0.01998	4.487	Rect.open
"PI 4736."	Reach	-4736.32	30.89	45.00	39.338	8.449	14438.00	18.99	5.60	44.94	0.000	9.282	1.151	0.00269	8.447	Rect.open
	"i.p."	-4633.80	31.16	45.28	39.613	8.449	14438.00	18.99	5.60	45.21	0.000	9.282	1.151	0.00269	8.449	Rect.open
	"i.p."	-3879.46	33.19	47.30	41.309	8.119	14438.00	19.76	6.06	47.37	0.000	9.282	1.222	0.00269	8.449	Rect.open
	"i.p."	-3499.07	34.21	48.32	41.953	7.741	14438.00	20.72	6.67	48.62	0.000	9.282	1.313	0.00269	8.449	Rect.open
"PI 3227."	Reach	-3227.86	34.94	50.30	42.321	7.381	14438.00	21.73	7.33	49.66	0.000	9.282	1.410	0.00269	8.449	Rect.open
	"i.p."	-3152.73	35.14	50.50	42.414	7.272	14438.00	22.06	7.56	49.97	0.000	9.282	1.442	0.00270	8.437	Rect.open
"GB 2"	Reach	-2938.65	35.72	50.40	42.653	6.933	14438.00	23.14	8.31	50.97	0.000	9.282	1.549	0.00270	8.437	Rect.open
"Link61"	Reach	-2923.73	35.87	50.40	42.857	6.988	14438.00	22.96	8.18	51.04	0.000	9.282	1.530	0.00999	5.573	Rect.open
"STW BX"	BriExit	-2923.73	35.87	50.40	43.826	7.957	14438.00	21.60	7.24	51.07	0.000	9.719	0.000	0.00000	0.000	Rect.open
	"i.p."	-2912.16	35.98	50.52	44.009	8.024	14438.00	21.42	7.12	51.13	0.000	9.719	1.333	0.01001	6.445	Rect.open
"Link13"	Reach	-2861.19	36.49	53.00	44.911	8.416	14438.00	20.42	6.48	51.39	0.000	9.719	1.241	0.01001	6.445	Rect.open
"STW SD"	Junction	-2857.19	36.53	53.00	44.727	8.192	14354.00	20.86	6.76	51.48	0.000	9.682	0.000	0.01000	0.000	Rect.open
"Link12"	Reach	-2828.43	36.82	52.33	45.279	8.456	14354.00	20.21	6.34	51.62	0.000	9.682	1.225	0.01001	6.419	Rect.open
"STW BE"	BriEntr	-2828.43	36.82	52.33	43.295	6.472	14354.00	24.64	9.43	52.72	0.000	9.247	0.000	0.00000	0.000	Rect.open
"PT 2755."	Reach	-2755.20	37.56	52.18	44.195	6.639	14354.00	24.02	8.96	53.16	0.000	9.247	1.643	0.01001	5.548	Rect.open
	"i.p."	-2751.04	37.60	52.22	44.248	6.650	14354.00	23.98	8.93	53.18	0.000	9.247	1.639	0.01001	5.548	Rect.open
	"i.p."	-2648.89	38.62	53.24	45.595	6.974	14354.00	22.87	8.12	53.71	0.000	9.247	1.526	0.01001	5.548	Rect.open
	"i.p."	-2576.61	39.34	53.97	46.659	7.315	14354.00	21.80	7.38	54.04	0.000	9.247	1.421	0.01001	5.548	Rect.open
	"i.p."	-2525.39	39.86	54.48	47.529	7.672	14354.00	20.79	6.71	54.24	0.000	9.247	1.323	0.01001	5.548	Rect.open
	"i.p."	-2490.07	40.21	54.83	48.257	8.046	14354.00	19.82	6.10	54.36	0.000	9.247	1.231	0.01001	5.548	Rect.open
	"i.p."	-2467.37	40.44	55.06	48.876	8.439	14354.00	18.90	5.55	54.42	0.000	9.247	1.146	0.01001	5.548	Rect.open
"GB 1"	Reach	-2455.12	40.56	55.19	49.411	8.851	14354.00	18.02	5.04	54.45	0.000	9.247	1.067	0.01001	5.548	Rect.open
	"i.p."	-2097.60	41.38	56.01	50.232	8.851	14354.00	18.02	5.04	55.27	0.000	9.247	1.067	0.00230	8.851	Rect.open
"Link47"	Reach	-1915.00	41.80	55.69	51.046	9.246	14354.00	17.25	4.62	55.67	0.000	9.247	1.000	0.00230	8.851	Rect.open
"Link5"	Transition	-1815.00	42.03	55.54	54.192	12.162	14354.00	11.00	1.88	56.07	0.000	8.222	0.556	0.00230	0.000	Rect.open
"Link62"	Reach	-1600.00	42.52	56.65	54.150	11.630	14354.00	11.50	2.05	56.20	0.000	8.222	0.594	0.00228	7.845	Rect.open
"CACH"	Junction	-1600.00	42.52	56.65	54.441	11.921	13944.00	10.90	1.84	56.29	0.000	8.065	0.000	0.00000	0.000	Rect.open
"Link45"	Reach	-1599.90	42.52	56.70	54.441	11.921	13944.00	10.90	1.84	56.29	0.000	8.065	0.556	0.00000	15.000	Rect.open
"WX"	WallExt	-1599.90	42.52	56.70	54.441	11.921	13944.00	13.00	2.62	57.06	0.000	9.069	0.000	0.00000	0.000	Rect.open
	"i.p."	-1388.12	43.01	57.19	54.376	11.366	13944.00	13.63	2.89	57.26	0.000	9.069	0.713	0.00231	8.667	Rect.open
"PC 1372."	Reach	-1372.54	43.05	58.00	54.371	11.325	13944.00	13.68	2.91	57.28	0.000	9.069	0.716	0.00231	8.667	Rect.open
"PT 1308."	Reach	-1308.12	43.19	58.00	54.347	11.153	13944.00	13.89	3.00	57.34	0.000	9.069	0.733	0.00230	8.686	Rect.open
	"i.p."	-1117.79	43.63	58.44	54.265	10.634	13944.00	14.57	3.30	57.56	0.000	9.069	0.787	0.00230	8.687	Rect.open
"PRC 1008"	Reach	-1001.99	43.90	58.00	54.198	10.301	13944.00	15.04	3.51	57.71	0.000	9.069	0.826	0.00230	8.687	Rect.open
"Link64"	Reach	-955.05	44.00	58.00	54.167	10.163	13944.00	15.25	3.61	57.78	0.000	9.069	0.843	0.00228	8.708	Rect.open
HYDRAULIC	JUMP at -888.06 of length	0.06														
	"i.p."	-888.06	44.16	58.15	54.131	9.973	13944.00	15.54	3.75	57.88	0.000	9.069	0.867	0.00230	8.686	Rect.open
	"i.p."	-888.06	44.16	58.15	52.376	8.219	13944.00	18.85	5.52	57.89	0.000	9.069	1.159	0.00230	8.686	Rect.open
"Link1"	Reach	-700.00	44.59	58.43	52.569	7.979	13944.00	19.42	5.85	58.42	0.000	9.069	1.211	0.00230	8.686	Rect.open
	"i.p."	-614.58	45.37	59.21	53.616	8.244	13944.00	18.79	5.48	59.10	0.000	9.069	1.153	0.00915	7.741	Rect.open
	"i.p."	-570.00	45.78	59.62	54.426	8.646	13944.00	17.92	4.99	59.41	0.000	9.069	1.074	0.00915	7.741	Rect.open
"Link65"	Reach	-560.00	45.87	56.43	54.939	9.068	13944.00	17.08	4.53	59.47	0.000	9.069	1.000	0.00915	7.741	Rect.open
	"i.p."	-549.52	45.89	56.45	55.407	9.512	13944.00	16.29	4.12	59.53	0.000	9.069	0.931	0.00226	12.154	Rect.open
	"i.p."	-509.04	45.99	56.55	55.963	9.976	13944.00	15.53	3.75	59.71	0.000	9.069	0.866	0.00226	12.154	Rect.open
"Link66"	Reach	-450.00	46.12	58.00	56.443	10.323	13944.00	15.01	3.50	59.94	0.000	9.069	0.823	0.00226	12.154	Rect.open
"Headwork"	Headwrk	-450.00	46.12	58.00	56.443	10.323	13944.00	15.01	3.50	59.94	0.000	9.069	0.000	0.00000	0.000	Rect.open

*) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
i.p. = intermediate point processing results for reaches



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix B-3

WSPG ANALYSIS – INTERIM CONDITION – NELLIS BOULEVARD TO CEDAR AVENUE

Las Vegas Wash - Cedar to Nellis
WSPG Profile Main Channel
30% Submittal - Interim condition with bulked bridge piers
April 9, 2013

STATION	LOCATION	TOE OF WALL ELEV, FT	CHANNEL CENTER ELEV, FT	ADJACENT GROUND ELEV, FT	W.S. ELEV, FT	DEPTH, FT	Q, CFS	VELOC., FT/S	VELOC. HEAD, FT	ENERGY GRADE LINE, FT	CRITICAL DEPTH, FT	FROUDE NUMBER	SLOPE AT WALL, FT/FT	CHANNEL SLOPE, FT/FT	NORMAL DEPTH, FT	BEND RADIUS, FT	CHANNEL WIDTH, FT	SUPER ELEVATION (SE), FT	HGL (WSE + SE) ELEVATION, FT	FREEBOARD (FB), FT	WSE+FB+SE, ELEVATION, FT	MIN WALL HEIGHT, FT
78+74.24	End Rectangular Channel	16.90	16.05	38.60	32.42	15.52	15156	11.49	2.05	34.47	9.96	0.000	0.0000	0.0014	0.00		85	0.00	32.42			
73+32.16	CH2M Hill Tie In Point	17.66	16.81	38.10	32.55	14.89	15156	11.98	2.23	34.77	9.96	0.547	0.0014	0.0014	11.22	600	85	0.32	32.86	2.73	35.59	17.93
70+91.17	PC: R= 600'	18.05	17.20	38.10	32.58	14.53	15156	12.27	2.34	34.92	9.96	0.567	0.0016	0.0016	10.67	600	85	0.33	32.92	2.84	35.75	17.70
69+73.72		18.22	17.37	38.00	32.62	14.40	15156	12.38	2.38	35.00	9.96	0.575	0.0014	0.0016	11.21		85	0.00	32.62	2.88	35.50	17.28
69+73.72	Nellis Bridge Exit	18.22	17.37	38.00	31.94	13.72	15156	13.98	3.04	34.98	10.46	0.000	0.0000	0.0016	0.00		85	0.00	31.94			
68+71.18	Nellis Bridge	18.41	17.56	37.40	32.08	13.66	15156	14.04	3.06	35.14	10.46	0.669	0.0019	0.0016	12.80		85	0.00	32.08	3.56	35.64	17.22
68+71.18	Nellis Bridge Entrance	18.41	17.56	37.40	33.29	14.87	15156	11.99	2.23	35.52	9.96	0.000	0.0000	0.0016	0.00		85	0.00	33.29			
68+69.18		18.41	17.56	37.40	33.29	14.87	15156	11.99	2.23	35.52	9.96	0.548	0.0010	0.0016	12.53		85	0.00	33.29	2.73	36.02	17.61
68+54.18	Junction - Nellis Wyoming Channel	18.44	17.59	37.40	33.35	14.91	15083	11.90	2.20	35.55	9.93	0.000	0.0017	0.0016	0.00		85	0.00	33.35			
68+49.29	PT	18.45	17.60	38.00	33.35	14.90	15083	11.91	2.20	35.55	9.93	0.544	0.0016	0.0016	10.63	1000	85	0.00	33.35	2.70	36.05	17.60
67+20.09		18.66	17.81	38.00	33.37	14.71	15083	12.06	2.26	35.63	9.93	0.554	0.0016	0.0016	10.64	1000	85	0.19	33.56	2.76	36.32	17.66
66+60.18	Transition 110' to 85'	19.01	17.91	38.00	34.55	15.55	15083	8.82	1.21	35.76	8.36	0.394	0.0058	0.0016	0.00	1000	110	0.13	34.69	1.71	36.39	17.39
65+36.64		19.20	18.10	38.80	34.56	15.36	15083	8.93	1.24	35.80	8.36	0.402	0.0016	0.0016	8.93	1407	110	0.10	34.66	1.74	36.40	17.19
65+18.64	Junction - Colorado Stormdrain	19.22	18.12	38.80	34.67	15.45	14811	8.72	1.18	35.85	8.26	0.000	0.0008	0.0016	0.00	1407	110	0.09	34.76			
61+70.40		19.80	18.70	38.70	34.68	14.88	14811	9.05	1.27	35.95	8.26	0.413	0.0017	0.0016	8.70	1407	110	0.10	34.78	1.77	36.55	16.76
60+59.36	GB: 0.93% to 0.16%	19.99	18.89	39.60	34.68	14.69	14811	9.16	1.30	35.99	8.26	0.421	0.0018	0.0016	8.56	1407	110	0.10	34.78	1.80	36.59	16.60
59+97.59		20.57	19.47	40.18	34.57	14.01	14811	9.61	1.43	36.01	8.26	0.453	0.0093	0.0093	5.07	1407	110	0.11	34.69	1.93	36.62	16.05
59+40.47		21.10	20.00	40.71	34.45	13.36	14811	10.08	1.58	36.03	8.26	0.486	0.0093	0.0093	5.07	1407	110	0.12	34.58	2.08	36.65	15.56
58+88.00		21.59	20.49	41.20	34.32	12.73	14811	10.57	1.74	36.06	8.26	0.522	0.0093	0.0093	5.07	1407	110	0.14	34.46	2.23	36.69	15.10
58+59.22	PCC: R= 1407'	21.85	20.75	40.50	34.23	12.38	14811	10.87	1.84	36.07	8.26	0.545	0.0093	0.0093	5.07	1407	110	0.14	34.38	2.33	36.71	14.86
58+14.11		22.27	21.17	40.92	34.08	11.81	14811	11.41	2.02	36.10	8.26	0.585	0.0093	0.0093	5.07	1119.342	110	0.20	34.28	2.52	36.80	14.53
57+78.65		22.60	21.50	41.25	33.93	11.33	14811	11.89	2.19	36.12	8.26	0.622	0.0093	0.0093	5.07	1119.342	110	0.22	34.14	2.70	36.84	14.24
57+78.65		22.60	21.50	41.25	28.41	5.80	14811	23.20	8.36	36.76	8.26	1.697	0.0093	0.0093	5.07	1119.342	110	0.82	29.23	2.04	31.27	8.67
57+09.73		23.24	22.14	41.00	29.17	5.93	14811	22.72	8.01	37.18	8.26	1.644	0.0093	0.0093	5.07	1119.342	110	0.79	29.96	2.03	31.99	8.74
56+97.73	Junction - Charleston 12'x9' RCB	23.35	22.25	41.80	28.86	5.51	14438	23.84	8.83	37.69	8.12	0.000	0.0093	0.0093	0.00	1119.342	110	0.87	29.73			
56+85.45	PC: R= 1119.34'	23.47	22.37	41.80	28.99	5.52	14438	23.77	8.78	37.77	8.12	1.783	0.0095	0.0093	4.95	1119.342	110	0.86	29.85	2.05	31.90	8.43
56+50.67		23.79	22.69	40.60	29.36	5.56	14438	23.59	8.64	38.00	8.12	1.762	0.0093	0.0093	4.99		110	0.00	29.36	2.04	31.40	7.61
56+50.67	Charleston Bridge Exit	23.79	22.69	40.60	30.45	6.66	14438	22.13	7.60	38.06	8.77	0.000	0.0000	0.0093	0.00		110	0.00	30.45			
55+53.35	Charleston Bridge	24.70	23.60	39.60	31.48	6.78	14438	21.73	7.33	38.81	8.77	1.470	0.0093	0.0093	6.29		110	0.00	31.48	2.03	33.51	8.81
55+53.35	Charleston Bridge Entrance	24.70	23.60	39.60	29.53	4.83	14438	27.16	11.46	40.99	8.12	0.000	0.0000	0.0093	0.00		110	0.00	29.53			
54+41.66	GB: 2% to 0.93%	25.74	24.64	44.60	30.54	4.80	14438	27.35	11.61	42.15	8.12	2.200	0.0093	0.0093	4.99		110	0.00	30.54	2.15	32.69	6.95
54+14.80	PI	26.28	25.18	44.60	31.15	4.87	14438	26.96	11.28	42.43	8.12	2.153	0.0200	0.0200	3.94		110	0.00	31.15	2.14	33.29	7.01
53+65.38	Transition 90' to 110'	27.07	26.17	44.60	33.57	6.51	14438	24.66	9.44	43.01	9.28	1.703	0.0160	0.0200	0.00		90	0.00	33.57	2.15	35.72	8.66
53+46.19		27.45	26.55	44.98	34.11	6.66	14438	24.10	9.02	43.13	9.28	1.646	0.0200	0.0200	4.49		90	0.00	34.11	2.13	36.24	8.79
53+12.51		28.12	27.22	45.66	35.10	6.98	14438	22.98	8.20	43.30	9.28	1.533	0.0200	0.0200	4.49		90	0.00	35.10	2.10	37.20	9.08
52+86.30		28.65	27.75	46.18	35.97	7.32	14438	21.91	7.45	43.42	9.28	1.427	0.0200	0.0200	4.49		90	0.00	35.97	2.06	38.03	9.39
52+66.37		29.04	28.14	46.58	36.72	7.68	14438	20.89	6.78	43.50	9.28	1.328	0.0200	0.0200	4.49		90	0.00	36.72	2.03	38.75	9.71
52+51.85		29.33	28.43	46.87	37.39	8.05	14438	19.92	6.16	43.55	9.28	1.237	0.0200	0.0200	4.49		90	0.00	37.39	2.00	39.39	10.05
52+42.08	GB: 0.27% to 2%	29.53	28.63	44.40	37.98	8.45	14438	18.99	5.60	43.58	9.28	1.151	0.0200	0.0200	4.49		90	0.00	37.98	1.97	39.94	10.41
47+36.32	PI	30.89	29.99	45.00	39.34	8.45	14438	18.99	5.60	44.94	9.28	1.151	0.0027	0.0200	8.45		90	0.00	39.34	1.97	41.30	10.42
46+33.80		31.16	30.26	45.28	39.61	8.45	14438	18.99	5.60	45.21	9.28	1.151	0.0027	0.0027	8.45		90	0.00	39.61	1.97	41.58	10.42
38+79.46		33.19	32.29	47.30	41.31	8.12	14438	19.76	6.06	47.37	9.28	1.222	0.0027	0.0027	8.45		90	0.00	41.31	1.99	43.30	10.11
34+99.07		34.21	33.31	48.32	41.95	7.74	14438	20.72	6.67	48.62	9.28	1.313	0.0027	0.0027	8.45		90	0.00	41.95	2.02	43.98	9.77
32+27.86	PI	34.94	34.04	50.30	42.32	7.38	14438	21.73	7.33	49.66	9.28	1.410	0.0027	0.0027	8.45		90	0.00	42.32	2.06	44.38	9.44

Las Vegas Wash - Cedar to Nellis
WSPG Profile Main Channel
30% Submittal - Interim condition with bulked bridge piers
April 9, 2013

STATION	LOCATION	TOE OF WALL ELEV, FT	CHANNEL CENTER ELEV, FT	ADJACENT GROUND ELEV, FT	W.S. ELEV, FT	DEPTH, FT	Q, CFS	VELOC., FT/S	VELOC. HEAD, FT	ENERGY GRADE LINE, FT	CRITICAL DEPTH, FT	FROUDE NUMBER	SLOPE AT WALL, FT/FT	CHANNEL SLOPE, FT/FT	NORMAL DEPTH, FT	BEND RADIUS, FT	CHANNEL WIDTH, FT	SUPER ELEVATION (SE), FT	HGL (WSE + SE) ELEVATION, FT	FREEBOARD (FB), FT	WSE+FB+SE, ELEVATION, FT	MIN WALL HEIGHT, FT
31+52.73		35.14	34.24	50.50	42.41	7.27	14438	22.06	7.56	49.97	9.28	1.442	0.0027	0.0027	8.44		90	0.00	42.41	2.07	44.48	9.34
29+38.65	GB: 1% to 0.27%	35.72	34.82	50.40	42.65	6.93	14438	23.14	8.31	50.97	9.28	1.549	0.0027	0.0027	8.44		90	0.00	42.65	2.10	44.76	9.04
29+23.73		35.87	34.97	50.40	42.86	6.99	14438	22.96	8.18	51.04	9.28	1.530	0.0100	0.0100	5.57		90	0.00	42.86	2.10	44.95	9.09
29+23.73	Stewart Bridge Exit	35.87	34.97	50.40	43.83	7.96	14438	21.60	7.24	51.07	9.72	0.000	0.0000	0.0100	0.00		90	0.00	43.83			
29+12.16		35.98	35.08	50.52	44.01	8.02	14438	21.42	7.12	51.13	9.72	1.333	0.0100	0.0100	6.45		90	0.00	44.01	2.07	46.08	10.10
28+61.19	Stewart Bridge	36.49	35.59	53.00	44.91	8.42	14438	20.42	6.48	51.39	9.72	1.241	0.0100	0.0100	6.45		90	0.00	44.91	2.04	46.95	10.45
28+57.19	Junction Stewart Stormdrain	36.53	35.63	53.00	44.73	8.19	14354	20.86	6.76	51.48	9.68	0.000	0.0100	0.0100	0.00		90	0.00	44.73			
28+28.43	Stewart Bridge	36.82	35.92	52.33	45.28	8.46	14354	20.21	6.34	51.62	9.68	1.225	0.0100	0.0100	6.42		90	0.00	45.28	2.03	47.31	10.49
28+28.43	Stewart Bridge Entrance	36.82	35.92	52.33	43.30	6.47	14354	24.64	9.43	52.72	9.25	0.000	0.0000	0.0000	0.00		90	0.00	43.30			
27+55.20	PT	37.56	36.66	52.18	44.20	6.64	14354	24.02	8.96	53.16	9.25	1.643	0.0100	0.0100	5.55	2420	90	0.33	44.53	2.13	46.66	9.10
27+51.04		37.60	36.70	52.22	44.25	6.65	14354	23.98	8.93	53.18	9.25	1.639	0.0100	0.0100	5.55	2420	90	0.33	44.58	2.13	46.71	9.11
26+48.89		38.62	37.72	53.24	45.60	6.97	14354	22.87	8.12	53.71	9.25	1.526	0.0100	0.0100	5.55	2420	90	0.30	45.90	2.09	47.99	9.37
25+76.61		39.34	38.44	53.97	46.66	7.32	14354	21.80	7.38	54.04	9.25	1.421	0.0100	0.0100	5.55	2420	90	0.27	46.93	2.06	48.99	9.65
25+25.39		39.86	38.96	54.48	47.53	7.67	14354	20.79	6.71	54.24	9.25	1.323	0.0100	0.0100	5.55	2420	90	0.25	47.78	2.03	49.80	9.95
24+90.07		40.21	39.31	54.83	48.26	8.05	14354	19.82	6.10	54.36	9.25	1.231	0.0100	0.0100	5.55	2420	90	0.23	48.48	1.99	50.48	10.27
24+67.37		40.44	39.54	55.06	48.88	8.44	14354	18.90	5.55	54.42	9.25	1.146	0.0100	0.0100	5.55	2420	90	0.21	49.08	1.96	51.04	10.61
24+55.12	GB: 0.23% to 1%	40.56	39.66	55.19	49.41	8.85	14354	18.02	5.04	54.45	9.25	1.067	0.0100	0.0100	5.55	2420	90	0.19	49.60	1.93	51.53	10.97
20+97.60		41.38	40.48	56.01	50.23	8.85	14354	18.02	5.04	55.27	9.25	1.067	0.0023	0.0023	8.85	2420	90	0.19	50.42	1.93	52.35	10.97
19+15.00		41.80	40.90	55.69	51.05	9.25	14354	17.25	4.62	55.67	9.25	1.000	0.0023	0.0023	8.85	2420	90	0.17	51.22	5.12	56.34	14.54
18+15.00	Transition 107.33' to 90'	42.03	41.13	55.54	54.19	12.16	14354	11.00	1.88	56.07	8.22	0.556	0.0023	0.0023	0.00	2420	107.33	0.08	54.28	2.38	56.65	14.62
16+00.00		42.52	41.62	56.65	54.15	11.63	14354	11.50	2.05	56.20	8.22	0.594	0.0023	0.0023	7.85	2420	107.33	0.09	54.24	2.55	56.79	14.27
16+00.00	Junction - Cedar Channel 12'x9' RCB	42.52	41.62	56.65	54.44	11.92	13944	10.90	1.84	56.29	8.07	0.000	0.0000	0.0023	0.00	2420	107.33	0.08	54.52			
15+99.90		42.52	41.62	56.70	54.44	11.92	13944	10.90	1.84	56.29	8.07	0.556	0.0000	0.0023	15.00	2420	107.33	0.08	54.52	2.34	56.87	14.35
15+99.90	Wall Exit 90' to 107.33'	42.52	41.62	56.70	54.44	11.92	13944	13.00	2.62	57.06	9.07	0.000	0.0000	0.0023	0.00	2420	107.33	0.12	54.56			
13+97.03		42.99	42.09	57.17	54.38	11.39	13944	13.60	2.87	57.25	9.07	0.710	0.0023	0.0023	8.67	2420	90	0.11	54.49	3.37	57.86	14.87
13+97.03		42.99	42.09	57.17	50.07	7.08	13944	21.87	7.43	57.50	9.07	1.448	0.0023	0.0023	8.67	2420	90	0.00	50.07	2.05	52.12	9.13
13+72.54	PC: R= 2420'	43.05	42.15	58.00	50.09	7.04	13944	22.00	7.51	57.60	9.07	1.461	0.0023	0.0023	8.67	2420	90	0.00	50.09	2.05	52.14	9.10
13+08.12	PT	43.19	42.29	58.00	50.12	6.92	13944	22.39	7.78	57.90	9.07	1.500	0.0023	0.0023	8.69		90	0.00	50.12	2.07	52.18	8.99
11+55.59		43.54	42.64	58.35	50.17	6.62	13944	23.39	8.50	58.66	9.07	1.602	0.0023	0.0023	8.69	1200	90	0.64	50.81	2.10	52.90	9.36
10+01.99	PRC: R= 1200'	43.90	43.00	58.00	50.21	6.32	13944	24.53	9.35	59.56	9.07	1.720	0.0023	0.0023	8.69	1200	90	0.70	50.91	2.13	53.05	9.15
9+55.05	Start 90' Rectangular Channel	44.00	43.10	58.00	50.22	6.22	13944	24.91	9.64	59.86	9.07	1.760	0.0023	0.0023	8.71	3407.41	90	0.25	50.48	2.15	52.62	8.62
7+00.00	Concrete Transition 80' Trapezodial to 90' Rectangular	44.59	43.79	58.43	51.03	6.44	13944	26.37	10.80	61.83	9.68	1.855	0.0023	0.0023	0.00	3407.41	80	0.25	51.28	2.23	53.51	8.92
5+60.00	Grouted RiprapTransition 70' Irregular to 80' Trapezodial Channel	45.87	45.87	56.43	60.13	14.26	13944	16.24	4.09	64.23	14.26	1.024	0.0092	0.0023	0.00	3407.41	70	0.08	60.22	4.60	64.81	18.94
5+50.21		45.89	45.89	56.45	60.55	14.66	13944	15.48	3.72	64.27	14.26	0.953	0.0023	0.0023	16.00	3407.41	70	0.08	60.63	4.22	64.85	18.96
5+12.62		45.98	45.98	56.54	61.05	15.07	13944	14.76	3.38	64.43	14.26	0.887	0.0023	0.0023	16.00	3407.41	70	0.07	61.12	3.88	65.00	19.02
4+50.00		46.12	46.12	58.00	61.52	15.40	13944	14.22	3.14	64.66	14.26	0.839	0.0023	0.0023	16.00	3407.41	70	0.06	61.58	3.64	65.22	19.10
4+50.00	Existing Earth Channel with Articulated Concrete Block	46.12	46.12	58.00	61.52	15.40	13944	14.22	3.14	64.66	14.26	0.000	0.0000	0.0000	0.00	3407.41	70	0.06	61.58			

Las Vegas Wash - Cedar to Nellis
30% Interim Condition WSPG Profile

CEDAR CHANNEL

STEWART BRIDGE

CHARLESTON BRIDGE & CHANNEL

COLORADO SD

NELLIS WY CHANNEL & NELLIS BRIDGE

WSE+FB+SE, ELEVATION,
W.S. ELEV,
Nellis Bridge
Charleston Bridge
Stewart Bridge
Lowest Adj. Grade
TOE OF WALL
Channel Invert

NOTE: BRIDGE LOCATIONS SHOW THE LOW CORD AND PILE CAP ELEVATIONS. GREY LINES SHOW JUNCTION LOCATIONS.

70.00
60.00
50.00
40.00
30.00
20.00
10.00

4+50
14+50
24+50
34+50
44+50
54+50
64+50
74+50

Station

Elevation, ft

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[TITLE]
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL
 INVERT ELEVATION  SET AT TOE OF CHANNEL WALL FOR MODELING PURPOSES


[REPORT]
COMPOSITE_ONLY

[NETWORK]
**TYPE            NAME
**-----           -------
Outlet            "END 85 REC"
Reach             "GB 6"
Reach             "PC 7091.17"
Reach             "Link41"
BridgeExit        "NLS BX"
Reach             "Link40"
BridgeEntrance    "NLS BE"
Reach             "Link67"
Junction          "NLWY SD"
Reach             "PT 6849.29"
Reach             "Link53"
Transition        "Link58"
Reach             "Link37"
Junction          "LVCO SD"
Reach             "Link36"
Reach             "GB 5"
Reach             "PCC 5859.2"
Reach             "Link33"
Junction          "LVCA SD"
Reach             "PC 5685.45"
Reach             "Link31"
BridgeExit        "CH BX"
Reach             "Link30"
BridgeEntrance    "CH BE"
Reach             "GB 4"
Reach             "PI 5414.80"
Transition        "Transition"
Reach             "GB 3"
Reach             "PI 4736.32"
Reach             "PI 3227.86"
Reach             "GB 2"
Reach             "Link61"
BridgeExit        "STW BX"
Reach             "Link13"
Junction          "STW SD"
Reach             "Link12"
BridgeEntrance    "STW BE"
Reach             "PT 2755.20"
Reach             "GB 1"
Reach             "Link47"
Transition        "Link5"
Reach             "Link62"
Junction          "CACH"
Reach             "Link45"
WallExit          "WX"
Reach             "PC 1372.54"
Reach             "PT 1308.12"
Reach             "PRC 1008.9"
Reach             "Link64"
Transition        "Link1"
Transition        "Link65"
Reach             "Link66"
Headwork          "Headworks"

**BRANCH DEFINITIONS
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[OUTLET]
**NAME          STATION   INVERT    GROUND    CHANNEL   WATER SURFACE
**                        ELEV      ELEV      ID        ELEV (opt.)
**------------  --------- --------- --------- --------- ----------
"END 85 REC"    -7874.24  16.9      38.6      "85x15"   32.42

[HEADWORK]
**NAME          INVERT    GROUND    CHANNEL   FLOW      WATER SURFACE
**              ELEV      ELEV      ID                  ELEV (opt.)
**------------  --------- --------- --------- --------- ----------
"Headworks"     46.12     58        "Irregular" 13944   0

[WALLENTRANCE]
**NAME          INVERT    GROUND    CHANNEL   LOSS
**              ELEV      ELEV      ID        COEFFICIENT(opt.)
**------------  --------- --------- --------- --------------

[WALLEXIT]
**NAME          INVERT    GROUND    CHANNEL   LOSS
**              ELEV      ELEV      ID        COEFFICIENT(opt.)
**------------  --------- --------- --------- --------------
"WX"            42.52     56.7      "90x15"   0

[BRIDGEENTRANCE]
**NAME          INVERT    GROUND    CHANNEL   REDUCTION
**              ELEV      ELEV      ID        FACTOR(opt.)
**------------  --------- --------- --------- --------------
"STW BE"        36.823    52.33     "90x15"   1
"CH BE"         24.7      39.6      "110x15"  1
"NLS BE"        18.413    37.4      "85x15"   1

[BRIDGEEXIT]
**NAME          INVERT    GROUND    CHANNEL   REDUCTION
**              ELEV      ELEV      ID        FACTOR(opt.)
**------------  --------- --------- --------- --------------
"STW BX"        35.869    50.4      "90 Bridge" 0
"CH BX"         23.794    40.6      "110 Bridge"0
"NLS BX"        18.219    38        "85 Bridge" 0

[JOIN]
**NAME          INVERT    GROUND    CHANNEL   LENGTH    MANNINGS n NUMBER OF  CONFLUENCE
**              ELEV      ELEV      ID                            BRANCHES   ANGLE
**------------  --------- --------- --------- --------- ---------- ---------- ----------

[JUNCTION]
**Name          INVERT    GROUND    CHANNEL   LENGTH    MANNINGS n NUMBER OF  CONFLUENCE FLOW
**              ELEV      ELEV      ID                            LATERALS   ANGLE
**------------  --------- --------- --------- --------- ---------- ---------- ---------- ----------
"CACH"          42.52     56.65     "Junction 107"0         0.015      1
"CACH_Lateral1" 42.86               "CACH"                                   0          410

"STW SD"        36.535    53        "90 Bridge" 4         0.015      1
"STW SD_Lateral1" 40.8              "STW SD"                                 90         84

"LVCA SD"       23.354    41.8      "110x15"  12          0.015      1
"LVCA SD_Lateral1" 23.36            "LVCA"                                   90         373

"LVCO SD"       19.219    38.8      "110x15"  18          0.015      1
"LVCO SD_Lateral0" 23.446           "LVCO"                                   90         272

"NLWY SD"       18.441    37.4      "85x15"   15          0.015      1
"NLWY SD_Lateral1" 25               "NLWY"                                   90         73

[TRANSITION]
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**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n
"Link1"	44.59	58.43	"80bw3to1ss"	255.05	0.015
"Link5"	42.03	55.54	"Junction 107"	100	0.015
"Link58"	19.008	38	"110x15"	59.91	0.015
"Link65"	45.871	56.43	"Irregular"	140	0.025
"Transition"	27.066	44.6	"90x15"	49.42	0.015

[REACH]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	CURVE (opt)	ANGLE POINT(opt)	NUMBER MANHOLES(opt)
"PC 1372.54"	43.046	58	"90x15"	227.36	0.015	0	0	0
"Link12"	36.823	52.33	"90 Bridge"	28.76	0.015	0	0	0
"Link13"	36.495	53	"90 Bridge"	62.54	0.015	0	0	0
"PI 3227.86"	34.94	50.3	"90x15"	1508.46	0.015	0	0	0
"GB 3"	29.53	44.4	"90x15"	123.3	0.015	0	0	0
"GB 4"	25.74	44.6	"110x15"	111.69	0.015	0	0	0
"Link30"	24.7	39.6	"110 Bridge"	97.32	0.015	0	0	0
"Link31"	23.794	40.6	"110x15"	34.78	0.015	0	0	0
"PC 5685.45"	23.471	41.8	"110x15"	12.28	0.015	0	0	0
"Link33"	23.243	41	"110x15"	149.49	0.015	0	0	0
"PCC 5859.2"	21.853	40.5	"110x15"	200.14	0.015	0	0	0
"GB 5"	19.99	39.6	"110x15"	111.04	0.015	0	0	0
"Link36"	19.796	38.7	"110x15"	348.24	0.015	0	0	0
"Link37"	19.204	38.8	"110x15"	123.54	0.015	0	0	0
"Link40"	18.413	37.4	"85 Bridge"	102.54	0.015	0	0	0
"Link41"	18.219	38	"85x15"	117.45	0.015	0	0	0
"PC 7091.17"	18.054	38.1	"85x15"	240.99	0.015	0	0	0
"Link45"	42.52	56.7	"Junction 107"	0.1	0.015	0	0	0
"GB 1"	40.56	55.19	"90x15"	300.08	0.015	0	0	0
"Link47"	41.8	55.69	"90x15"	540.12	0.015	0	0	0
"PT 2755.20"	37.556	52.18	"90x15"	73.23	0.015	0	0	0
"PI 4736.32"	30.889	45	"90x15"	505.76	0.015	0	0	0
"PRC 1008.9"	43.897	58	"90x15"	306.13	0.015	0	0	0
"PI 5414.80"	26.276	44.6	"110x15"	26.86	0.015	0	0	0
"PT 6849.29"	18.449	38	"85x15"	4.89	0.015	0	0	0
"Link53"	18.66	38	"85x15"	129.2	0.015	0	0	0
"GB 6"	17.66	38.1	"85x15"	542.08	0.015	0	0	0
"GB 2"	35.72	50.4	"90x15"	289.21	0.015	0	0	0
"Link61"	35.869	50.4	"90x15"	14.92	0.015	0	0	0
"Link62"	42.52	56.65	"Junction 107"	215	0.015	0	0	0
"PT 1308.12"	43.194	58	"90x15"	64.42	0.015	0	0	0
"Link64"	44.004	58	"90x15"	46.94	0.015	0	0	0
"Link66"	46.12	58	"Irregular"	110	0.025	0	0	0
"Link67"	18.415	37.4	"85x15"	2	0.015	0	0	0

[CHANNEL]
**REGULAR TYPES 1-4

**ID	TYPE	HEIGHT	WIDTH	LEFT SLOPE	RIGHT SLOPE	NUMBER PIERS	AVG PIER WIDTH	INVERT CROSS FALL
"85x15"	2	16.5	85			0	0	0
"90x15"	2	15	90			0	0	0
"110x15"	2	16.5	110			0	0	0
"90 Bridge"	2	15	90			2	3	0
"110 Bridge"	2	16.5	110			4	3	0
"85 Bridge"	2	16.5	85			2	3	0
"Junction 107"	2	15	107.33			0	0	0
"CACH"	3	9	15	0	0	0	0	0
"STW SD"	4	5.5	5.5					
"LVCA"	3	9	12	0	0	0	0	0
"LVCO"	3	8	18	0	0	0	0	0
"NLWY"	3	6	15	0	0	0	0	0
"80bw3to1ss"	1	15	80	0.33	0.33	0	0	0

```
**IRREGULAR TYPES 5-6
**ID        TYPE NUMBER     AVG PIER   PIER1      PIER2      PIER3      PIER4      PIER5      PIER6      PIER7      PIER8      PIER9      PIER10
**                PIERS     WIDTH      ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV       ELEV
**------    ---- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
"Irregular"5         0          0


[POINT]
**ID          XCOORD     YCOORD
**----------- ---------- ----------
"Irregular"   -55        16
"Irregular"   -54        15
"Irregular"   -35        6
"Irregular"   -3.5       3
"Irregular"   -3.5       0
"Irregular"   3.5        0
"Irregular"   3.5        3
"Irregular"   35         6
"Irregular"   54         15
"Irregular"   55         16
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Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 1.3          06/09/2010
XP Software         www.xpsoftware.com
**************************************

INPUT FILE
**************************************
R:\24523-LV Wash\06-Studies\01-30DesignDocumentationReport\Hydraulics-WSPG\Las Vegas Wash Main Channel 30Interim Condition Submittal.wsx
Computed  04/10/13  08:51:04

TITLE INFORMATION
**************************************
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL
 INVERT ELEVATION  SET AT TOE OF CHANNEL WALL FOR MODELING PURPOSES

WARNING SUMMARY
**************************************
 WARNING 25: Link type element Link13 has different invert elevation than its upstream node.
 WARNING 25: Link type element Link33 has different invert elevation than its upstream node.
 WARNING 25: Link type element Link37 has different invert elevation than its upstream node.
 WARNING 25: Link type element Link67 has different invert elevation than its upstream node.
 WARNING 36: D/S processing stopped in junction NLWY SD because critical momentum is greater than maximum momentum.

RESULTS
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================================================================
   Main Line

 Composite Profile:
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ELEMENT NAME	TYPE	STATION	INVERT ELEV	GROUND ELEV	W.S. ELEV	DEPTH	Q	VELOC.	VELOC. HEAD	ENERGY GRADE LN	SUPER ELEV	CRITICAL DEPTH	FROUDE NUMBER	SLOPE	NORMAL DEPTH	CROSS SECTION
###																
"END 85 R"	Outlet	-7874.24	16.90	38.60	32.420	15.520	15156.00	11.49	2.05	34.47	0.000	9.960	0.000	0.00000	0.000	Rect.open
"GB 6"	Reach	-7332.16	17.66	38.10	32.546	14.886	15156.00	11.98	2.23	34.77	0.000	9.960	0.547	0.00140	11.215	Rect.open
"PC 7091."	Reach	-7091.17	18.05	38.10	32.584	14.530	15156.00	12.27	2.34	34.92	0.000	9.960	0.567	0.00163	10.666	Rect.open
"Link41"	Reach	-6973.72	18.22	38.00	32.618	14.399	15156.00	12.38	2.38	35.00	0.000	9.960	0.575	0.00140	11.208	Rect.open
"NLS BX"	BriExit	-6973.72	18.22	38.00	31.940	13.721	15156.00	13.98	3.04	34.98	0.000	10.458	0.000	0.00000	0.000	Rect.open
"Link40"	Reach	-6871.18	18.41	37.40	32.077	13.664	15156.00	14.04	3.06	35.14	0.000	10.458	0.669	0.00189	12.797	Rect.open
"NLS BE"	BriEntr	-6871.18	18.41	37.40	33.287	14.874	15156.00	11.99	2.23	35.52	0.000	9.960	0.000	0.00000	0.000	Rect.open
"Link67"	Reach	-6869.18	18.41	37.40	33.288	14.873	15156.00	11.99	2.23	35.52	0.000	9.960	0.548	0.00100	12.532	Rect.open
"NLWY SD"	Junction	-6854.18	18.44	37.40	33.351	14.910	15083.00	11.90	2.20	35.55	0.000	9.928	0.000	0.00173	0.000	Rect.open
"PT 6849."	Reach	-6849.29	18.45	38.00	33.351	14.902	15083.00	11.91	2.20	35.55	0.000	9.928	0.544	0.00164	10.630	Rect.open
"Link53"	Reach	-6720.09	18.66	38.00	33.371	14.711	15083.00	12.06	2.26	35.63	0.000	9.928	0.554	0.00163	10.636	Rect.open
"Link58"	Transition	-6660.18	19.01	38.00	34.554	15.546	15083.00	8.82	1.21	35.76	0.000	8.360	0.394	0.00581	0.000	Rect.open
"Link37"	Reach	-6536.64	19.20	38.80	34.560	15.356	15083.00	8.93	1.24	35.80	0.000	8.360	0.402	0.00159	8.927	Rect.open
"LVCO SD"	Junction	-6518.64	19.22	38.80	34.667	15.448	14811.00	8.72	1.18	35.85	0.000	8.259	0.000	0.00083	0.000	Rect.open
"Link36"	Reach	-6170.40	19.80	38.70	34.680	14.884	14811.00	9.05	1.27	35.95	0.000	8.259	0.413	0.00166	8.703	Rect.open
"GB 5"	Reach	-6059.36	19.99	39.60	34.682	14.692	14811.00	9.16	1.30	35.99	0.000	8.259	0.421	0.00175	8.558	Rect.open
	"i.p."	-5997.59	20.57	40.18	34.573	14.008	14811.00	9.61	1.43	36.01	0.000	8.259	0.453	0.00931	5.065	Rect.open
	"i.p."	-5940.47	21.10	40.71	34.453	13.356	14811.00	10.08	1.58	36.03	0.000	8.259	0.486	0.00931	5.065	Rect.open
	"i.p."	-5888.00	21.59	41.20	34.320	12.734	14811.00	10.57	1.74	36.06	0.000	8.259	0.522	0.00931	5.065	Rect.open
"PCC 5859"	Reach	-5859.22	21.85	40.50	34.234	12.381	14811.00	10.87	1.84	36.07	0.000	8.259	0.545	0.00931	5.065	Rect.open
HYDRAULIC	JUMP at -5778.65 of length 0.18															
	"i.p."	-5814.11	22.27	40.92	34.078	11.805	14811.00	11.41	2.02	36.10	0.000	8.259	0.585	0.00930	5.067	Rect.open
	"i.p."	-5778.65	22.60	41.25	33.929	11.326	14811.00	11.89	2.19	36.12	0.000	8.259	0.622	0.00930	5.067	Rect.open
	"i.p."	-5778.65	22.60	41.25	28.406	5.804	14811.00	23.20	8.36	36.76	0.000	8.259	1.697	0.00930	5.067	Rect.open

"Link33"	Reach	-5709.73	23.24	41.00	29.170	5.927	14811.00	22.72	8.01	37.18	0.000	8.259	1.644	0.00930	5.067	Rect.open
"LVCA SD"	Junction	-5697.73	23.35	41.80	28.859	5.505	14438.00	23.84	8.83	37.69	0.000	8.120	0.000	0.00925	0.000	Rect.open
"PC 5685."	Reach	-5685.45	23.47	41.80	28.992	5.521	14438.00	23.77	8.78	37.77	0.000	8.120	1.783	0.00953	4.950	Rect.open
"Link31"	Reach	-5650.67	23.79	40.60	29.358	5.564	14438.00	23.59	8.64	38.00	0.000	8.120	1.762	0.00929	4.989	Rect.open
"CH BX"	BriExit	-5650.67	23.79	40.60	30.451	6.657	14438.00	22.13	7.60	38.06	0.000	8.770	0.000	0.00000	0.000	Rect.open
"Link30"	Reach	-5553.35	24.70	39.60	31.481	6.781	14438.00	21.73	7.33	38.81	0.000	8.770	1.470	0.00931	6.294	Rect.open
"CH BE"	BriEntr	-5553.35	24.70	39.60	29.532	4.832	14438.00	27.16	11.46	40.99	0.000	8.120	0.000	0.00000	0.000	Rect.open
"GB 4"	Reach	-5441.66	25.74	44.60	30.540	4.800	14438.00	27.35	11.61	42.15	0.000	8.120	2.200	0.00931	4.985	Rect.open
"PI 5414."	Reach	-5414.80	26.28	44.60	31.145	4.869	14438.00	26.96	11.28	42.43	0.000	8.120	2.153	0.01996	3.938	Rect.open
"Transiti"	Transition	-5365.38	27.07	44.60	33.573	6.507	14438.00	24.66	9.44	43.01	0.000	9.282	1.703	0.01599	0.000	Rect.open
	"i.p."	-5346.19	27.45	44.98	34.106	6.656	14438.00	24.10	9.02	43.13	0.000	9.282	1.646	0.01998	4.487	Rect.open
	"i.p."	-5312.51	28.12	45.66	35.104	6.981	14438.00	22.98	8.20	43.30	0.000	9.282	1.533	0.01998	4.487	Rect.open
	"i.p."	-5286.30	28.65	46.18	35.968	7.322	14438.00	21.91	7.45	43.42	0.000	9.282	1.427	0.01998	4.487	Rect.open
	"i.p."	-5266.37	29.04	46.58	36.724	7.679	14438.00	20.89	6.78	43.50	0.000	9.282	1.328	0.01998	4.487	Rect.open
	"i.p."	-5251.85	29.33	46.87	37.389	8.054	14438.00	19.92	6.16	43.55	0.000	9.282	1.237	0.01998	4.487	Rect.open
"GB 3"	Reach	-5242.08	29.53	44.40	37.977	8.447	14438.00	18.99	5.60	43.58	0.000	9.282	1.151	0.01998	4.487	Rect.open
"PI 4736."	Reach	-4736.32	30.89	45.00	39.338	8.449	14438.00	18.99	5.60	44.94	0.000	9.282	1.151	0.00269	8.447	Rect.open
	"i.p."	-4633.80	31.16	45.28	39.613	8.449	14438.00	18.99	5.60	45.21	0.000	9.282	1.151	0.00269	8.449	Rect.open
	"i.p."	-3879.46	33.19	47.30	41.309	8.119	14438.00	19.76	6.06	47.37	0.000	9.282	1.222	0.00269	8.449	Rect.open
	"i.p."	-3499.07	34.21	48.32	41.953	7.741	14438.00	20.72	6.67	48.62	0.000	9.282	1.313	0.00269	8.449	Rect.open
"PI 3227."	Reach	-3227.86	34.94	50.30	42.321	7.381	14438.00	21.73	7.33	49.66	0.000	9.282	1.410	0.00269	8.449	Rect.open
	"i.p."	-3152.73	35.14	50.50	42.414	7.272	14438.00	22.06	7.56	49.97	0.000	9.282	1.442	0.00270	8.437	Rect.open
"GB 2"	Reach	-2938.65	35.72	50.40	42.653	6.933	14438.00	23.14	8.31	50.97	0.000	9.282	1.549	0.00270	8.437	Rect.open
"Link61"	Reach	-2923.73	35.87	50.40	42.857	6.988	14438.00	22.96	8.18	51.04	0.000	9.282	1.530	0.00999	5.573	Rect.open
"STW BX"	BriExit	-2923.73	35.87	50.40	43.826	7.957	14438.00	21.60	7.24	51.07	0.000	9.719	0.000	0.00000	0.000	Rect.open
	"i.p."	-2912.16	35.98	50.52	44.009	8.024	14438.00	21.42	7.12	51.13	0.000	9.719	1.333	0.01001	6.445	Rect.open
"Link13"	Reach	-2861.19	36.49	53.00	44.911	8.416	14438.00	20.42	6.48	51.39	0.000	9.719	1.241	0.01001	6.445	Rect.open
"STW SD"	Junction	-2857.19	36.53	53.00	44.727	8.192	14354.00	20.86	6.76	51.48	0.000	9.682	0.000	0.01000	0.000	Rect.open
"Link12"	Reach	-2828.43	36.82	52.33	45.279	8.456	14354.00	20.21	6.34	51.62	0.000	9.682	1.225	0.01001	6.419	Rect.open
"STW BE"	BriEntr	-2828.43	36.82	52.33	43.295	6.472	14354.00	24.64	9.43	52.72	0.000	9.247	0.000	0.00000	0.000	Rect.open
"PT 2755."	Reach	-2755.20	37.56	52.18	44.195	6.639	14354.00	24.02	8.96	53.16	0.000	9.247	1.643	0.01001	5.548	Rect.open
	"i.p."	-2751.04	37.60	52.22	44.248	6.650	14354.00	23.98	8.93	53.18	0.000	9.247	1.639	0.01001	5.548	Rect.open
	"i.p."	-2648.89	38.62	53.24	45.595	6.974	14354.00	22.87	8.12	53.71	0.000	9.247	1.526	0.01001	5.548	Rect.open
	"i.p."	-2576.61	39.34	53.97	46.659	7.315	14354.00	21.80	7.38	54.04	0.000	9.247	1.421	0.01001	5.548	Rect.open
	"i.p."	-2525.39	39.86	54.48	47.529	7.672	14354.00	20.79	6.71	54.24	0.000	9.247	1.323	0.01001	5.548	Rect.open
	"i.p."	-2490.07	40.21	54.83	48.257	8.046	14354.00	19.82	6.10	54.36	0.000	9.247	1.231	0.01001	5.548	Rect.open
	"i.p."	-2467.37	40.44	55.06	48.876	8.439	14354.00	18.90	5.55	54.42	0.000	9.247	1.146	0.01001	5.548	Rect.open
"GB 1"	Reach	-2455.12	40.56	55.19	49.411	8.851	14354.00	18.02	5.04	54.45	0.000	9.247	1.067	0.01001	5.548	Rect.open
	"i.p."	-2097.60	41.38	56.01	50.232	8.851	14354.00	18.02	5.04	55.27	0.000	9.247	1.067	0.00230	8.851	Rect.open
"Link47"	Reach	-1915.00	41.80	55.69	51.046	9.246	14354.00	17.25	4.62	55.67	0.000	9.247	1.000	0.00230	8.851	Rect.open
"Link5"	Transition	-1815.00	42.03	55.54	54.192	12.162	14354.00	11.00	1.88	56.07	0.000	8.222	0.556	0.00230	0.000	Rect.open
"Link62"	Reach	-1600.00	42.52	56.65	54.150	11.630	14354.00	11.50	2.05	56.20	0.000	8.222	0.594	0.00228	7.845	Rect.open
"CACH"	Junction	-1600.00	42.52	56.65	54.441	11.921	13944.00	10.90	1.84	56.29	0.000	8.065	0.000	0.00000	0.000	Rect.open
"Link45"	Reach	-1599.90	42.52	56.70	54.441	11.921	13944.00	10.90	1.84	56.29	0.000	8.065	0.556	0.00000	15.000	Rect.open
"WX"	WallExt	-1599.90	42.52	56.70	54.441	11.921	13944.00	13.00	2.62	57.06	0.000	9.069	0.000	0.00000	0.000	Rect.open
HYDRAULIC	JUMP at -1397.03 of length 0.14															
	"i.p."	-1397.03	42.99	57.17	54.381	11.392	13944.00	13.60	2.87	57.25	0.000	9.069	0.710	0.00231	8.667	Rect.open
	"i.p."	-1397.03	42.99	57.17	50.073	7.084	13944.00	21.87	7.43	57.50	0.000	9.069	1.448	0.00231	8.667	Rect.open
"PC 1372."	Reach	-1372.54	43.05	58.00	50.089	7.043	13944.00	22.00	7.51	57.60	0.000	9.069	1.461	0.00231	8.667	Rect.open
"PT 1308."	Reach	-1308.12	43.19	58.00	50.115	6.921	13944.00	22.39	7.78	57.90	0.000	9.069	1.500	0.00230	8.686	Rect.open
	"i.p."	-1155.59	43.54	58.35	50.168	6.623	13944.00	23.39	8.50	58.66	0.000	9.069	1.602	0.00230	8.687	Rect.open
"PRC 1008"	Reach	-1001.99	43.90	58.00	50.212	6.315	13944.00	24.53	9.35	59.56	0.000	9.069	1.720	0.00230	8.687	Rect.open
"Link64"	Reach	-955.05	44.00	58.00	50.223	6.219	13944.00	24.91	9.64	59.86	0.000	9.069	1.760	0.00228	8.708	Rect.open
"Link1"	Transition	-700.00	44.59	58.43	51.028	6.438	13944.00	26.37	10.80	61.83	0.000	9.678	1.855	0.00230	0.000	Trapez.open
"Link65"	Transition	-560.00	45.87	56.43	*60.132	14.261	13944.00	16.24	4.09	64.23	0.000	14.262	1.024	0.00915	0.000	Irreg.open
	"i.p."	-550.21	45.89	56.45	*60.552	14.659	13944.00	15.48	3.72	64.27	0.000	14.262	0.953	0.00226	16.000	Irreg.open
	"i.p."	-512.62	45.98	56.54	*61.047	15.068	13944.00	14.76	3.38	64.43	0.000	14.262	0.887	0.00226	16.000	Irreg.open
"Link66"	Reach	-450.00	46.12	58.00	*61.518	15.398	13944.00	14.22	3.14	64.66	0.000	14.262	0.839	0.00226	16.000	Irreg.open
"Headwork"	Headwrk	-450.00	46.12	58.00	*61.518	15.398	13944.00	14.22	3.14	64.66	0.000	14.262	0.000	0.00000	0.000	Irreg.open

*) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
i.p. = intermediate point processing results for reaches



Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C

HYDRAULIC ANLYSIS – LATERAL SYSTEMS



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook
30% Submittal

Appendix C-1

WSPG ANALYSIS – CEDAR AVENUE CHANNEL

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Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 1.3         06/09/2010
XP Software        www.xpsoftware.com
************************************

INPUT FILE
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R:\24523-LV Wash\06-Studies\01-30DesignDocumentationReport\Hydraulics-WSPG\Tributary Channels\CACH_30 PERCENT FINAL02.wsx
Computed  03/14/13  15:43:36

TITLE INFORMATION
************************************
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL MARCH 13, 2013
 CEDAR AVENUE CHANNEL
 PROPOSED CONDITION - 1544 CFS, 15X9 RCB

WARNING SUMMARY
************************************

RESULTS
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   Main Line
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 Composite Profile:
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ELEMENT NAME	TYPE	STATION	INVERT ELEV	GROUND ELEV	W.S. ELEV	DEPTH	Q	VELOC.	VELOC. HEAD	ENERGY GRADE LN	SUPER ELEV	CRITICAL DEPTH	FROUDE NUMBER	SLOPE	NORMAL DEPTH	CROSS SECTION
###																
"Node11"	Outlet	0.00	1742.86	1760.00	1746.908	4.048	1544.00	25.43	10.04	1756.95	0.000	6.905	0.000	0.00000	0.000	Tr./Rect.closed
	"i.p."	42.39	1744.28	1761.42	1748.514	4.239	1544.00	24.28	9.16	1757.67	0.000	6.905	2.079	0.03338	3.281	Tr./Rect.closed
	"i.p."	76.27	1745.41	1762.55	1749.851	4.445	1544.00	23.15	8.33	1758.18	0.000	6.905	1.935	0.03338	3.281	Tr./Rect.closed
	"i.p."	102.79	1746.29	1763.43	1750.954	4.662	1544.00	22.08	7.57	1758.52	0.000	6.905	1.802	0.03338	3.281	Tr./Rect.closed
"Link10"	Reach	123.72	1746.99	1760.60	1751.880	4.890	1544.00	21.05	6.88	1758.76	0.000	6.905	1.678	0.03338	3.281	Tr./Rect.closed
"Link9"	Reach	184.32	1747.92	1761.00	1753.003	5.083	1544.00	20.25	6.37	1759.37	0.000	6.905	1.583	0.01535	4.293	Tr./Rect.closed
"Link11"	Transition	189.32	1748.00	1760.00	1753.102	5.102	1544.00	20.18	6.32	1759.42	0.000	6.905	1.574	0.01600	0.000	Rect.open
	"i.p."	209.05	1748.30	1760.30	1753.491	5.187	1544.00	19.84	6.11	1759.61	0.000	6.905	1.535	0.01539	4.289	Rect.open
	"i.p."	252.64	1748.97	1760.97	1754.415	5.441	1544.00	18.92	5.56	1759.97	0.000	6.905	1.429	0.01539	4.289	Rect.open
	"i.p."	282.65	1749.44	1761.44	1755.142	5.706	1544.00	18.04	5.05	1760.20	0.000	6.905	1.331	0.01539	4.289	Rect.open
	"i.p."	302.97	1749.75	1761.75	1755.734	5.985	1544.00	17.20	4.59	1760.33	0.000	6.905	1.239	0.01539	4.289	Rect.open
	"i.p."	315.91	1749.95	1761.95	1756.225	6.277	1544.00	16.40	4.18	1760.40	0.000	6.905	1.154	0.01539	4.289	Rect.open
	"i.p."	322.97	1750.06	1762.06	1756.640	6.583	1544.00	15.64	3.80	1760.44	0.000	6.905	1.074	0.01539	4.289	Rect.open
"Link8"	Reach	325.13	1750.09	1761.00	1756.994	6.904	1544.00	14.91	3.45	1760.45	0.000	6.905	1.000	0.01539	4.289	Rect.open
"Link7"	Transition	375.13	1750.86	1761.00	1760.477	9.617	1544.00	4.98	0.38	1760.86	0.000	5.799	0.356	0.01540	0.000	Irreg.open
"Link6"	Reach	425.13	1750.96	1761.00	1760.478	9.518	1544.00	5.06	0.40	1760.88	0.000	5.799	0.364	0.00200	6.466	Irreg.open
"Link4"	Reach	439.58	1751.00	1760.86	1760.477	9.477	1544.00	5.09	0.40	1760.88	0.000	5.799	0.368	0.00277	5.545	Irreg.open
	"i.p."	580.07	1751.29	1761.15	1760.481	9.194	1544.00	5.34	0.44	1760.92	0.000	5.799	0.396	0.00204	6.445	Irreg.open
	"i.p."	715.70	1751.56	1761.42	1760.485	8.923	1544.00	5.60	0.49	1760.97	0.000	5.799	0.425	0.00204	6.445	Irreg.open
"Link1"	Reach	743.98	1751.62	1761.00	1760.486	8.866	1544.00	5.66	0.50	1760.98	0.000	5.799	0.431	0.00204	6.445	Irreg.open
"Node1"	Headwrk	743.98	1751.62	1761.00	1760.486	8.866	1544.00	5.66	0.50	1760.98	0.000	5.799	0.000	0.00000	0.000	Irreg.open

```
 *) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
    i.p. = intermediate point processing results for reaches
```

```
[TITLE]
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL MARCH 13, 2013
 CEDAR AVENUE CHANNEL
 PROPOSED CONDITION - 1544 CFS, 15X9 RCB

[REPORT]
COMPOSITE_ONLY

[NETWORK]
**TYPE            NAME
**-----           -------
Outlet            "Node11"
Reach             "Link10"
Reach             "Link9"
Transition        "Link11"
Reach             "Link8"
Transition        "Link7"
Reach             "Link6"
Reach             "Link4"
Reach             "Link1"
Headwork          "Node1"

**BRANCH DEFINITIONS

[OUTLET]
**NAME            STATION    INVERT     GROUND     CHANNEL     WATER SURFACE
**                           ELEV       ELEV       ID          ELEV (opt.)
**------------    ---------  ---------- ---------- ----------  ----------
"Node11"          0          1742.86    1760       "PROPOSED RCB"1750.04

[HEADWORK]
**NAME            INVERT     GROUND     CHANNEL     FLOW        WATER SURFACE
**                ELEV       ELEV       ID                      ELEV (opt.)
**------------    ---------  ---------- ----------  ----------  ----------
"Node1"           1751.62    1761       "EXIST TRAP"1544        1760.4

[WALLENTRANCE]
**NAME            INVERT     GROUND     CHANNEL     LOSS
**                ELEV       ELEV       ID          COEFFICIENT(opt.)
**------------    ---------  ---------- ----------  --------------

[WALLEXIT]
**NAME            INVERT     GROUND     CHANNEL     LOSS
**                ELEV       ELEV       ID          COEFFICIENT(opt.)
**------------    ---------  ---------- ----------  --------------

[BRIDGEENTRANCE]
**NAME            INVERT     GROUND     CHANNEL     REDUCTION
**                ELEV       ELEV       ID          FACTOR(opt.)
**------------    ---------  ---------- ----------  --------------

[BRIDGEEXIT]
**NAME            INVERT     GROUND     CHANNEL     REDUCTION
**                ELEV       ELEV       ID          FACTOR(opt.)
**------------    ---------  ---------- ----------  --------------

[JOIN]
**NAME            INVERT     GROUND     CHANNEL     LENGTH      MANNINGS n NUMBER OF  CONFLUENCE
**                ELEV       ELEV       ID                                 BRANCHES   ANGLE
**------------    ---------  ---------- ----------  ----------  ---------- ---------- ----------
```

[JUNCTION]

**Name	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	NUMBER OF LATERALS	CONFLUENCE ANGLE	FLOW

[TRANSITION]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n
"Link7"	1750.86	1761	"EXIST TRAP"	50	0.015
"Link11"	1748	1760	"NEW CHANNEL"	5	0.015

[REACH]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	CURVE (opt)	ANGLE POINT (opt)	NUMBER MANHOLES (opt)
"Link1"	1751.62	1761	EXIST TRAP	304.4	0.015	0	0	0
"Link4"	1751	1760.86	EXIST TRAP	14.45	0.015	0	0	0
"Link6"	1750.96	1761	EXIST TRAP	50	0.015	0	0	0
"Link8"	1750.09	1761	NEW CHANNEL	135.81	0.015	0	0	0
"Link9"	1747.92	1761	PROPOSED RCB	60.6	0.015	60.4	0	1
"Link10"	1746.99	1760.6	PROPOSED RCB	123.72	0.015	0	0	0

[CHANNEL]

**REGULAR TYPES 1-4

**ID	TYPE	HEIGHT	WIDTH	LEFT SLOPE	RIGHT SLOPE	NUMBER PIERS	AVG PIER WIDTH	INVERT CROSS FALL
"PROPOSED RCB"	3	9	15	0	0	0	0	0
"NEW CHANNEL"	2	9	15			0	0	0

**IRREGULAR TYPES 5-6

**ID	TYPE	NUMBER PIERS	AVG PIER WIDTH	PIER1 ELEV	PIER2 ELEV	PIER3 ELEV	PIER4 ELEV	PIER5 ELEV	PIER6 ELEV	PIER7 ELEV	PIER8 ELEV	PIER9 ELEV	PIER10 ELEV
"EXIST TRAP"	5	0	0										

[POINT]

**ID	XCOORD	YCOORD
"EXIST TRAP"	-12	12
"EXIST TRAP"	-12	6.24
"EXIST TRAP"	0	6
"EXIST TRAP"	9	0
"EXIST TRAP"	23	0
"EXIST TRAP"	39	10

Cross Section for CEDAR AVENUE CHANNEL-UPSTREAM EXISTING CONDITION

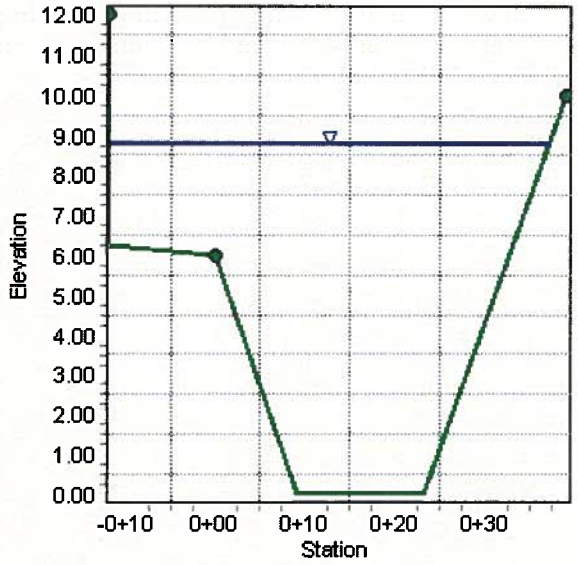
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00054	ft/ft
Normal Depth	8.78	ft
Discharge	1544.00	ft³/s

Cross Section Image



Cross Section for LV WASH SECTION AT CEDAR AVENUE CHANNEL

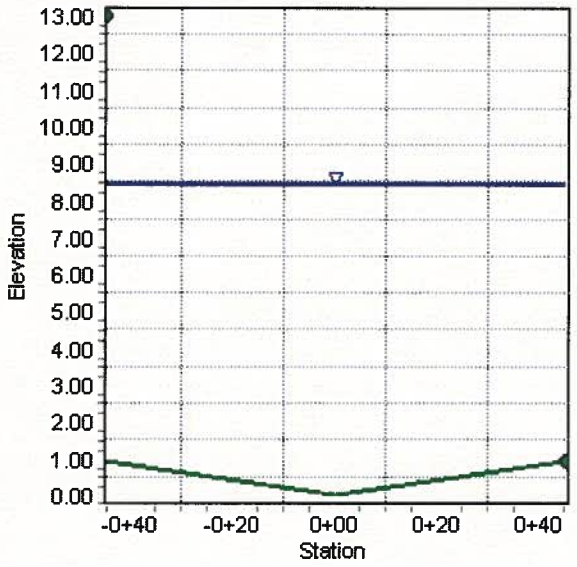
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00230	ft/ft
Normal Depth	8.42	ft
Discharge	12256.00	ft³/s

Cross Section Image





Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C-2

WSPG ANALYSIS – COLORADO AVENUE SYSTEM

```
************************************
Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 1.3         06/09/2010
XP Software        www.xpsoftware.com
************************************

INPUT FILE
************************************
R:\24523-LV Wash\06-Studies\01-30DesignDocumentationReport\Hydraulics-WSPG\Tributary Channels\LVCO_30 PERCENT FINAL02.wsx
Computed  03/28/13  16:45:14

TITLE INFORMATION
************************************
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL
 COLORADO AVENUE SYSTEM
 PROPOSED CONDITION - 1015 CFS, 18X8 RCB EXTENDED, NO TAIL WATER

WARNING SUMMARY
************************************

RESULTS
************************************

================================================================
   Main Line
================================================================
 Composite Profile:

ELEMENT    TYPE       STATION   INVERT   GROUND   W.S.     DEPTH    Q        VELOC.  VELOC.  ENERGY     SUPER   CRITICAL FROUDE  SLOPE    NORMAL   CROSS
NAME                            ELEV     ELEV     ELEV                               HEAD    GRADE LN   ELEV    DEPTH    NUMBER          DEPTH    SECTION
---------- ---------- --------- -------- -------- --------  -------- -------- ------- ------ ---------- ------  -------- ------  -------  ------   ---------
###
"Node14"   Outlet     0.00      1723.45  1733.00  1724.849  1.399    1015.00  25.02   9.72   1734.57    0.000   3.363    0.000   0.00000  0.000    Tr./Rect.closed
"Link13"   Reach      1.00      1723.93  1734.74  1725.364  1.434    1015.00  24.41   9.25   1734.62    0.000   3.363    3.592   0.48000  0.680    Tr./Rect.closed
"Link10"   Transition 10.70     1728.60  1739.60  1733.222  4.622    1015.00  12.20   2.31   1735.53    0.000   4.623    1.000   0.48144  0.000    Tr./Rect.closed
           "i.p."     29.76     1728.65  1739.65  1733.494  4.848    1015.00  11.63   2.10   1735.59    0.000   4.623    0.931   0.00239  5.243    Tr./Rect.closed
           "i.p."     141.77    1728.91  1739.91  1733.998  5.085    1015.00  11.09   1.91   1735.91    0.000   4.623    0.867   0.00239  5.243    Tr./Rect.closed
"Link9"    Reach      165.76    1728.97  1739.85  1734.074  5.104    1015.00  11.05   1.90   1735.97    0.000   4.623    0.862   0.00239  5.243    Tr./Rect.closed
"Link8"    Reach      255.51    1729.18  1739.95  1734.348  5.168    1015.00  10.91   1.85   1736.20    0.000   4.623    0.846   0.00234  5.279    Tr./Rect.closed
 HYDRAULIC JUMP  at  340.49  of length  0.04
           "i.p."     340.49    1729.38  1740.15  1734.572  5.188    1015.00  10.87   1.83   1736.41    0.000   4.623    0.841   0.00239  5.239    Tr./Rect.closed
           "i.p."     340.49    1729.38  1740.15  1733.482  4.099    1015.00  13.76   2.94   1736.42    0.000   4.623    1.198   0.00239  5.239    Tr./Rect.closed
           "i.p."     367.29    1729.45  1740.22  1733.408  3.960    1015.00  14.24   3.15   1736.56    0.000   4.623    1.261   0.00239  5.239    Tr./Rect.closed
"Link7"    Reach      406.00    1729.54  1740.45  1733.316  3.776    1015.00  14.93   3.46   1736.78    0.000   4.623    1.354   0.00239  5.239    Tr./Rect.closed
"Link6"    Reach      433.67    1729.61  1740.45  1733.268  3.658    1015.00  15.41   3.69   1736.96    0.000   4.623    1.420   0.00253  5.137    Tr./Rect.closed
"Link5"    Reach      461.34    1729.68  1740.45  1733.225  3.545    1015.00  15.91   3.93   1737.15    0.000   4.623    1.489   0.00253  5.137    Tr./Rect.closed
           "i.p."     499.89    1729.77  1740.54  1733.154  3.386    1015.00  16.65   4.31   1737.46    0.000   4.623    1.595   0.00230  5.314    Tr./Rect.closed
"Link4"    Reach      539.70    1729.86  1741.45  1733.088  3.228    1015.00  17.47   4.74   1737.83    0.000   4.623    1.713   0.00230  5.314    Tr./Rect.closed
"Link3"    Transition 545.70    1729.87  1741.65  1735.335  5.465    1015.00  13.27   2.73   1738.07    0.000   5.466    1.000   0.00167  0.000    Tr./Rect.closed
           "i.p."     559.32    1729.90  1741.68  1735.636  5.733    1015.00  12.65   2.48   1738.12    0.000   5.466    0.931   0.00242  6.585    Tr./Rect.closed
           "i.p."     619.98    1730.05  1741.83  1736.062  6.012    1015.00  12.06   2.26   1738.32    0.000   5.466    0.867   0.00242  6.585    Tr./Rect.closed
           "i.p."     800.70    1730.49  1742.27  1736.793  6.306    1015.00  11.50   2.05   1738.85    0.000   5.466    0.807   0.00242  6.585    Tr./Rect.closed
"Link2"    Reach      1090.70   1731.19  1743.95  1737.659  6.469    1015.00  11.21   1.95   1739.61    0.000   5.466    0.777   0.00242  6.585    Tr./Rect.closed
           "i.p."     1922.49   1733.19  1745.95  1739.794  6.608    1015.00  10.97   1.87   1741.66    0.000   5.466    0.752   0.00240  6.608    Tr./Rect.closed
"Link1"    Reach      2140.70   1733.71  1746.45  1740.318  6.608    1015.00  10.97   1.87   1742.19    0.000   5.466    0.752   0.00240  6.608    Tr./Rect.closed
"Node1"    Headwrk    2140.70   1733.71  1746.45  1740.318  6.608    1015.00  10.97   1.87   1742.19    0.000   5.466    0.000   0.00000  0.000    Tr./Rect.closed

 *) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
    i.p. = intermediate point processing results for reaches
```

```
[TITLE]
 LV WASH - SLOAN AVENUE TO CEDAR AVENUE CHANNEL
 COLORADO AVENUE SYSTEM
 PROPOSED CONDITION - 1015 CFS, 18X8 RCB EXTENDED, NO TAIL WATER

[REPORT]
COMPOSITE_ONLY

[NETWORK]
**TYPE          NAME
**-----         -------
Outlet          "Node14"
Reach           "Link13"
Transition      "Link10"
Reach           "Link9"
Reach           "Link8"
Reach           "Link7"
Reach           "Link6"
Reach           "Link5"
Reach           "Link4"
Transition      "Link3"
Reach           "Link2"
Reach           "Link1"
Headwork        "Node1"

**BRANCH DEFINITIONS

[OUTLET]
**NAME          STATION    INVERT     GROUND     CHANNEL     WATER SURFACE
**                         ELEV       ELEV       ID          ELEV (opt.)
**------------  ---------  ---------- ---------- ----------  ----------
"Node14"        0          1723.45    1733       "29X8 Box"  1726.46

[HEADWORK]
**NAME          INVERT     GROUND     CHANNEL     FLOW        WATER SURFACE
**              ELEV       ELEV       ID                      ELEV (opt.)
**------------  ---------  ---------- ----------  ----------  ----------
"Node1"         1733.71    1746.45    "14X8 Box"  1015        1740.32

[WALLENTRANCE]
**NAME          INVERT     GROUND     CHANNEL     LOSS
**              ELEV       ELEV       ID          COEFFICIENT(opt.)
**------------  ---------  ---------- ----------  --------------

[WALLEXIT]
**NAME          INVERT     GROUND     CHANNEL     LOSS
**              ELEV       ELEV       ID          COEFFICIENT(opt.)
**------------  ---------  ---------- ----------  --------------

[BRIDGEENTRANCE]
**NAME          INVERT     GROUND     CHANNEL     REDUCTION
**              ELEV       ELEV       ID          FACTOR(opt.)
**------------  ---------  ---------- ----------  --------------

[BRIDGEEXIT]
**NAME          INVERT     GROUND     CHANNEL     REDUCTION
**              ELEV       ELEV       ID          FACTOR(opt.)
**------------  ---------  ---------- ----------  --------------

[JOIN]
**NAME          INVERT     GROUND     CHANNEL     LENGTH      MANNINGS n  NUMBER OF   CONFLUENCE
**              ELEV       ELEV       ID                                  BRANCHES    ANGLE
**------------  ---------  ---------- ----------  ----------  ----------  ----------  ----------

[JUNCTION]
**Name          INVERT     GROUND     CHANNEL     LENGTH      MANNINGS n  NUMBER OF   CONFLUENCE FLOW
**              ELEV       ELEV       ID                                  LATERALS    ANGLE
**------------  ---------  ---------- ----------  ----------  ----------  ----------  ---------- ----------

[TRANSITION]
**NAME          INVERT     GROUND     CHANNEL     LENGTH      MANNINGS n
**              ELEV       ELEV       ID
**------------  ---------  ---------- ----------  ----------  ----------
"Link3"         1729.87    1741.65    "14X8 Box"  6           0.015
"Link10"        1728.6     1739.6     "18X8 Box"  9.7         0.015
```

[REACH]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	CURVE (opt)	ANGLE POINT(opt)	NUMBER MANHOLES(opt)
"Link1"	1733.71	1746.45	"14X8 Box"	1050	0.015	0	0	3
"Link2"	1731.19	1743.95	"14X8 Box"	545	0.015	0	0	2
"Link4"	1729.86	1741.45	"18X8 Box"	78.36	0.015	0	0	0
"Link5"	1729.68	1740.45	"18X8 Box"	27.67	0.015	31.7	0	0
"Link6"	1729.61	1740.45	"18X8 Box"	27.67	0.015	31.71	0	0
"Link7"	1729.54	1740.45	"18X8 Box"	150.49	0.015	0	0	0
"Link8"	1729.18	1739.95	"18X8 Box"	89.75	0.015	34.28	0	0
"Link9"	1728.97	1739.85	"18X8 Box"	155.06	0.015	0	0	1
"Link13"	1723.93	1734.74	"29X8 Box"	1	0.015	0	8	0

[CHANNEL]

**REGULAR TYPES 1-4

**ID	TYPE	HEIGHT	WIDTH	LEFT SLOPE	RIGHT SLOPE	NUMBER PIERS	AVG PIER WIDTH	INVERT CROSS FALL
"29X8 Box"	3	8	29	0	0	0	0	0
"14X8 Box"	3	8	14	0	0	0	0	0
"18X8 Box"	3	8	18	0	0	0	0	0

**IRREGULAR TYPES 5-6

**ID	TYPE	NUMBER PIERS	AVG PIER WIDTH	PIER1 ELEV	PIER2 ELEV	PIER3 ELEV	PIER4 ELEV	PIER5 ELEV	PIER6 ELEV	PIER7 ELEV	PIER8 ELEV	PIER9 ELEV	PIER10 ELEV

[POINT]

**ID	XCOORD	YCOORD

Cross Section for COLORADO AVENUE SYSTEM-UPSTREAM EXISTING CONDITION

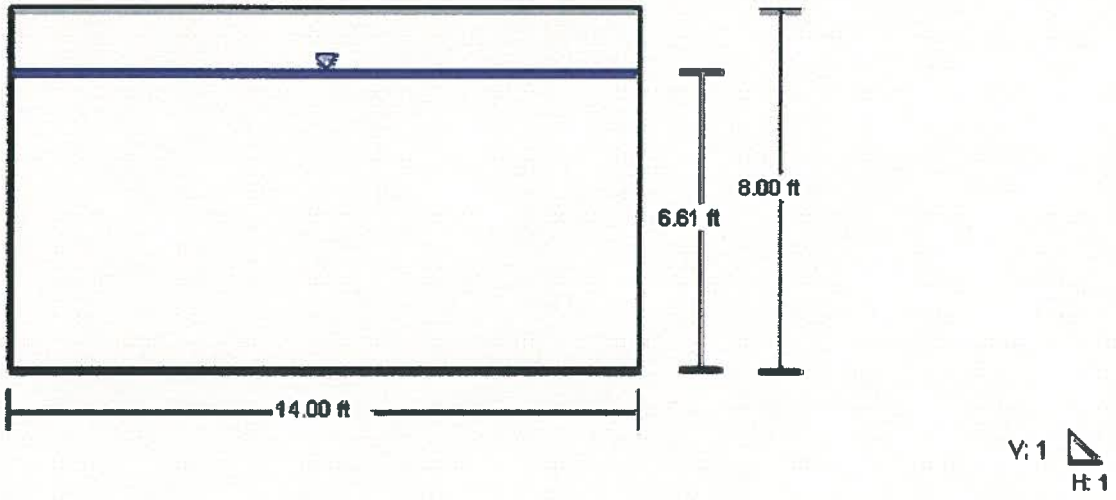
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00240	ft/ft
Normal Depth	6.61	ft
Height	8.00	ft
Bottom Width	14.00	ft
Discharge	1015.00	ft^3/s

Cross Section Image



Cross Section for LV WASH SECTION AT COLORADO AVE SYSTEM

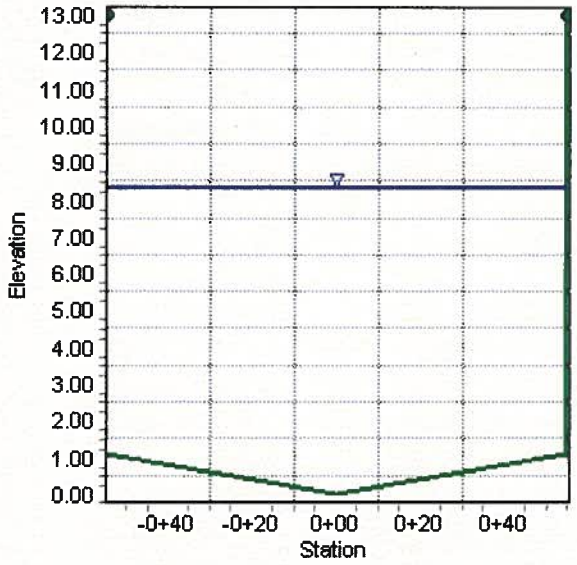
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	8.33	ft
Discharge	13698.00	ft³/s

Cross Section Image





Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C-3

WSPG ANALYSIS – NELLIS WYOMING CHANNEL

```
************************************
Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 1.3         06/09/2010
XP Software        www.xpsoftware.com
************************************

INPUT FILE
************************************
R:\24523-LV Wash\06-Studies\01-30DesignDocumentationReport\Hydraulics-WSPG\Tributary Channels\NLWY_30 PERCENT FINAL03.wsx
Computed  04/09/13  11:15:20

TITLE INFORMATION
************************************
 LV WASH - SLOAN CHANNEL TO CEDAR AVENUE, APRIL 2013
 NELLIS WYOMING CHANNEL
 PROPOSED CONDITION - 15X6 RCB, 338 CFS

WARNING SUMMARY
************************************

RESULTS
************************************


================================================================
   Main Line
================================================================

 Composite Profile:
```

ELEMENT NAME	TYPE	STATION	INVERT ELEV	GROUND ELEV	W.S. ELEV	DEPTH	Q	VELOC.	VELOC. HEAD	ENERGY GRADE LN	SUPER ELEV	CRITICAL DEPTH	FROUDE NUMBER	SLOPE	NORMAL DEPTH	CROSS SECTION
###																
"Node13"	Outlet	0.00	1725.00	1736.50	1726.136	1.136	338.00	19.84	6.11	1732.25	0.000	2.508	0.000	0.00000	0.000	Tr./Rect.closed
	"i.p."	6.68	1725.66	1737.16	1726.837	1.179	338.00	19.11	5.67	1732.51	0.000	2.508	3.102	0.09845	0.861	Tr./Rect.closed
	"i.p."	13.76	1726.35	1737.85	1727.592	1.237	338.00	18.22	5.16	1732.75	0.000	2.508	2.888	0.09845	0.861	Tr./Rect.closed
	"i.p."	19.65	1726.93	1738.43	1728.231	1.297	338.00	17.37	4.69	1732.92	0.000	2.508	2.688	0.09845	0.861	Tr./Rect.closed
	"i.p."	24.59	1727.42	1738.92	1728.781	1.360	338.00	16.57	4.26	1733.04	0.000	2.508	2.503	0.09845	0.861	Tr./Rect.closed
	"i.p."	28.76	1727.83	1739.33	1729.258	1.427	338.00	15.79	3.87	1733.13	0.000	2.508	2.330	0.09845	0.861	Tr./Rect.closed
"Link12"	Reach	32.30	1728.18	1737.00	1729.676	1.496	338.00	15.06	3.52	1733.20	0.000	2.508	2.170	0.09845	0.861	Tr./Rect.closed
"Link13"	Transition	42.30	1729.16	1737.00	1732.344	3.184	338.00	8.75	1.19	1733.53	0.000	3.185	1.225	0.09800	0.000	Irreg.open
	"i.p."	46.60	1729.16	1737.00	1732.464	3.300	338.00	8.34	1.08	1733.54	0.000	3.185	1.139	0.00110	4.124	Irreg.open
	"i.p."	62.27	1729.18	1737.02	1732.600	3.418	338.00	7.95	0.98	1733.58	0.000	3.185	1.061	0.00110	4.124	Irreg.open
	"i.p."	95.06	1729.22	1737.06	1732.758	3.540	338.00	7.58	0.89	1733.65	0.000	3.185	0.988	0.00110	4.124	Irreg.open
	"i.p."	155.12	1729.28	1737.12	1732.949	3.665	338.00	7.22	0.81	1733.76	0.000	3.185	0.919	0.00110	4.124	Irreg.open
"Link6"	Reach	260.95	1729.40	1740.00	1733.192	3.792	338.00	6.89	0.74	1733.93	0.000	3.185	0.857	0.00110	4.124	Irreg.open
"Node6"	WallExt	260.95	1729.40	1740.00	1733.191	3.791	338.00	6.51	0.66	1733.85	0.000	3.116	0.000	0.00000	0.000	Tr./Rect.closed
	"i.p."	329.78	1729.56	1740.16	1733.225	3.666	338.00	6.83	0.72	1733.95	0.000	3.116	0.746	0.00232	3.294	Tr./Rect.closed
"Link5"	Reach	347.34	1729.60	1739.60	1733.235	3.635	338.00	6.91	0.74	1733.98	0.000	3.116	0.757	0.00232	3.294	Tr./Rect.closed
"Link4"	Transition	362.34	1729.65	1736.65	1733.080	3.430	338.00	7.91	0.97	1734.05	0.000	3.185	1.053	0.00333	0.000	Irreg.open
"Link3"	Reach	368.83	1729.66	1736.66	1733.107	3.447	338.00	7.86	0.96	1734.07	0.000	3.185	1.043	0.00154	3.771	Irreg.open
"Link2"	Reach	402.13	1729.75	1736.75	1733.127	3.377	338.00	8.08	1.01	1734.14	0.000	3.185	1.087	0.00270	3.247	Irreg.open
	"i.p."	468.19	1729.87	1736.87	1733.364	3.497	338.00	7.70	0.92	1734.28	0.000	3.185	1.012	0.00176	3.641	Irreg.open
"Link1"	Reach	515.82	1729.95	1736.95	1733.487	3.537	338.00	7.59	0.89	1734.38	0.000	3.185	0.989	0.00176	3.641	Irreg.open
"Node1"	Headwrk	515.82	1729.95	1736.95	1733.487	3.537	338.00	7.59	0.89	1734.38	0.000	3.185	0.000	0.00000	0.000	Irreg.open

*) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
   i.p. = intermediate point processing results for reaches

```
[TITLE]
 LV WASH - SLOAN CHANNEL TO CEDAR AVENUE, APRIL 2013
 NELLIS WYOMING CHANNEL
 PROPOSED CONDITION - 15X6 RCB, 338 CFS

[REPORT]
COMPOSITE_ONLY

[NETWORK]
**TYPE           NAME
**-----          -------
Outlet           "Node13"
Reach            "Link12"
Transition       "Link13"
Reach            "Link6"
WallExit         "Node6"
Reach            "Link5"
Transition       "Link4"
Reach            "Link3"
Reach            "Link2"
Reach            "Link1"
Headwork         "Node1"

**BRANCH DEFINITIONS

[OUTLET]
**NAME           STATION    INVERT     GROUND     CHANNEL     WATER SURFACE
**                          ELEV       ELEV       ID          ELEV (opt.)
**-------------  ---------  ---------- ---------- ----------  ----------
"Node13"         0          1725       1736.5     "PROPOSED RCB"1726.5

[HEADWORK]
**NAME           INVERT     GROUND     CHANNEL     FLOW        WATER SURFACE
**               ELEV       ELEV       ID                      ELEV (opt.)
**-------------  ---------  ---------- ----------  ----------  ----------
"Node1"          1729.95    1736.95    "EXIST TRAP"338         1733.62

[WALLENTRANCE]
**NAME           INVERT     GROUND     CHANNEL     LOSS
**               ELEV       ELEV       ID          COEFFICIENT(opt.)
**-------------  ---------  ---------- ----------  --------------

[WALLEXIT]
**NAME           INVERT     GROUND     CHANNEL     LOSS
**               ELEV       ELEV       ID          COEFFICIENT(opt.)
**-------------  ---------  ---------- ----------  --------------
"Node6"          1729.4     1740       "EXIST RCB AT DW"0

[BRIDGEENTRANCE]
**NAME           INVERT     GROUND     CHANNEL     REDUCTION
**               ELEV       ELEV       ID          FACTOR(opt.)
**-------------  ---------  ---------- ----------  --------------

[BRIDGEEXIT]
**NAME           INVERT     GROUND     CHANNEL     REDUCTION
**               ELEV       ELEV       ID          FACTOR(opt.)
**-------------  ---------  ---------- ----------  --------------

[JOIN]
**NAME           INVERT     GROUND     CHANNEL     LENGTH     MANNINGS n NUMBER OF  CONFLUENCE
**               ELEV       ELEV       ID                                BRANCHES   ANGLE
**-------------  ---------  ---------- ----------  ---------- ---------- ---------- ----------

[JUNCTION]
**Name           INVERT     GROUND     CHANNEL     LENGTH     MANNINGS n NUMBER OF  CONFLUENCE FLOW
**               ELEV       ELEV       ID                                LATERALS   ANGLE
**-------------  ---------  ---------- ----------  ---------- ---------- ---------- ---------- ----------

[TRANSITION]
**NAME           INVERT     GROUND     CHANNEL     LENGTH     MANNINGS n
**               ELEV       ELEV       ID
**-------------  ---------  ---------- ----------  ---------- ----------
"Link4"          1729.65    1736.65    "EXIST TRAP"15         0.015
"Link13"         1729.16    1737       "EXIST TRAP"10         0.015
```

[REACH]

**NAME	INVERT ELEV	GROUND ELEV	CHANNEL ID	LENGTH	MANNINGS n	CURVE (opt)	ANGLE POINT (opt)	NUMBER MANHOLES (opt)
"Link1"	1729.95	1736.95	EXIST TRAP	113.69	0.015	0	0	0
"Link2"	1729.75	1736.75	EXIST TRAP	33.3	0.015	0	0	0
"Link3"	1729.66	1736.66	EXIST TRAP	6.49	0.015	0	0	0
"Link5"	1729.6	1739.6	EXIST RCB AT DW	86.39	0.015	0	0	0
"Link6"	1729.4	1740	EXIST TRAP	218.65	0.015	10	0	0
"Link12"	1728.18	1737	PROPOSED RCB	32.3	0.015	15	0	0

[CHANNEL]

**REGULAR TYPES 1-4

**ID	TYPE	HEIGHT	WIDTH	LEFT SLOPE	RIGHT SLOPE	NUMBER PIERS	AVG PIER WIDTH	INVERT CROSS FALL
PROPOSED RCB3	6	15	0	0	0	0	0	
EXIST RCB AT DW3	6	8	1.5	1.5	0	0	0	

**IRREGULAR TYPES 5-6

**ID	TYPE	NUMBER PIERS	AVG PIER WIDTH	PIER1 ELEV	PIER2 ELEV	PIER3 ELEV	PIER4 ELEV	PIER5 ELEV	PIER6 ELEV	PIER7 ELEV	PIER8 ELEV	PIER9 ELEV	PIER10 ELEV
"EXIST TRAP"	5	0	0										

[POINT]

**ID	XCOORD	YCOORD
"EXIST TRAP"	-4	6
"EXIST TRAP"	0	4
"EXIST TRAP"	5.2	0
"EXIST TRAP"	13.2	0
"EXIST TRAP"	18.4	4
"EXIST TRAP"	20.4	6



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C-4

RCP LATERALS – SLOAN CHANNEL TO NELLIS BOULEVARD

Worksheet for Circular Orifice - 72" RCP from Christy Lane (Q=267 cfs)

Project Description

Solve For	Headwater Elevation

Input Data

Discharge	267.00	ft³/s
Centroid Elevation	18.20	ft
Tailwater Elevation	22.06	ft
Discharge Coefficient	0.65	
Diameter	6.00	ft

Results

Headwater Elevation	25.34	ft
Headwater Height Above Centroid	7.14	ft
Tailwater Height Above Centroid	3.86	ft
Flow Area	28.27	ft²
Velocity	9.44	ft/s

Cross Section for Circular Orifice - 72" RCP from Christy Lane (Q=267

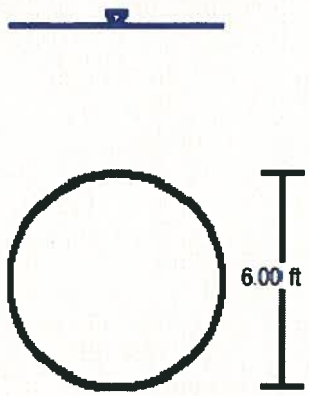
Project Description

Solve For	Headwater Elevation

Input Data

Discharge	267.00	ft³/s
Headwater Elevation	25.34	ft
Centroid Elevation	18.20	ft
Tailwater Elevation	22.06	ft
Discharge Coefficient	0.65	
Diameter	6.00	ft

Cross Section Image



42" Lateral Pipe - Sahara

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00700	ft/ft
Normal Depth	3.50	ft
Diameter	3.50	ft
Discharge	72.95	ft³/s

Results

Discharge	72.95	ft³/s
Normal Depth	3.50	ft
Flow Area	9.62	ft²
Wetted Perimeter	11.00	ft
Hydraulic Radius	0.88	ft
Top Width	0.00	ft
Critical Depth	2.68	ft
Percent Full	100.0	%
Critical Slope	0.00806	ft/ft
Velocity	7.58	ft/s
Velocity Head	0.89	ft
Specific Energy	4.39	ft
Froude Number	0.00	
Maximum Discharge	78.47	ft³/s
Discharge Full	72.95	ft³/s
Slope Full	0.00700	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

42" Lateral Pipe - Sahara

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.50	ft
Critical Depth	2.68	ft
Channel Slope	0.00700	ft/ft
Critical Slope	0.00806	ft/ft

42" Lateral Pipe - Sahara

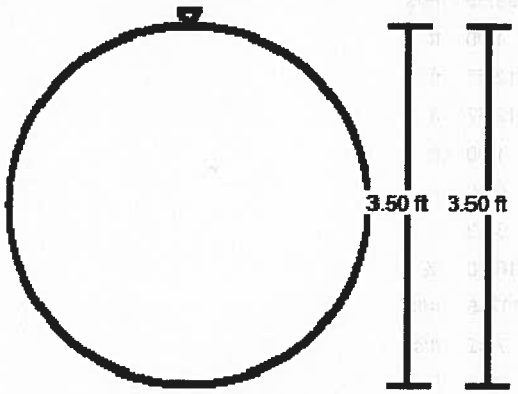
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00700	ft/ft
Normal Depth	3.50	ft
Diameter	3.50	ft
Discharge	72.95	ft³/s

Cross Section Image



V: 1
H: 1

48" Clubhouse Lateral

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00640	ft/ft
Normal Depth	4.00	ft
Diameter	4.00	ft
Discharge	99.59	ft^3/s

Results

Discharge	99.59	ft^3/s
Normal Depth	4.00	ft
Flow Area	12.57	ft^2
Wetted Perimeter	12.57	ft
Hydraulic Radius	1.00	ft
Top Width	0.00	ft
Critical Depth	3.02	ft
Percent Full	100.0	%
Critical Slope	0.00756	ft/ft
Velocity	7.92	ft/s
Velocity Head	0.98	ft
Specific Energy	4.98	ft
Froude Number	0.00	
Maximum Discharge	107.13	ft^3/s
Discharge Full	99.59	ft^3/s
Slope Full	0.00640	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

48" Clubhouse Lateral

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.00	ft
Critical Depth	3.02	ft
Channel Slope	0.00640	ft/ft
Critical Slope	0.00756	ft/ft

48" Clubhouse Lateral

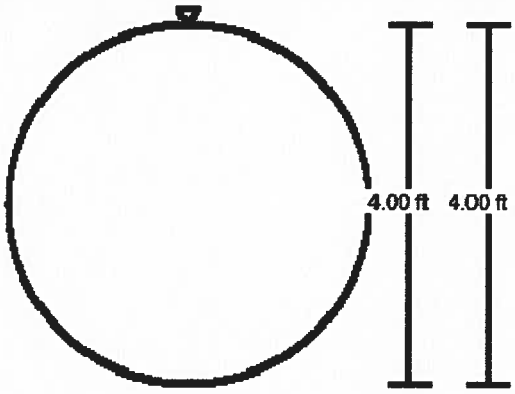
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00640	ft/ft
Normal Depth	4.00	ft
Diameter	4.00	ft
Discharge	99.59	ft^3/s

Cross Section Image



V: 1
H: 1

Worksheet for Circular Orifice - 18" RCP by 2nd Ped. Bridge

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	16.20	ft
Centroid Elevation	12.75	ft
Tailwater Elevation	15.05	ft
Discharge Coefficient	0.65	
Diameter	1.50	ft

Results

Discharge	9.88	ft^3/s
Headwater Height Above Centroid	3.45	ft
Tailwater Height Above Centroid	2.30	ft
Flow Area	1.77	ft^2
Velocity	5.59	ft/s

Cross Section for Circular Orifice - 18" RCP by 2nd Ped. Bridge

Project Description

Solve For	Discharge

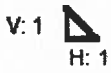
Input Data

Discharge	9.88	ft³/s
Headwater Elevation	16.20	ft
Centroid Elevation	12.75	ft
Tailwater Elevation	15.05	ft
Discharge Coefficient	0.65	
Diameter	1.50	ft

Cross Section Image









Las Vegas Wash— Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C-5

RCP LATERALS – NELLIS BOULEVAD TO CEDAR AVENUE

Worksheet for 38X60 INCH LATERAL AT "LV" 36+29.27

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.15320	ft/ft
Rise	5.00	ft
Span	3.17	ft
Discharge	51.00	ft³/s

Results

Normal Depth	1.00	ft
Flow Area	1.76	ft²
Wetted Perimeter	3.40	ft
Hydraulic Radius	0.52	ft
Top Width	2.53	ft
Critical Depth	2.54	ft
Percent Full	19.9	%
Critical Slope	0.00517	ft/ft
Velocity	28.91	ft/s
Velocity Head	12.99	ft
Specific Energy	13.98	ft
Froude Number	6.11	
Maximum Discharge	566.99	ft³/s
Discharge Full	541.21	ft³/s
Slope Full	17.25096	ft/ft
Flow Type	Supercritical	

Worksheet for 38X60 INCH LATERAL AT "LV" 36+29.27

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	19.94	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.00	ft
Critical Depth	2.54	ft
Channel Slope	0.15320	ft/ft
Critical Slope	0.00517	ft/ft

Worksheet for 48-INCH LATERAL AT "LV" 36+29.27

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.12790	ft/ft
Diameter	4.00	ft
Discharge	51.00	ft³/s

Results

Normal Depth	0.85	ft
Flow Area	1.95	ft²
Wetted Perimeter	3.84	ft
Hydraulic Radius	0.51	ft
Top Width	3.27	ft
Critical Depth	2.14	ft
Percent Full	21.3	%
Critical Slope	0.00400	ft/ft
Velocity	26.09	ft/s
Velocity Head	10.58	ft
Specific Energy	11.43	ft
Froude Number	5.95	
Maximum Discharge	552.57	ft³/s
Discharge Full	513.69	ft³/s
Slope Full	0.00126	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for 48-INCH LATERAL AT "LV" 36+29.27

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	21.28	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.85	ft
Critical Depth	2.14	ft
Channel Slope	0.12790	ft/ft
Critical Slope	0.00400	ft/ft

Worksheet for 48-INCH LATERAL AT "LV" 49+29.00

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01970	ft/ft
Diameter	4.00	ft
Discharge	139.00	ft^3/s

Results

Normal Depth	2.44	ft
Flow Area	8.03	ft^2
Wetted Perimeter	7.17	ft
Hydraulic Radius	1.12	ft
Top Width	3.90	ft
Critical Depth	3.50	ft
Percent Full	61.0	%
Critical Slope	0.00848	ft/ft
Velocity	17.30	ft/s
Velocity Head	4.65	ft
Specific Energy	7.09	ft
Froude Number	2.13	
Maximum Discharge	216.86	ft^3/s
Discharge Full	201.60	ft^3/s
Slope Full	0.00936	ft/ft
Flow Type	SuperCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Worksheet for 48-INCH LATERAL AT "LV" 49+29.00

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	61.03	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.44	ft
Critical Depth	3.50	ft
Channel Slope	0.01970	ft/ft
Critical Slope	0.00848	ft/ft

Worksheet for 48-INCH LATERAL AT "LV" 61+70.40

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01800	ft/ft
Diameter	4.00	ft
Discharge	103.00	ft³/s

Results

Normal Depth	2.08	ft
Flow Area	6.61	ft²
Wetted Perimeter	6.44	ft
Hydraulic Radius	1.03	ft
Top Width	4.00	ft
Critical Depth	3.07	ft
Percent Full	52.0	%
Critical Slope	0.00585	ft/ft
Velocity	15.59	ft/s
Velocity Head	3.78	ft
Specific Energy	5.86	ft
Froude Number	2.14	
Maximum Discharge	207.30	ft³/s
Discharge Full	192.71	ft³/s
Slope Full	0.00514	ft/ft
Flow Type	SuperCritical	

Worksheet for 48-INCH LATERAL AT "LV" 61+70.40

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	52.02	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.08	ft
Critical Depth	3.07	ft
Channel Slope	0.01800	ft/ft
Critical Slope	0.00585	ft/ft

Messages

Notes

103 CFS FROM SUBBASIN NEL06-C1, HEC-1 "LVWASH_01.OUT"

Worksheet for 48-INCH LATERAL AT "LV" 61+70.40

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01800	ft/ft
Diameter	4.00	ft
Discharge	204.46	ft^3/s

Results

Normal Depth	3.56	ft
Flow Area	11.82	ft^2
Wetted Perimeter	9.87	ft
Hydraulic Radius	1.20	ft
Top Width	2.49	ft
Critical Depth	3.86	ft
Percent Full	89.1	%
Critical Slope	0.01773	ft/ft
Velocity	17.29	ft/s
Velocity Head	4.65	ft
Specific Energy	8.21	ft
Froude Number	1.40	
Maximum Discharge	207.30	ft^3/s
Discharge Full	192.71	ft^3/s
Slope Full	0.02026	ft/ft
Flow Type	SuperCritical	

Worksheet for 48-INCH LATERAL AT "LV" 61+70.40

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	89.10	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.56	ft
Critical Depth	3.86	ft
Channel Slope	0.01800	ft/ft
Critical Slope	0.01773	ft/ft

Messages

Notes

204.46 CFS FROM CHARLESTON-ARLINGTON FLOW SPLIT CALCULATION

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1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*             VERSION 4.1               *
*                                       *
*  RUN DATE   28MAR13  TIME  09:54:09   *
*                                       *
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*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
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XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
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X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
      LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
                    *DIAGRAM
*** FREE ***
          1         ID   LAS VEGAS WASH, SLOAN CHANNEL TO CEDAR AVENUE
          2         ID   10-YEAR AND 100-YEAR  6-HOUR STORM
          3         ID   INPUT FILE = LVWASH_02.DAT
          4         ID
          5         ID   CURVE NUMBERS OBTAINED FROM:
          6         ID   CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
          7         ID   LAS VEGAS WASH THROUGH THE CENTRAL WATERSHED
          8         ID   RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
          9         ID   INPUT FILE = CLVWASH5.DAT
         10         ID   INPUT FILE DATE = 06/10/08
         11         ID   DESIGN STORM = 100-YEAR 6-HOUR STORM
         12         ID
         13         ID
         14         JR    PREC    0.57    1.00
         15         IT       5       0       0     300
         16         IO       5       0       0
         17         IN       5
                    *
         18         KK CH77-C1
         19         KM   PORTION OF MPU BASIN CH77-C
         20         KM   CONTRIBUTES TO PROPOSED 48-INCH RCP AT LV WASH STATION "LV" 36+29.47
         21         KM   CN = 90.1
         22         BA  0.0398
         23         PB    2.77
         24         PC    0.00   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
         25         PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
         26         PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
         27         PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
         28         PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
         29         PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
         30         PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
         31         PC   0.998   0.999   1.000
         32         LS       0    90.1
         33         UD   0.208
                    *
         34         KK CH77-C2
         35         KM   PORTION OF MPU BASIN CH77-C
         36         KM   CONTRIBUTES TO PROPOSED 48-INCH RCP AT LV WASH STATION "LV" 49+29.00
         37         KM   CN = 90.1
         38         BA  0.1256
         39         LS       0    90.1
         40         UD   0.305
                    *
         41         KKNEL06-C1
         42         KM   PORTION OF MPU BASIN NEL06-C
         43         KM   CONTRIBUTES TO PROPOSED 48-INCH RCP AT LV WASH STATION "LV" 61+70.40
         44         KM   CN = 88.2
         45         BA   0.112
         46         LS       0    88.2
         47         UD   0.387
                    *
```

1

```
         LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

          48           ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    18     CH77-C1
                .
                .
    34          .     CH77-C2
                .          .
                .          .
    41          .          .    NEL06-C1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                ****************************************
*                                      *                *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                *    U.S. ARMY CORPS OF ENGINEERS      *
*              JUN  1998               *                *    HYDROLOGIC ENGINEERING CENTER     *
*            VERSION 4.1               *                *         609 SECOND STREET            *
*                                      *                *       DAVIS, CALIFORNIA 95616        *
*  RUN DATE   28MAR13  TIME  09:54:09  *                *          (916) 756-1104              *
*                                      *                *                                      *
****************************************                ****************************************
```

LAS VEGAS WASH, SLOAN CHANNEL TO CEDAR AVENUE
10-YEAR AND 100-YEAR 6-HOUR STORM
INPUT FILE = LVWASH_01.DAT

CURVE NUMBERS OBTAINED FROM:
CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT 2008 MASTER PLAN UPDATE
LAS VEGAS WASH THROUGH THE CENTRAL WATERSHED
RECOMMENDED DRAINAGE SYSTEM WITH ULTIMATE DEVELOPMENT
INPUT FILE = CLVWASH5.DAT
INPUT FILE DATE = 06/10/08
DESIGN STORM = 100-YEAR 6-HOUR STORM

```
  16 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT           HYDROGRAPH TIME DATA
                      NMIN           5  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1   0  STARTING DATE
                      ITIME        0000  STARTING TIME
                        NQ          300  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2   0  ENDING DATE
                     NDTIME        0055  ENDING TIME
                     ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                     TOTAL TIME BASE   24.92 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT

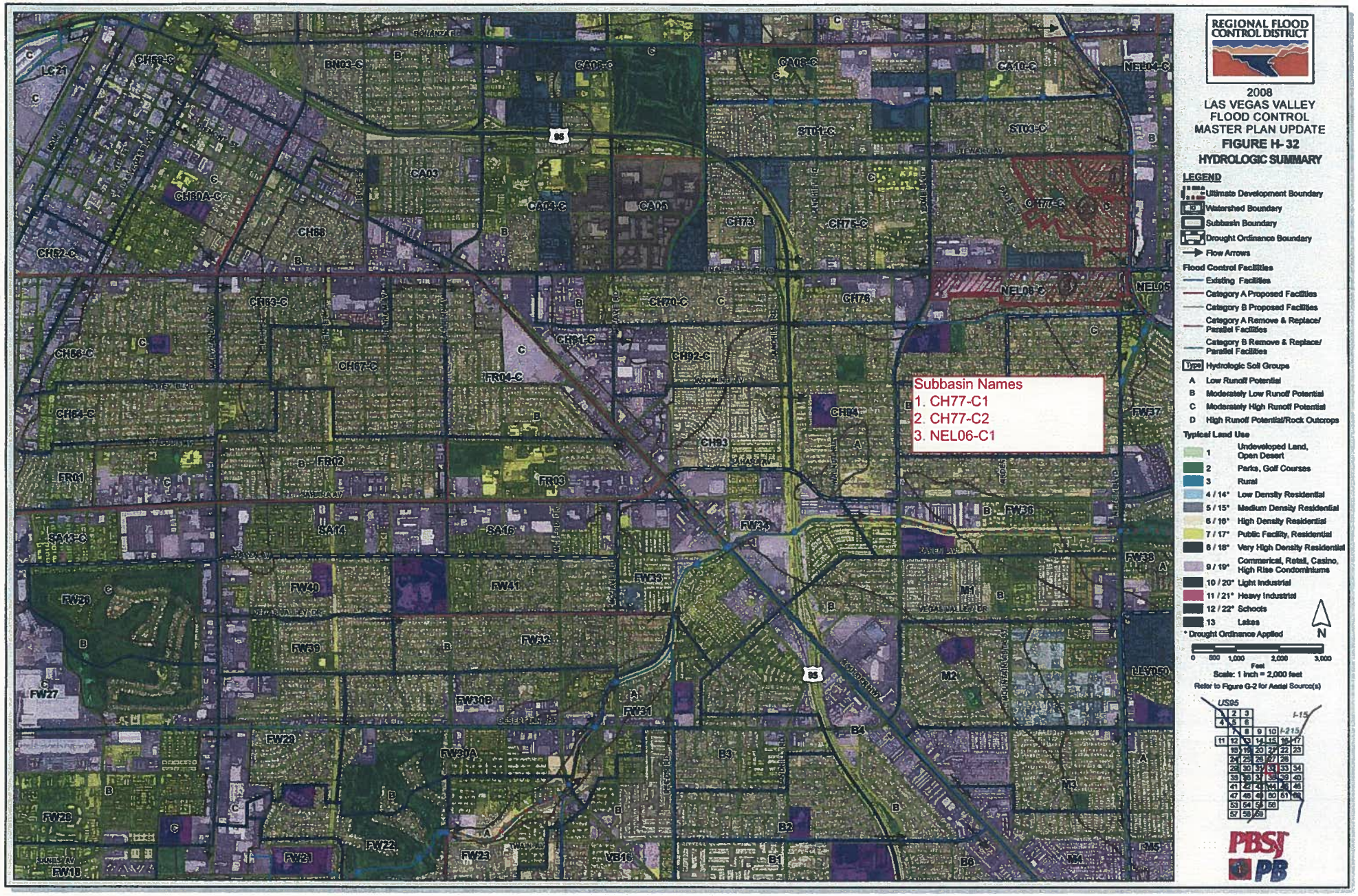
     JP          MULTI-PLAN OPTION
                      NPLAN          1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                     .57      1.00
1
```

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	 RATIO 2 1.00
HYDROGRAPH AT						
+	CH77-C1	.04	1	FLOW	22.	51.
				TIME	3.67	3.58
HYDROGRAPH AT						
+	CH77-C2	.13	1	FLOW	61.	139.
				TIME	3.75	3.75
HYDROGRAPH AT						
+	NEL06-C1	.11	1	FLOW	42.	103.
				TIME	3.83	3.83

*** NORMAL END OF HEC-1 ***


Subbasin Names
1. CH77-C1
2. CH77-C2
3. NEL06-C1
REGIONAL FLOOD CONTROL DISTRICT
2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H-32
HYDROLOGIC SUMMARY
LEGEND
Ultimate Development Boundary
Watershed Boundary
Subbasin Boundary
Drought Ordinance Boundary
Flow Arrows
Flood Control Facilities
Existing Facilities
Category A Proposed Facilities
Category B Proposed Facilities
Category A Remove & Replace/ Parallel Facilities
Category B Remove & Replace/ Parallel Facilities
Type Hydrologic Soil Groups
A Low Runoff Potential
B Moderately Low Runoff Potential
C Moderately High Runoff Potential
D High Runoff Potential/Rock Outcrops
Typical Land Use
1 Undeveloped Land, Open Desert
2 Parks, Golf Courses
3 Rural
4 / 14* Low Density Residential
5 / 15* Medium Density Residential
6 / 16* High Density Residential
7 / 17* Public Facility, Residential
8 / 18* Very High Density Residential
9 / 19* Commerical, Retail, Casino, High Rise Condominiums
10 / 20* Light Industrial
11 / 21* Heavy Industrial
12 / 22* Schools
13 Lakes
* Drought Ordinance Applied
N
0 500 1,000 2,000 3,000
Feet
Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)
US95
I-15
I-215
PBSJ
PB

Stanley Consultants, Inc.
5820 S. Eastern Ave., Suite 200, Las Vegas, NV 89119
Phone: (702) 369-9396

Project: **LAS VEGAS WASH - SLOAN CHANNEL TO CEDAR AVENUE**
Job no.: 24523
Prepared by : VF Date: 3/13/2013
Checked by : HM Date: 3/28/2013

Computation: **Developed Conditions - Calculating Lag Time for input into HEC-1 for drainage basins less than 1 square mile**
References: RFCD's *Hydrologic Criteria and Drainage Design Manual* (Adopted August 12, 1999) Section 600 Storm Runoff
CN's referenced from 2008 MPU, HEC-1 output file: CLVWASH5.out

1	2	3	4	5	6	7	8	9	10	11	12a	12b	13	14	15	16	17
Subbasin I.D.	Subbasin Data					Initial/Overland Time			Travel Time					Conc. Time t_c (min.)	Total Length L_T (ft)	Check Urban t_c (min.)	T_{lag} (hours)
	DEV/UN (D or U)	CN	K	Area (acres)	Area (mi^2)	Length L_O (ft)	Slope S_O (%)	t_i min.	Length L_t(ft)	Slope S (%)	V_1 fps	V_2 fps	t_t min.				
CH77-C1	D	90.1	0.7993	25.46	0.0398	130	2.00	4.90	1813	0.28	1.07	1.62	21.31	26.21	1942.92	20.79	0.208
CH77-C2	D	90.1	0.7993	80.40	0.1256	152	2.00	5.30	3533	0.42	1.31	1.98	31.85	37.15	3684.67	30.47	0.305
NEL06-C1	D	88.2	0.7742	71.53	0.112	56	2.00	3.48	5103	0.39	1.26	1.91	46.75	50.23	5159.00	38.66	0.387

Stanley Consultants, Inc.
5820 S. Eastern Ave. Las Vegas, NV 89119
Phone: (702) 369-9396
Fax: (702) 369-9793

Stanley Consultants INC.

Summary of flow rates and drop inlets for 5-ft drainage easements

Project: Las Vegas Wash, Sloan Channel to Cedar Avenue
Proj. No.: 24523
Date: 3/26/2013
By: HM

LV Wash Station	HEC-1 Sub-basin	Q 100 cfs	Easement width ft	Existing depth ft	Proposed DI width ft	Proposed depth ft	Inlet flow cfs	Easement flow cfs	Location
36+00	CH77-C1	51	5	2.9	20	1	50	1	Currie/Oakford Intersection
49+00	CH77-C2	139	5	5.6	25	1.5	125	15	Chantilly/Arlington Intersection
61+50	NEL06-C1	103	20 easement/ 50 trap channel	2.7	N/A	N/A	N/A	307	California/Arlington Intersection
	Existing trapezoidal channel provides 1 ft freeboard; opening in channel wall provided to convey flow to wash								

Note: existing depth is from flowline of curb

Worksheet for Weir - 5-ft Wide Easement

Project Description

Solve For	Headwater Elevation

Input Data

Discharge		139.00	ft³/s
Crest Elevation		0.50	ft
Tailwater Elevation		0.00	ft
Weir Coefficient		3.00	US
Crest Length		5.00	ft
Number Of Contractions	2		

Results

Headwater Elevation	5.64	ft
Headwater Height Above Crest	5.14	ft
Tailwater Height Above Crest	-0.50	ft
Flow Area	25.72	ft²
Velocity	5.40	ft/s
Wetted Perimeter	15.29	ft
Top Width	5.00	ft

Rating Curve for Weir - 5-ft Wide Easement

Project Description

Solve For	Headwater Elevation

Input Data

Discharge		139.00	ft³/s
Crest Elevation		0.50	ft
Tailwater Elevation		0.00	ft
Weir Coefficient		3.00	US
Crest Length		5.00	ft
Number Of Contractions	2		

Rating Curve Plot



Worksheet for 20-ft Combination Inlet In Sag

Project Description

Solve For	Spread

Input Data

Discharge		95.00	ft³/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.00	in
Local Depression Width		17.50	ft
Grate Width		1.50	ft
Grate Length		17.50	ft
Grate Type	Curved Vaned		
Clogging		50.00	%
Curb Opening Length		20.00	ft
Opening Height		0.50	ft
Curb Throat Type	Inclined		
Throat Incline Angle		14.00	degrees

Options

Calculation Option	Use Both

Results

Spread	15.72	ft
Depth	1.35	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	4.59	ft²
Active Grate Weir Length	19.00	ft

Rating Curve for 20-ft Combination Inlet In Sag

Project Description

Solve For	Spread

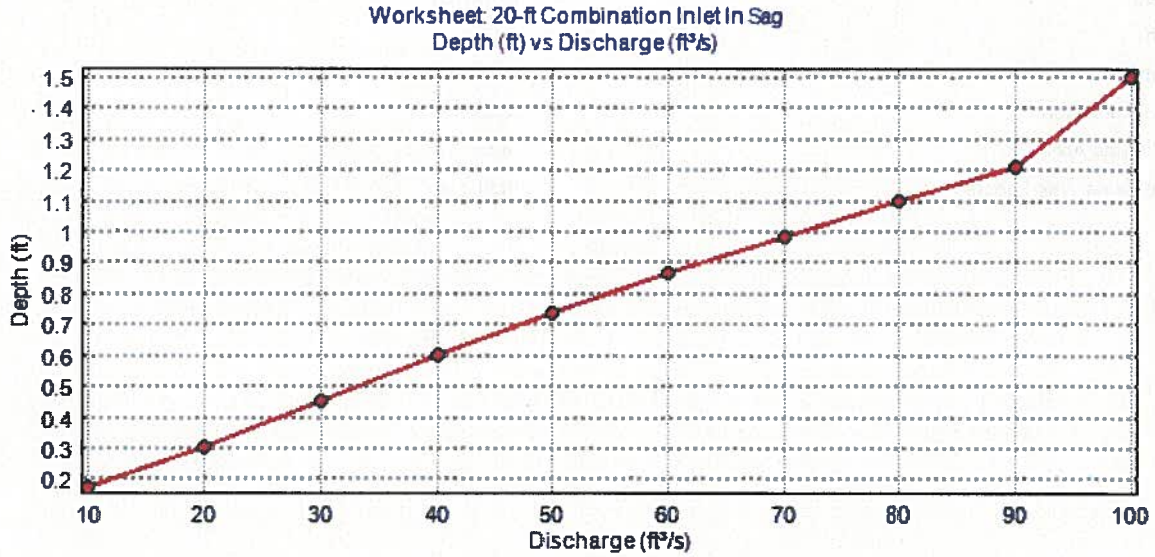
Input Data

Discharge		95.00	ft³/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.00	in
Local Depression Width		17.50	ft
Grate Width		1.50	ft
Grate Length		17.50	ft
Grate Type	Curved Vaned		
Clogging		50.00	%
Curb Opening Length		20.00	ft
Opening Height		0.50	ft
Curb Throat Type	Inclined		
Throat Incline Angle		14.00	degrees

Options

Calculation Option	Use Both

Rating Curve Plot



Worksheet for 25-ft Combination Inlet In Sag

Project Description

Solve For	Spread

Input Data

Discharge		125.00	ft³/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.00	in
Local Depression Width		22.50	ft
Grate Width		1.50	ft
Grate Length		22.50	ft
Grate Type	Curved Vaned		
Clogging		50.00	%
Curb Opening Length		25.00	ft
Opening Height		0.50	ft
Curb Throat Type	Inclined		
Throat Incline Angle		14.00	degrees

Options

Calculation Option	Use Both

Results

Spread	17.43	ft
Depth	1.48	ft
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Open Grate Area	5.91	ft²
Active Grate Weir Length	24.00	ft

Rating Curve for 25-ft Combination Inlet In Sag

Project Description

Solve For	Spread

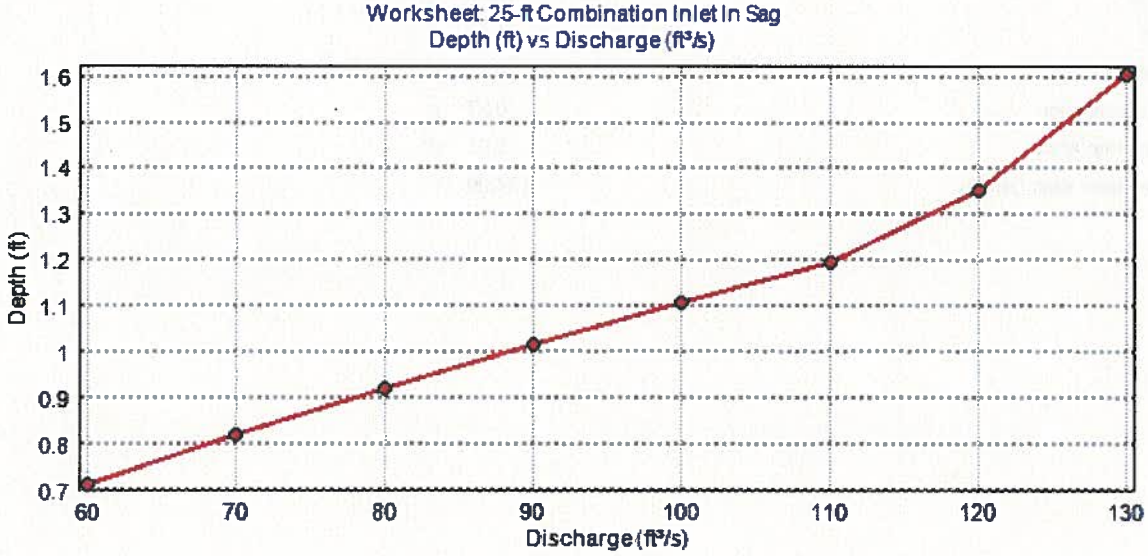
Input Data

Discharge		125.00	ft³/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.09	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.00	in
Local Depression Width		22.50	ft
Grate Width		1.50	ft
Grate Length		22.50	ft
Grate Type	Curved Vaned		
Clogging		50.00	%
Curb Opening Length		25.00	ft
Opening Height		0.50	ft
Curb Throat Type	Inclined		
Throat Incline Angle		14.00	degrees

Options

Calculation Option	Use Both

Rating Curve Plot





Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C-6

FLOW SPLIT ANALYSIS – CHARLESTON AND ARLINGTON

Stanley Consultants, Inc.
5820 S. Eastern Ave. Las Vegas, NV 89119
Phone: (702) 369-9396
Fax: (702) 369-9793

Stanley Consultants INC

Flow Split Calculation

Project Name: Las Vegas Wash, Sloan Channel to Cedar Avenue
Job Number: 24523
Date: 1/30/2013
Calculated By: VFlock

$$Q_L = \frac{Q_m^{0.93} * W_{ss}^{0.85}}{S_m^{0.41} * W_m^{0.79}} * 0.042$$

Equation 12.3: Standards Manual for Drainage Design and Floodplain Management in Tucson, Arizona, December, 1989 (Revised July, 1998), prepared for the City of Tucson Department of

Parameters:

$Q_{100\ yr\ or\ 10\ yr}$ = total Q in the main street (obtained from 2008 MPU HEC-1 model SW3.out)
Q_m = Q in the main street (measured between curbs in cfs)
W_{ss} = Width of the side street (in feet)
S_m = Slope of the main street (in feet/foot)
W_m = Width of the main street (in feet)
Q_L = Lateral flow into the side street (in cfs)
$Q_{L(total)}$ = QL + minimum (Qo, Actual Overbank Q)

Overbank Flow
Overbank Q = Overbank flow upstream of flow split [$(Q-Q_L)/2$]
Qo = $46.8\ y_o\ W_{ss}\ (S_s^{0.5}) - Q_L$
Qo = Maximum amount of overbank flow intercepted by side street
Ss = Slope of the side street (in feet/foot)
yo = average depth of overbank flow intercepted by side street

Location: Charleston/Arlington Intersection

Point 1			Point 2		
Q_{100} =	1104	cfs	Q_{10} =	525	cfs
Q_m =	944.16	cfs	Q_m =	448.80	cfs
W_{ss} =	60.00	ft	W_{ss} =	60.00	ft
S_m =	0.0020	ft/ft	S_m =	0.0020	ft/ft
W_m =	100.00	ft	W_m =	100.00	ft
Q_L =	**267.95**	**cfs**	**Q_L =**	**134.17**	**cfs**
Overbank Q =	**79.92**	**cfs**	**Overbank Q =**	**38.1**	**cfs**
W_{ss} =	60.00	ft	W_{ss} =	60.00	ft
Ss =	0.0015	ft/ft	Ss =	0.0015	ft/ft
yo =	1.88	ft	yo =	1.23	ft
Qo =	**-63.49**	**cfs**	**Qo =**	**-0.41**	**cfs**
$Q_{L\ (total)}$ =	**204.46**	**cfs**	**$Q_{L\ (total)}$ =**	**133.77**	**cfs**

Q_{TOTAL}	1104.00	525.00
$Q_{ARLINGTON}$	204.46	133.77
$Q_{CHARLESTON}$	899.54	391.23

100-year flow

Cross Section for 100 ft ROW Charleston Blvd full section

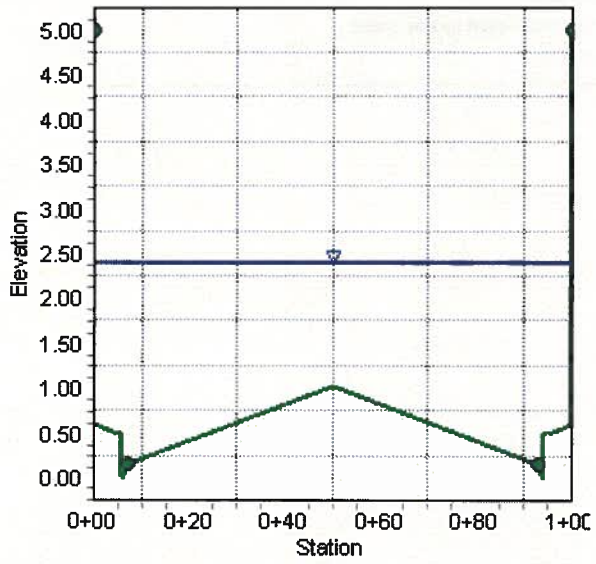
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	2.38	ft
Discharge	1104.00	ft³/s

Cross Section Image



100-year flow

Cross Section for 100 ft ROW Charleston Blvd between curbs

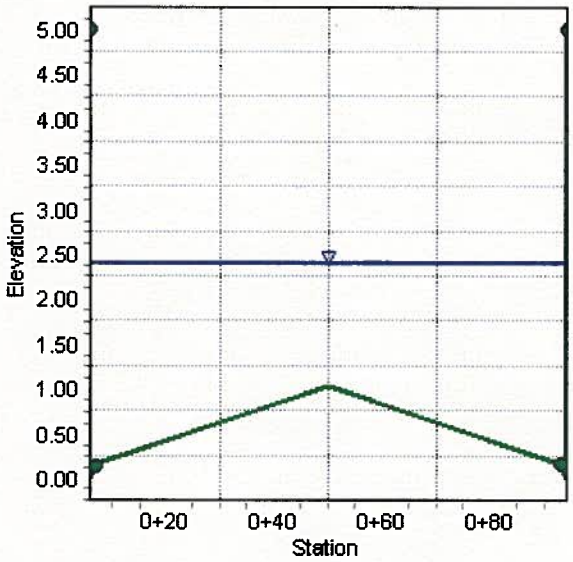
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	2.38	ft
Discharge	944.16	ft³/s

Cross Section Image



10-year flow

Cross Section for 100 ft ROW Charleston Blvd full section

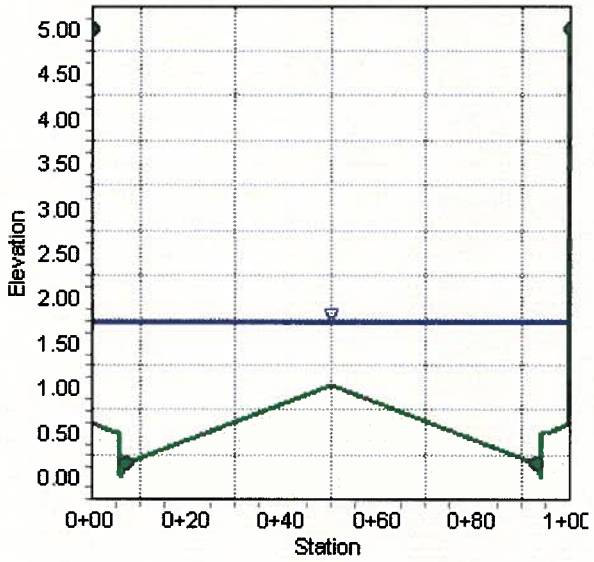
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	1.73	ft
Discharge	525.00	ft³/s

Cross Section Image



10-year flow

Cross Section for 100 ft ROW Charleston Blvd between curbs

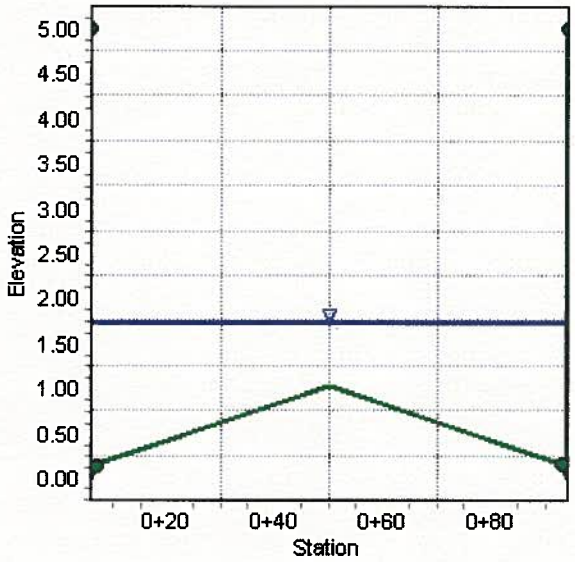
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00200	ft/ft
Normal Depth	1.73	ft
Discharge	448.80	ft³/s

Cross Section Image





Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook

30% Submittal

Appendix C-7

WEIR CALCULATIONS – DRAINAGE EASEMENT "CAAR" 2+06.75

Cross Section for Cross Section at Station "CAAR" 2+06.75, 10' RT TO 40.2 FT LT

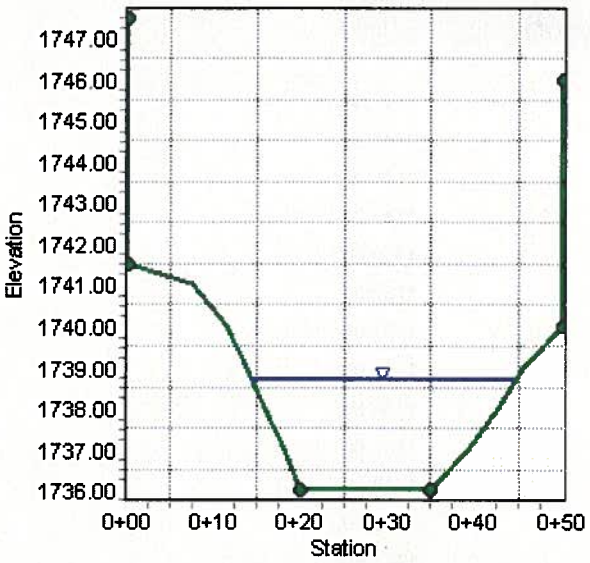
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00439	ft/ft
Normal Depth	2.68	ft
Discharge	307.00	ft³/s

Cross Section Image



Q from flowsplit = 204 cfs
Q from subbasin NEL06-C1 = 103 cfs
Total = 307 cfs

Worksheet for Cross Section at Station "CAAR" 2+06.75, 10' RT TO 40.2 FT LT

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00439	ft/ft
Discharge	307.00	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1747.50
0+00.00	1741.50
0+07.51	1741.00
0+11.50	1740.00
0+13.70	1739.00
0+15.80	1738.00
0+18.00	1737.00
0+20.00	1736.00
0+35.00	1736.00
0+39.30	1737.00
0+42.70	1738.00
0+45.40	1739.00
0+50.20	1740.00
0+50.20	1746.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1747.50)	(0+00.00, 1741.50)	0.0
(0+00.00, 1741.50)	(0+20.00, 1736.00)	0.0
(0+20.00, 1736.00)	(0+35.00, 1736.00)	0.0
(0+35.00, 1736.00)	(0+50.20, 1740.00)	0.0
(0+50.20, 1740.00)	(0+50.20, 1746.00)	0.0

Worksheet for Cross Section at Station "CAAR" 2+06.75, 10' RT TO 40.2 FT LT

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		2.68	ft
Elevation Range	1736.00 to 1747.50 ft		
Flow Area		61.59	ft²
Wetted Perimeter		31.14	ft
Hydraulic Radius		1.98	ft
Top Width		30.15	ft
Normal Depth		2.68	ft
Critical Depth		2.03	ft
Critical Slope		0.01253	ft/ft
Velocity		4.98	ft/s
Velocity Head		0.39	ft
Specific Energy		3.06	ft
Froude Number		0.61	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.68	ft
Critical Depth	2.03	ft
Channel Slope	0.00439	ft/ft
Critical Slope	0.01253	ft/ft

Cross Section for OPENING IN CHANNEL AT "LV" 61+91, 59' RT

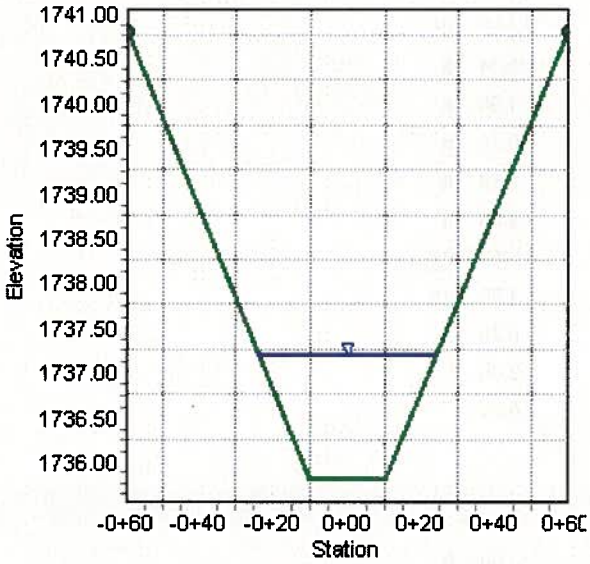
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00439	ft/ft
Normal Depth	1.39	ft
Discharge	307.00	ft³/s

Cross Section Image



Worksheet for OPENING IN CHANNEL AT "LV" 61+91, 59' RT

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00439	ft/ft
Discharge	307.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
-0+60.00	1740.80
-0+10.00	1735.80
0+10.00	1735.80
0+60.00	1740.80

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+60.00, 1740.80)	(0+60.00, 1740.80)	0.0

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	1.39	ft
Elevation Range	1735.80 to 1740.80 ft	
Flow Area	47.26	ft²
Wetted Perimeter	48.00	ft
Hydraulic Radius	0.98	ft
Top Width	47.86	ft
Normal Depth	1.39	ft
Critical Depth	1.50	ft
Critical Slope	0.00324	ft/ft
Velocity	6.50	ft/s
Velocity Head	0.66	ft
Specific Energy	2.05	ft
Froude Number	1.15	
Flow Type	Supercritical	

Worksheet for OPENING IN CHANNEL AT "LV" 61+91, 59' RT

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.39	ft
Critical Depth	1.50	ft
Channel Slope	0.00439	ft/ft
Critical Slope	0.00324	ft/ft


Opening in channel at approximate station
"LV" 61+91, 59' RT
top wall elevation 1740.8,
bottom wall elevation 1735.8
Cross Section at approximate
station "CAAR" 2+06.75



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix D-1

SAHARA AVENUE BRIDGE HYDRAULIC ANALYSIS – PIER BULKING

Las Vegas Wash - Sahara Bridge Bulking Model

Reach	River Sta	Plan	E.G. Elev	W.S. Elev	Crit W.S.	Frctn Loss	C & E Loss	Top Width	Q Left	Q Channel	Q Right	Vel Chnl
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft/s)
Las Vegas Wash	-5995.45	Plan 01	1721.57	1720.29	1716.73	0.02	0.12	221.99		15438		9.11
Las Vegas Wash	-5995.45	Plan 03	1721.62	1720.36	1716.73	0.02	0.12	223.28		15438		9.02
				0.07								
Las Vegas Wash	-6025.88	Plan 01	1721.43	1720.55	1715.69	0.01	0.01	256.93		15438		7.53
Las Vegas Wash	-6025.88	Plan 03	1721.49	1720.62	1715.69	0.01	0.02	257.89		15438		7.48
				0.07								
Las Vegas Wash	-6100 BR U	Plan 01	1721.42	1720.48	1715.83	0.07	0.01	196.17		15438		7.79
Las Vegas Wash	-6100 BR U	Plan 03	1721.46	1720.44	1716.04	0.07	0.01	190.18		15438		8.13
				-0.04								
Las Vegas Wash	-6100 BR D	Plan 01	1721.34	1720.29	1715.38	0.01	0.02	194.73		15438		8.24
Las Vegas Wash	-6100 BR D	Plan 03	1721.37	1720.22	1715.6	0.01	0.05	188.58		15438		8.64
				-0.07								
Las Vegas Wash	-6150	Plan 01	1721.31	1720.32	1715.23	0.05	0.03	255.27		15438		8
Las Vegas Wash	-6150	Plan 03	1721.31	1720.32	1715.23	0.05	0.03	255.27		15438		8
				0.00								
Las Vegas Wash	-6200	Plan 01	1721.23	1720.33	1715.15	0.07	0.01	218.83		15438		7.64
Las Vegas Wash	-6200	Plan 03	1721.23	1720.33	1715.15	0.07	0.01	218.83		15438		7.64

Plan 01 is without bulking, Plan 03 is with a bulking factor of three feet to the piers.



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix D-2

MANNING'S "N" ROUGHNESS ANALYSIS

LAS VEGAS WASH - SLOAN CHANNEL TO CEDAR AVENUE

Hydraulic Roughness Calculations - Golf Course Sections

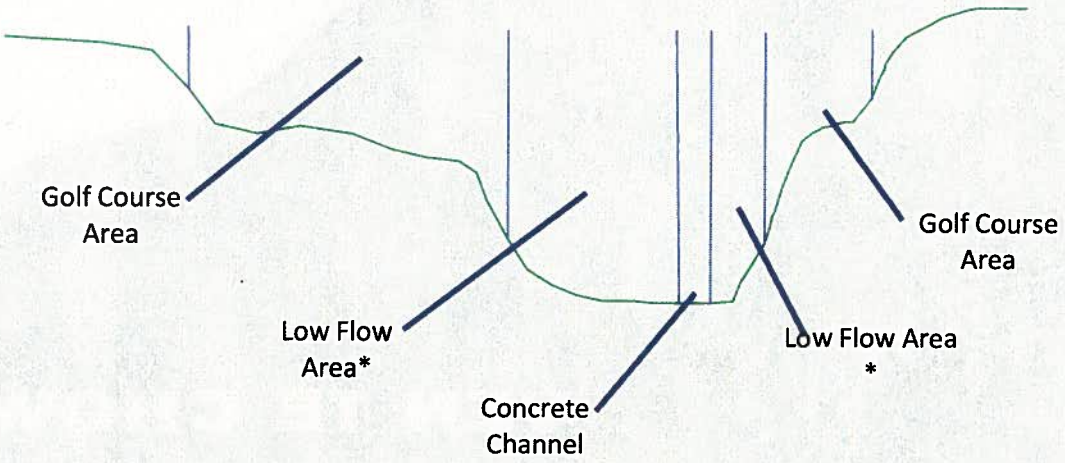
Composite Manning's 'n' Calculations

Concrete Channel		Low Flow Area		Golf Course Area		Wetted Perimiter	Composite Roughness
P (ft)	'n'	P (ft)	'n'	P (ft)	'n'	P	'n'
20	0.015	57	0.035	50	0.03	127	0.030298358
20	0.015	57	0.035	153	0.03	230	0.030164928
20	0.015	66	0.035	179	0.03	265	0.030319196
20	0.015	66	0.035	274	0.03	360	0.030235127

Equation 6-17 from "*Open-Channel Hydraulics* " by Ven Te Chow

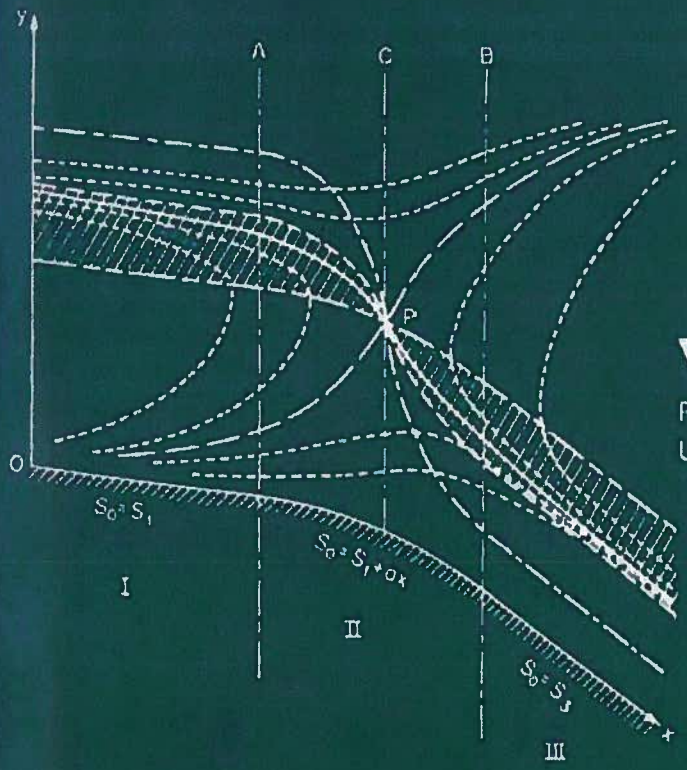
$$n = \frac{\left(P_1 n_1^{1.5} + P_2 n_2^{1.5} + P_3 n_3^{1.5} + ... + P_N n_N^{1.5}\right)^{2/3}}{P^{2/3}}$$

P = Wetted Perimeter of Section
n = Manning's 'n' for Section
Concrete 'n' = 0.015
Less maintained grass areas 'n' = 0.035
Golf Course Maintained areas 'n' = 0.03



* Low Flow Area - Will be maintained with less frequency than the golf course and contain taller grasses such as lovegrass.

OPEN-CHANNEL HYDRAULICS



VEN TE CHOW
Professor of Hydraulic Engineering
University of Illinois

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n
(Boldface figures are values generally recommended in design)

Type of channel and description	Minimum	Normal	Maximum
A. CLOSED CONDUITS FLOWING PARTLY FULL			
A-1. Metal			
a. Brass, smooth	0.009	**0.010**	0.013
b. Steel			
1. Lockbar and welded	0.010	0.012	0.014
2. Riveted and spiral	0.013	0.016	0.017
c. Cast iron			
1. Coated	0.010	0.013	0.014
2. Uncoated	0.011	0.014	0.016
d. Wrought iron			
1. Black	0.012	0.014	0.015
2. Galvanized	0.013	0.016	0.017
e. Corrugated metal			
1. Subdrain	0.017	0.019	0.021
2. Storm drain	0.021	**0.024**	0.030
A-2. Nonmetal			
a. Lucite	0.008	0.009	0.010
b. Glass	0.009	**0.010**	0.013
c. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
d. Concrete			
1. Culvert, straight and free of debris	0.010	0.011	0.013
2. Culvert with bends, connections, and some debris	0.011	**0.013**	0.014
3. Finished	0.011	0.012	0.014
4. Sewer with manholes, inlet, etc., straight	0.013	0.015	0.017
5. Unfinished, steel form	0.012	0.013	0.014
6. Unfinished, smooth wood form	0.012	**0.014**	0.016
7. Unfinished, rough wood form	0.015	0.017	0.020
e. Wood			
1. Stave	0.010	0.012	0.014
2. Laminated, treated	0.015	0.017	0.020
f. Clay			
1. Common drainage tile	0.011	**0.013**	0.017
2. Vitrified sewer	0.011	0.014	0.017
3. Vitrified sewer with manholes, inlet, etc.	0.013	0.015	0.017
4. Vitrified subdrain with open joint	0.014	**0.016**	**0.018**
g. Brickwork			
1. Glazed	0.011	0.013	0.015
2. Lined with cement mortar	0.012	0.015	0.017
h. Sanitary sewers coated with sewage slimes, with bends and connections	0.012	0.013	0.016
i. Paved invert, sewer, smooth bottom	0.016	0.019	0.020
j. Rubble masonry, cemented	0.018	0.025	0.030

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
B. LINED OR BUILT-UP CHANNELS			
B-1. Metal			
a. Smooth steel surface			
1. Unpainted	0.011	**0.012**	0.014
2. Painted	0.012	0.013	0.017
b. Corrugated	0.021	0.025	0.030
B-2. Nonmetal			
a. Cement			
1. Neat, surface	0.010	0.011	0.013
2. Mortar	0.011	0.013	0.015
b. Wood			
1. Planed, untreated	0.010	0.012	0.014
2. Planed, creosoted	0.011	0.012	0.015
3. Unplaned	0.011	0.013	0.015
4. Plank with battens	0.012	**0.015**	0.018
5. Lined with roofing paper	0.010	0.014	0.017
c. Concrete			
1. Trowel finish	0.011	**0.013**	0.015
2. Float finish	0.013	0.015	0.016
3. Finished, with gravel on bottom	0.015	0.017	**0.020**
4. Unfinished	0.014	0.017	**0.020**
5. Gunite, good section	0.016	**0.019**	0.023
6. Gunite, wavy section	0.018	0.022	0.025
7. On good excavated rock	0.017	0.020	
8. On irregular excavated rock	0.022	0.027	
d. Concrete bottom float finished with sides of			
1. Dressed stone in mortar	0.015	0.017	0.020
2. Random stone in mortar	0.017	0.020	0.024
3. Cement rubble masonry, plastered	0.016	0.020	0.024
4. Cement rubble masonry	0.020	0.025	0.030
5. Dry rubble or riprap	0.020	**0.030**	0.035
e. Gravel bottom with sides of			
1. Formed concrete	0.017	0.020	0.025
2. Random stone in mortar	0.020	**0.023**	0.026
3. Dry rubble or riprap	0.023	0.033	0.036
f. Brick			
1. Glazed	0.011	**0.013**	0.015
2. In cement mortar	0.012	**0.015**	0.018
g. Masonry			
1. Cemented rubble	0.017	0.025	0.030
2. Dry rubble	0.023	0.032	0.035
h. Dressed ashlar	0.013	0.015	0.017
i. Asphalt			
1. Smooth	0.013	0.013	
2. Rough	0.016	0.016	
j. Vegetal lining	0.030	.....	0.500

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

depth, because the depth for maximum discharge is so close to the top that there is always a possibility of slight backwater to increase this depth closer to and eventually equal to the full depth.

6-5. Flow in a Channel Section with Composite Roughness. In simple channels, the roughness along the wetted perimeter may be distinctly different from part to part of the perimeter, but the mean velocity can still be computed by a uniform-flow formula without actually subdividing the section. For example, a rectangular channel built with a wooden bottom and glass walls must have different n values for the bottom and the walls. In applying the Manning formula to such channels, it is sometimes necessary to compute an *equivalent n value* for the entire perimeter and use this equivalent value for the computation of the flow in the whole section.

For the determination of the equivalent roughness, the water area is divided imaginatively into N parts of which the wetted perimeters $P_1, P_2, \ldots, P_N$ and the coefficients of roughness $n_1, n_2, \ldots, n_N$ are known. Horton [6] and Einstein [7,8] assumed that each part of the area has the same mean velocity, which at the same time is equal to the mean velocity of the whole section; that is, $V_1 = V_2 = \cdots = V_N = V$. On the basis of this assumption, the equivalent coefficient of roughness may be obtained by the following equation:

$$n = \left[\frac{\sum_1^N (P_N n_N^{1.5})}{P}\right]^{\frac{2}{3}} = \frac{(P_1 n_1^{1.5} + P_2 n_2^{1.5} + \cdots + P_N n_N^{1.5})^{\frac{2}{3}}}{P^{\frac{2}{3}}} \qquad (6\text{-}17)$$

There are many other assumptions for the determination of an equivalent roughness. Pavlovskii [9] and also Mühlhofer [10] and Einstein and Banks [11] assumed that the total force resisting the flow (that is, KV^2PL; see Art. 5-4) is equal to the sum of the forces resisting the flow developed in the subdivided areas. By this assumption, the equivalent roughness coefficient is

$$n = \frac{\left[\sum_1^N (P_N n_N^2)\right]^{\frac{1}{2}}}{P^{\frac{1}{2}}} = \frac{(P_1 n_1^2 + P_2 n_2^2 + \cdots + P_N n_N^2)^{\frac{1}{2}}}{P^{\frac{1}{2}}} \qquad (6\text{-}18)$$

Lotter [12] assumed that the total discharge of the flow is equal to the sum of the discharges of the subdivided areas. Thus, the equivalent roughness coefficient is

$$n = \frac{PR^{\frac{2}{3}}}{\sum_1^N \left(\frac{P_N R_N^{\frac{2}{3}}}{n_N}\right)} = \frac{PR^{\frac{2}{3}}}{\frac{P_1 R_1^{\frac{2}{3}}}{n_1} + \frac{P_2 R_2^{\frac{2}{3}}}{n_2} + \cdots + \frac{P_N R_N^{\frac{2}{3}}}{n_N}} \qquad (6\text{-}19)$$

where $R_1, R_2, \ldots, R_N$ are hydraulic radii of the subdivided areas. For simple channel sections, it may be assumed that

$$R_1 = R_2 = \cdots = R_N = R$$

Roughness of Ice-covered Channels. When a channel is covered with ice, the wetted perimeter of the flow is greatly increased. The bottom surface of the ice cover may be either as smooth as a finished concrete surface or as rough as the natural channel bed when drifting ice blocks exist. Table 6-1 gives the n values for dredged channels covered with ice, as proposed by Lotter [13].

TABLE 6-1. n VALUES FOR ICE-COVERED DREDGED CHANNELS

Ice condition	Velocity of flow, fps	n Value
Smooth ice:		
Without drifting ice blocks	1.3–2.0	0.010–0.012
	>2.0	0.014–0.017
With drifting ice blocks	1.3–2.0	0.016–0.018
	>2.0	0.017–0.020
Rough ice with drifting ice blocks	. . .	0.023–0.025

Let n and n_1 be the roughness coefficients for channels with and without ice cover, respectively. By means of Eqs. (6-17) to (6-19) it is possible to compute the roughness coefficient n_2 of the ice cover. However, the coefficient thus computed may sometimes be a negative value, which is, of course, unrealistic.

In order to develop a realistic approach to the problem, Pavlovskii [14] assumed that the total force resisting the flow is equal to the sum of the resisting forces due to the channel bed and the ice cover. Thus, from Art. 5-4,

$$KV^2LP = K_1V^2LP_1 + K_2V^2LP_2 \qquad (6\text{-}20)$$

where the subscript 1 refers to the channel bed and 2 to the ice cover. Since Chézy's $C = \sqrt{w/K}$ or $K = w/C^2$, the above equation becomes

$$\frac{P}{C^2} = \frac{P_1}{C_1^2} + \frac{P_2}{C_2^2} \qquad (6\text{-}21)$$

Let the wetted perimeter $P_2 = aP_1$ or $P = P_1 + P_2 = (1 + a)P_1$; then

$$\frac{1 + a}{C^2} = \frac{1}{C_1^2} + \frac{a}{C_2^2} \qquad (6\text{-}22)$$

Since, by Eq. (5-7), $C = 1.49R^{\frac{1}{6}}/n$,

$$\frac{(1 + a)n^2}{R^{\frac{1}{3}}} = \frac{n_1^2}{R_1^{\frac{1}{3}}} + \frac{an_2^2}{R_2^{\frac{1}{3}}} \qquad (6\text{-}23)$$

MANNING'S ROUGHNESS COEFFICIENTS FOR CHANNEL LINING TYPES

Channel Material	Roughness Coefficient (n)	
	Normal	Maximum
Corrugated Metal	0.025	0.030
Concrete**		
1) Trowel finish	0.013	0.015
2) Float finish	0.015	0.016
3) Unfinished	0.017	0.020
4) Shotcrete, Good section	0.019	0.023
5) Shotcrete, wavy section	0.122	0.025
Asphalt (use maximum value when cars are present)	0.016	0.020
Soil-Cement	0.020	0.025
Constructed channels with earth or sand bottom, sides of		
1) Clean earth; straight	0.022	0.025
2) Earth with grass and weeds	0.025	0.030
3) Earth with trees and shrubs	0.032	0.040
4) Shotcrete	0.022	0.025
5) Soil-cement	0.025	0.028
6) Concrete	0.020	0.024
7) Dry rubble or riprap	0.033	0.036
Natural channels with sand bottom, sides of		
1) Trees and shrubs	0.035	0.045
2) Rock	0.032	0.040
Natural channel with rock bottom	0.060	0.090
Overbank floodplains		
1) Desert brush, normal density	0.060	0.080
2) Dense vegetation	0.100	0.160

• Adapted from Chow (1959) and Aldridge and Garrett (1973).
** Manning's Coefficients for Clear Water Only
__ City of Tucson Standards Manual for Drainage Design

Revision	Date

REFERENCE:

TABLE 702



Las Vegas Wash—
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Appendix D-3

RIPRAP CHANNEL ANALYSIS

Stanley Consultants, Inc.
5820 S. Eastern Ave. Las Vegas, NV 89119
Phone: (702) 369-9396
Fax: (702) 369-9793

Stanley Consultants INC.

Riprap protection for water surface elevation (WSE) >= 2* d50

Project Name: Las Vegas Wash Sloan to Cedar
Job Number: 24523
Date: 3/14/2013
Calculated By: HM

Riprap protection for water surface elevation (WSE) >= 2* d50

Rock Size
V = 3(d50^0.5)(Ss-1)/S^0.17 (CCRFCD, Sect. 705.4.6, Eqn. 734)
Ss = Specific gravity of rock (minimum Ss = 2.50)
S = Longitudinal channel slope (ft/ft)
d50 = Rock size for which 50% of the riprap by weight is smaller (ft)

Length of riprap
Min length = channel width (Design of Riprap Revetment, HEC 11, FHWA, Figure 15)

Location: Natural to Concrete Transistion

Assume d_{50} =	1.50	ft	
S =	0.0023	(ft/ft)	
S_s =	2.50		(Minimum 2.50)
V =	15.48	ft/sec	Where 10 ft/sec is Max Allowable
FlowMaster velocty =	8.30	ft/sec	
Existing upstream contition =	23.00	ft/sec	ref. from LOMR
Length upstream of transition =	140.00	ft	(70' bottom width; ~140' top width)

Worksheet for Trapezoidal Riprap Channel

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.025	
Channel Slope	0.00230	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	75.00	ft
Discharge	13944.00	ft^3/s

Results

Normal Depth	11.56	ft
Flow Area	1134.49	ft^2
Wetted Perimeter	126.71	ft
Hydraulic Radius	8.95	ft
Top Width	121.25	ft
Critical Depth	9.38	ft
Critical Slope	0.00483	ft/ft
Velocity	12.29	ft/s
Velocity Head	2.35	ft
Specific Energy	13.91	ft
Froude Number	0.71	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	11.56	ft
Critical Depth	9.38	ft
Channel Slope	0.00230	ft/ft

Worksheet for Trapezoidal Riprap Channel

GVF Output Data

Critical Slope	0.00483	ft/ft

5.8 Rock-Lined Channel Design

Rock-lined channels constructed from riprap, grouted riprap, or wire-enclosed rock can be cost effective at controlling erosion along short channel reaches. These rock-lined channels might be appropriate in the following scenarios:

- Where major flows generate velocities in excess of allowable non-eroding values.
- Where right-of-way restrictions necessitate channel side slopes to be steeper than 3H:1V.
- Where rapid changes in channel geometry occur such as at channel bends and transitions.
- For low flow channels.

For hydraulic calculations, the following equation can be used for Manning's n values for riprap (this equation does not apply to situations involving very shallow flow where the roughness coefficient will be greater):

$$n = 0.0395\ (d_{50})^{1/6} \qquad (5.6)$$

Where: n = Manning's roughness coefficient for stone riprap
d_{50} = diameter of stone for which 50 percent, by weight, of the gradation is finer (ft)

A Manning's n value of 0.035 can be used for wire-enclosed rock and a value of 0.023 to 0.030 can be used for grouted riprap.

Riprap requirements for a stable channel lining can be based on the following relationship (UDFCD 1984):

$$\frac{VS^{0.17}}{d_{50}^{0.5}\ (S_s - 1)^{0.66}} = 4.5 \qquad (5.7)$$

Where: V = mean channel velocity (ft/s)
S = longitudinal channel slope (ft/ft)
S_s = specific gravity of rock (minimum $S_s = 2.5$)
d_{50} = diameter of stone for which 50 percent, by weight, of the gradation is finer (ft)

Rock sizing requirements are based on rock having a specific gravity of at least 2.5. Gradation and classification for riprap are shown in Tables 5-8 and 5-9.

Table 5-8 Rock Riprap Gradation Limits

Stone Size Range (ft.)	Stone Weight Range (lb)	Percent of Gradation Smaller Than
1.5 d_{50} to 1.7 d_{50}	3.0 W_{50} to 5.0 W_{50}	100
1.2 d_{50} to 1.4 d_{50}	2.0 W_{50} to 2.75 W_{50}	85
1.0 d_{50} to 1.15 d_{50}	1.0 W_{50} to 1.5 W_{50}	50
0.4 d_{50} to 0.6 d_{50}	0.1 W_{50} to 0.2 W_{50}	15



Las Vegas Wash—
Sloan Channel to Cedar Avenue

Technical Notebook

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Appendix D-4

HYDRAULIC JUMP ANALYSIS

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Stanley Consultants INC.

Hydraulic Jump - location

Project Name: Las Vegas Wash, Sloan Channel to Cedar Avenue
Job Number: 24523
Date: 3/14/2013
Calculated By: HM

Reference: Brater, EF, King, HW, Lindell, JE, Wei, CY, 1996, Handbook of Hydraulics, 7th ed., McGraw Hill, Boston, MA. Position of Jump, pp. 8.44-8.46

Nonuniform to uniform flow in rectangular channel

Solve for D1, depth in channel immediately upstream of hydraulic jump

D1	=	D2 * (-0.5 + sqrt(2F2^2 + 0.25))		eqn 8.102
where:				
Q	=	14811 cfs	Flow rate in channel	
D2	=	11 ft	Depth of flow in downstream channel	
F2	=	0.65	Froude number in downstream channel	
D1	=	6.0 ft		

Solve for distance between gate and location of D1 (start of hydraulic jump)
Gate location was assumed after the junction with the Charleston Stormdrain

l	=	[V1^2 / (2g) + D1 - V^2 / (2g) - D]/(so - sav)		eqn 8.123a
where:				
V1	=	22.6 ft/s	Velocity at D1	
V	=	23.4 ft/s	Velocity at gate (ref. from WSPG at upstream junction)	
D	=	5.6 ft	Depth at gate (ref. from WSPG at upstream junction)	
so	=	0.01 ft/ft	slope of channel bottom	
sav	=	avg. loss of head per unit length		
sav	=	[Qn/(K'b^(8/3))]^2		eqn 8.126
b	=	110 ft	bottom width	
D/b	=	0.050909	use to find K'	
K'	=	0.00637		Tbl 7.10; p 7.29
n	=	0.015	coefficient of roughness	
sav	=	0.015763 ft/ft		
l	=	27.9 ft	from the Charleston junction	
		50 ft	Distance btw Charleston bridge and Charleston stormdrain	
Estimated location		77.9 ft	from Charleston Bridge	



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix D-5

TRANSITION LENGTH ANALYSIS

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Stanley Consultants INC.

Transition Length Calculations - expanding or contracting subcritical flow

Project Name: Las Vegas Wash, Sloan Channel to Cedar Avenue
Job Number: 24523
Date: 2/1/2013
Calculated By: VFlock

Equation 739: Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual

Parameters:

L_t = Minimum transition length in feet
L_c = Length coefficient, approach velocity < 12 ft/s, Lc = 4.5; velocity > 12 ft/s, Lc = 10
T_w = Difference in top width of the normal water surface upstream and downstream of the transition

LV Wash Station		Velocity ft/s	L_C	Top width Upstream	Top width Downstream	T_w ft	L_T ft	Note
7+00.00		50	10	120	90	30	150	Existing to 90; channel
17+40.00		12	10	107	90	17	85	Contraction transition (107 to 90) downstream of Cedar Channel
67+61.82		9	4.5	110	85	25	56	Contraction transition (110' BW to 85' BW) upstream of Nellis Bridge
3+18.65		8.75	4.5	17.1	15	2.1	5	Nellis Wyoming channel transition

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Stanley Consultants INC.

Transition Length Calculations - expansion of supercritical flow

Project Name: Las Vegas Wash, Sloan Channel to Cedar Avenue
Job Number: 24523
Date:
Calculated By:

Equation 745: Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual

Parameters:

L_t = Minimum transition length in feet

F_{r1} = Upstream Froude number

T_w = Difference in top width of the normal water surface upstream and downstream of the transition

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LV Wash Station	F_{r1}	Top width Upstream	Top width Downstream	T_w	L_T	Note
55+17.15	1.2	90	110	20	36	Expansion from 90' to 110' channel



Las Vegas Wash—
Sloan Channel to Cedar Avenue

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Appendix E

DATA CD