Appendix L Exponent Water Displacement Analysis & Supplemental Letter

Exponent®
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Irvine, CA 92618

Technical Memorandum
July 29, 2005

Newland Street Vicinity Displacement Analysis

Executive Summary

Exponent was retained by WL-Direct Huntington Beach, LLC, to analyze the effect of placing fill in a proposed development within an area northwest of the intersection of Newland Street and Hamilton Avenue. This area is bounded on the west and south by Huntington Beach Channel (Facility D01) which is identified as a regional flooding source in the Federal Emergency Management Agency (FEMA) detailed Flood Insurance Study (FIS). The FEMA mathematical hydraulic model used to calculate flooding depths in the watershed that includes the project site is the U.S. Army Corps of Engineers unsteady network model "HEC-UNET". A subset of the HEC-UNET mathematical model was adjusted and run to verify that it correctly modeled the baseline condition flooding water surface elevation of 4.99 ft MSL NGVD 29 (7.43 ft MSL NAVD 88). The same model was modified to account for the proposed 110,000 cubic yard fill volume and re-run. The flooding water surface elevation with fill was 5.18 ft MSL NGVD 29 (7.62 ft MSL NAVD 88). The displacement effect was 0.19 ft.

The 0.19 ft displacement effect is less than the 1 ft limit provided in FEMA regulations (44 CFR 60.3(c)(10) [italics added]: "…until a regulatory floodway is designated, …no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, *unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community."*

Proposed Project

The proposed project involves placing approximately 110,000 cubic yards of fill to a depth up to about 6 ft, within an approximately 20-acre area northwest of the intersection of Newland Street and Hamilton Avenue. This area is bounded on the south by a line extended from Hamilton Street, on the east by Newland Street, and on the west by Huntington Beach Channel (Facility D01).

The displacement analysis was requested as part of environmental impact documentation for the proposed project, to investigate the effect of fill on the flooding depth previously calculated by FEMA.

FEMA Flood Insurance Study

A FEMA detailed Flood Insurance Study (FIS) was prepared by a FEMA Study Contractor to document potential flooding conditions that existed in the Talbert Valley area of the City of Huntington Beach as of late 2000. The basis of the flooding analysis was the U.S. Army Corps of Engineers unsteady network hydraulic flow model "HEC-UNET[1]". The FEMA Study Contractor's HEC-UNET model was fully documented in a Special Problem Report[2]. The full HEC-UNET model included Huntington Beach Channel (D01), Talbert Channel (D02), and Fountain Valley Channel (D05), divided into five reaches. Flooding caused by levee overtopping or breaching was calculated routing the flood flows into 44 interconnected off-channel storage areas. Storage Area 46 includes the project site. Storage Area 46 is bounded on the north by Atlanta Avenue, on the east by Newland Street, and on the west and south by Huntington Beach Channel (Facility D01). The computed flood elevations within each storage area were based on the water surface elevations caused by combinations of levee breaches

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[1] HEC-UNET, One-Dimensional Unsteady Flow Through a Full Network of Open Channels, CPD-66, U.S. Army Corps of Engineers Hydrologic Engineering Center.

[2] Special Problem Report No. 3, Addendum to Revised Flood Insurance Study for Cities of Fountain Valley and Huntington Beach, Orange County, California, WEST Consultants, Inc., November 21, 2000.

resulting in the highest water surface elevations. In summary, multiple runs of many HEC-UNET models over several months were required to develop the maximum water surface elevations in each of the storage areas, which were adopted by FEMA as Base Flood Elevations (BFEs). The BFE for Storage Area 46 is 4.99 ft MSL NGVD 29 datum. NGVD 29 elevations may be converted to NAVD 88 elevations by adding 2.44 ft to NGVD 29 elevations. The corresponding BFE would be 7.43 ft MSL NAVD 88.

Displacement Analysis

To expedite the displacement effect analysis, a subset of the model was extracted from the FEMA HEC-UNET model. This subset model was the entire D01 Reach 4 including Storage Area 46, from the D01/D02 confluence upstream to Seabridge Lane, upstream of Indianapolis Avenue. The model included 21 levee failure reaches (SL cards) extending about 1/3 mile upstream of Newland Street. The linear routing coefficient (CIN) for flow from the channel to storage area for each of the SL cards was adjusted so that the computed maximum water surface elevation in Storage Area 46 equaled the 4.99 ft MSL NGVD 29 (7.43 ft MSL NAVD 88) elevation reported in the Special Problems Report. This model was the existing condition HEC-UNET model. Existing condition HEC-UNET Storage Area 46 hydrograph is shown in Figure 1, captioned by the HEC-UNET summary output file.

A copy of the existing condition HEC-UNET model was modified to create a post-project conditions model. The water surface elevation vs. storage area relationship in the existing condition (SV card) was adjusted for less available storage from elevation 2 ft to 6 ft MSL NGVD 29. The total difference in storage at elevations impacted by flooding was about 67 acre-ft, or about 108,000 cubic yards.

The post-project conditions HEC-UNET model computed a maximum water surface elevation of 5.18 ft MSL NGVD 29 (7.62 ft MSL NAVD 88) in Storage Area 46. Filled condition HEC-UNET Storage Area 46 hydrograph is shown in Figure 1, captioned by the HEC-UNET summary output file.

The displacement effect is the difference between post-project and existing condition model calculations, or 0.19 ft.

Evaluation of Displacement Effect

The 0.19 ft displacement effect is less than the 1 ft limit provided in FEMA regulations (44 CFR 60.3(c)(10). The applicable text from the FEMA regulations is:

§ 60.3 Flood plain management criteria for flood-prone areas.

The Administrator will provide the data upon which flood plain management regulations shall be based. If the Administrator has not provided sufficient data to furnish a basis for these regulations in a particular community, the community shall obtain, review and reasonably utilize data available from other Federal, State or other sources pending receipt of data from the Administrator. However, when special flood hazard area designations and water surface elevations have been furnished by the Administrator, they shall apply. The symbols defining such special flood hazard designations are set forth in §64.3 of this subchapter. In all cases the minimum requirements governing the adequacy of the flood plain management regulations for flood-prone areas adopted by a particular community depend on the amount of technical data formally provided to the community by the Administrator. Minimum standards for communities are as follows:

(c) When the Administrator has provided a notice of final flood elevations for one or more special flood hazard areas on the community's FIRM and, if appropriate, has designated other special flood hazard areas without base flood elevations on the community's FIRM, but has not identified a regulatory floodway or coastal high hazard area, the community shall:

(10) Require until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1–30 and AE on the community's FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

Conclusion

The area within Storage Area 46 has not been designated as a regulatory floodway. Therefore the 0.19 ft displacement effect would be evaluated with respect to the 1 ft limit provided in FEMA regulations.

Sincerely,

Neil M Jordan

Neil M. Jordan
Senior Engineer

Licensed Civil Engineer 44012, by the
California Board of Professional Engineers and
and Surveyors

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No. 44012
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Figures

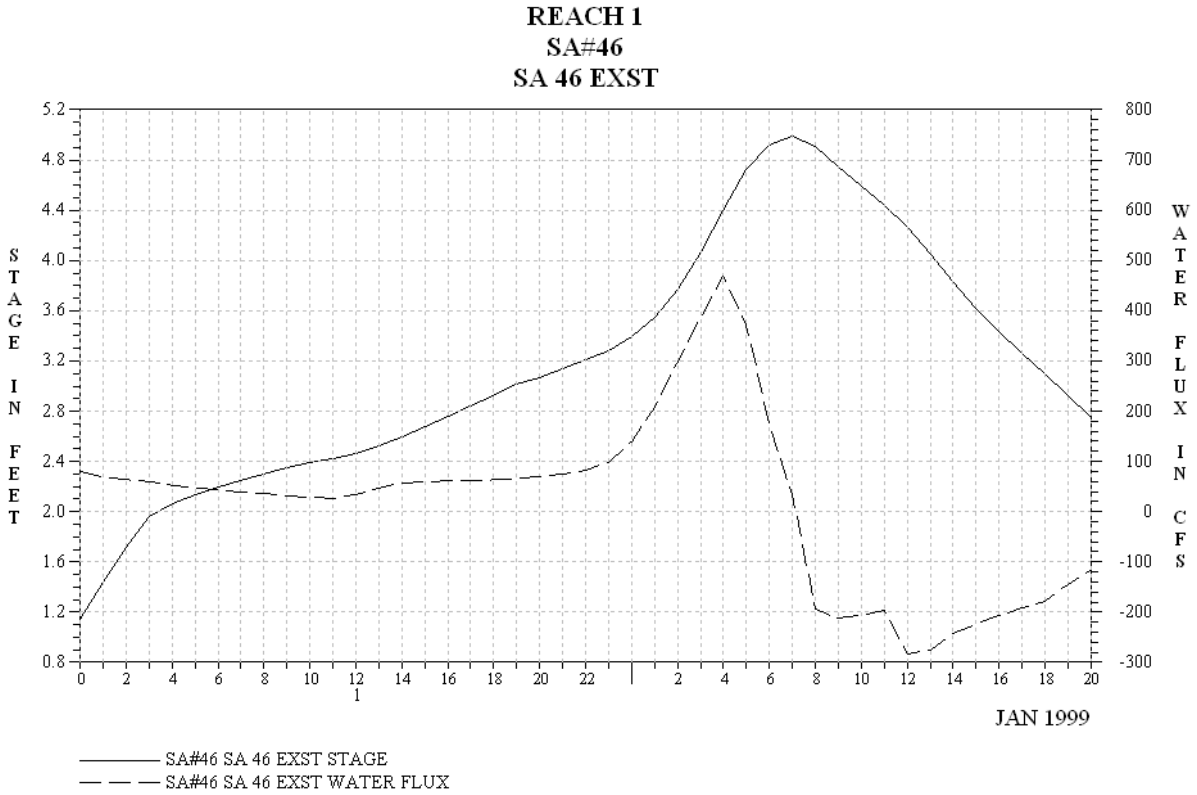

Figure 1.

Max and Min Storage Cell Elevations

Cell No	Cell Name	Max Elev	Date	Hour	Min Elev	Date	Hour
*******	*********	****	****	****	****	****	****
46	SA#46	4.99	1/ 2/1999	7.083	1.13	1/ 1/1999	0.000

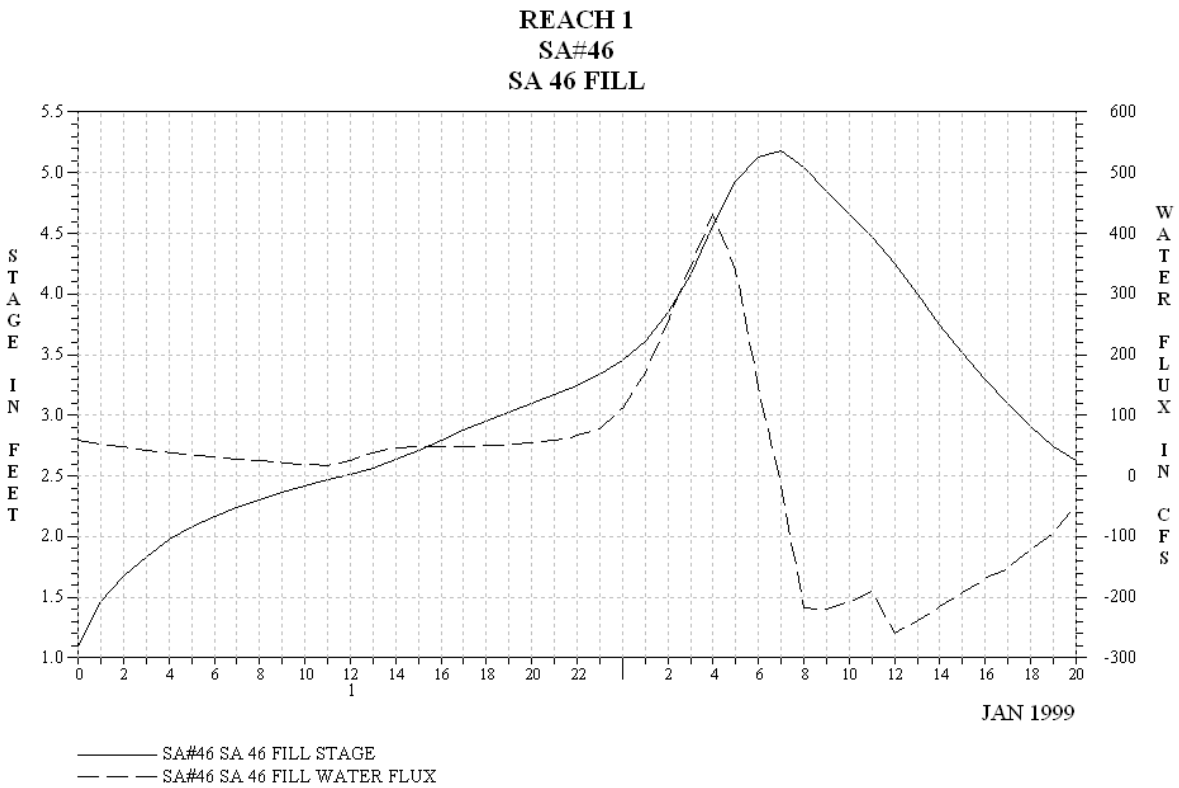

Figure 2.

Max and Min Storage Cell Elevations

Cell No	Cell Name	Max Elev	Date	Hour	Min Elev	Date	Hour
*******	*********	****	****	****	****	****	****
46	SA#46	5.18	1/ 2/1999	6.917	1.10	1/ 1/1999	0.000

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August 31, 2005

Steve Bogart
City of Huntington Beach
Public Works Engineering
2000 Main Street
Huntington Beach, CA 92648

Subject: Displacement Analysis Additional Technical Information
Project No. OC10895.000

Dear Mr. Bogart:

This letter provides additional technical information in response to your 23 August 2005 phone call requesting additional information regarding Exponent's 29 July 2005 technical memorandum. In particular, you had questions regarding interpretation of Federal Emergency Management Agency (FEMA) hydraulic modeling, and the effect of displacement on property to the east of Newland Street.

Exponent did additional modeling, described in detail below, that refined FEMA's modeling and came to the conclusion consistent with the conclusion presented in Exponent's 29 July 2005 report. If FEMA's storage areas (3 and 5) adjacent to storage area 46 are added to storage area 46 and treated as a single ponding area as illustrated in the Flood Insurance Rate Map, the flood elevation increase is 0.13 foot rather than 0.19 foot as calculated in the original work. This increase would apply to areas to the east of Newland Street, and also north of the project site.

Massoud Rezakhani of Exponent provided an interpretation of the displacement effect in view of FEMA's and Community's floodplain regulations. Mr. Rezakhani was formerly with Michael Baker, Jr., FEMA's engineering consultant, and helped develop FEMA's regulations. Paragraph 60.3(c)(10) of the National Flood Insurance Program (NFIP) and related regulations state that *"…until a regulatory floodway is designated, …no new construction, substantial improvements, or other development (including fill) shall be permitted within flood zones designations of A1-30 and AE on the community's FIRM, unless is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community."*

The result of Exponent's refined analysis shows that the effect of the proposed fill in the 100-year floodplain adjacent to Huntington Beach Channel (D01) is a net increases of 0.13 foot

above the established base flood elevations on the FIRM panels, rather than 0.19 foot calculated in the original work. The 0.13 foot increase (as well as the 0.09 foot increase) is allowable, and permitted under the requirements of paragraph of 60.3(c) (10) of the NFIP and the Community-adopted Minimum Floodplain Management Criteria. This analysis takes into considerations the proposed development fill and any existing fills mapped by FEMA for the effective FIRM dated 18 February 2004.

It is the intent of 44 CFR 60.3(c)(10) that any future new construction, substantial improvements, or other development (including fill) be analyzed by a method consistent with the one for the proposed project, to apportion the remaining permitted increase in water surface elevation. Under the Letter of Map Change processing established by FEMA, the proposed project does not require any mitigation to eliminate the 0.13 foot increase or the 0.19 foot increase. Please note that these increases are not significant relative to the scale of the mapping, and do not warrant a physical change to the FIRM panel and flood profile in the Flood Insurance Study for your Community.

Exponent used the effective hydraulic model, UNET, that FEMA used to develop the base flood elevations for Huntington Beach Channel (D01) and surrounding area as depicted on the Community FIRM panels. Exponent's 29 July 2005 report conservatively applied FEMA's model, assuming that the impact of fill was restricted to FEMA's storage area 46, which is bounded on the east by Newland Street. The report concluded a 0.19 foot increase in flooding. In response to questions regarding impact to areas to the east of Newland Street, the impact on FEMA storage area 5 to the east and storage area 3 to the north would need to be included. The original FEMA UNET model calculated water surface elevations separately for the three areas. However, FEMA's final interpretation of the UNET modeling results concluded that a single water surface elevation was appropriate, and FEMA mapped all three areas (3, 5, and 46) with a single ponding elevation (8 foot NAVD 88 = 5.56 foot NGVD 29).

Consistent with FEMA's final interpretation, Exponent added the combined UNET stage-storage data for storage areas 3 and 5 to the UNET area 46 stage-storage data used in the 29 July 2005 report model. The combined storage area 3 and 5 data were added to the existing condition and post-project area 46 models. UNET simple lateral connection routing coefficients (CIN, COUT) and flow adjustment (QMULT) were iteratively changed so that the existing condition model computed a peak storage area (combined areas 3, 5, and 46) water surface elevation of 5.56 foot (NGVD 29). The same coefficients were then applied to the post-project model, which computed a peak water surface elevation of 5.69 foot (NGVD 29), or 0.13 foot increase.

Existing condition and post-project UNET hydrographs are provided as an attachment to this letter. Below each hydrograph is the UNET calculation summary.

Note that the rising limb of the hydrographs can be used to estimate the time progression of flooding. Estimating the ground surface east of Newland Street as 6 foot NAVD 88 (= 3.6 foot NGVD 29), it takes over three hours for the flood elevation to rise one foot and about four hours for the flood elevation to rise a second foot. It can be concluded that lower-lying property to the east of Newland Street would be flooded for many hours before any displacement effect of the proposed project could be felt.

If you have any questions regarding the modeling or additional technical information, please contact me directly at 949-341-6012.

Sincerely,

Neil M Jordan

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Neil M. Jordan
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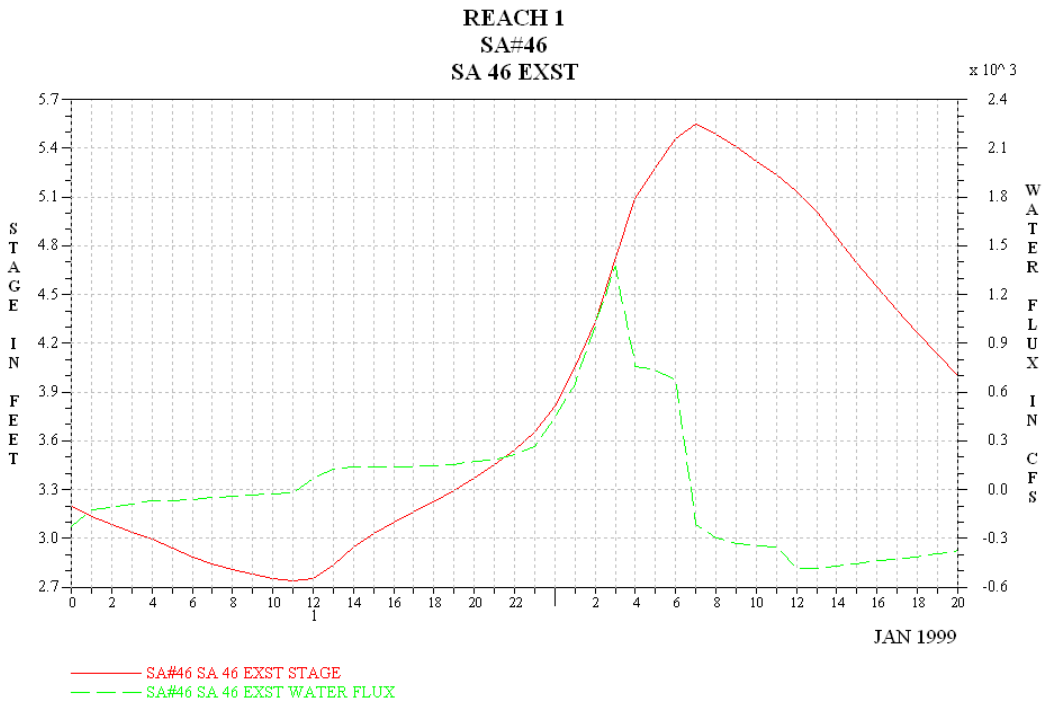
Enclosures (1)

cc: Jane James, City of Huntington Beach
Steve Schwartz, JCC Homes

ATTACHMENT TO LETTER



Max and Min Storage Cell Elevations* EXISTING CONDITION

		Max			Min		
Cell No	Cell Name	**Elev**	Date	Hour	Elev	Date	Hour
*******	*********	********	********	*****	****	********	******
46	SA#46	**5.56**	1/2/1999	6.750	2.73	1/1/1999	11.333

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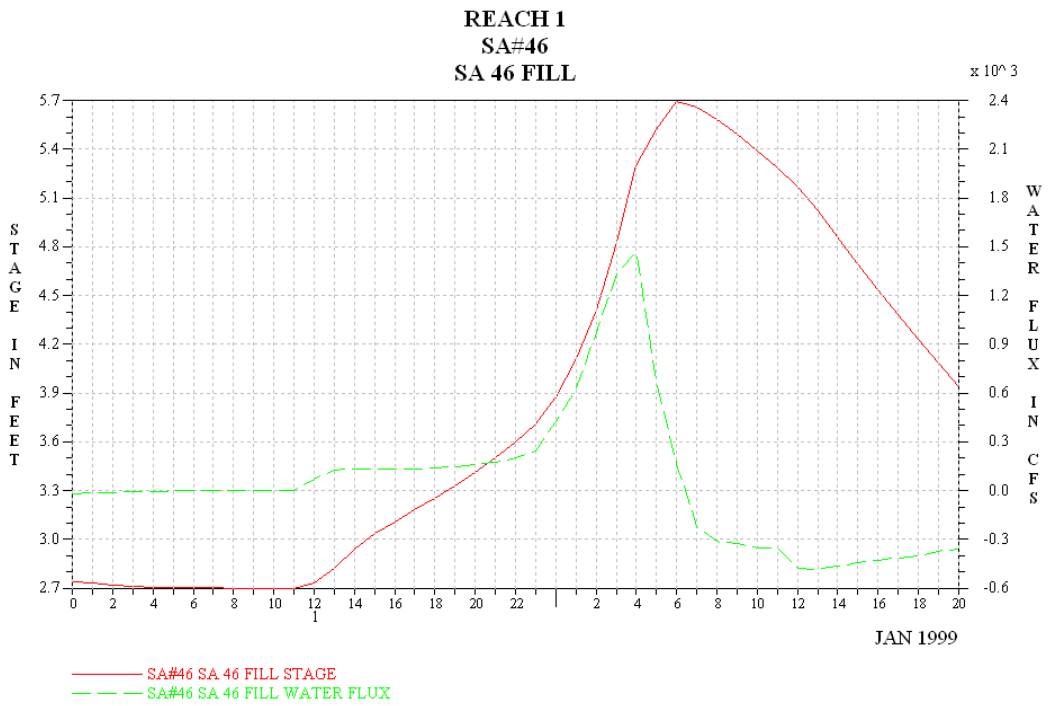
* NGVD 29. For NAVD 88, add 2.44 ft.



Max and Min Storage Cell Elevations* WITH FILL

		Max			Min		
Cell No	Cell Name	**Elev**	Date	Hour	Elev	Date	Hour
*******	*********	********	********	*****	****	********	******
46	SA#46	**5.69**	1/2/1999	6.083	2.70	1/1/1999	10.333

* NGVD 29. For NAVD 88, add 2.44 ft.