

June 16, 2010

Letter Report to City of Delano Engineering Department

Attn: Roman Dowling, City Engineer  
1015 Eleventh Avenue  
Delano, CA 93215

In regards to: Base Flood Elevations for Parcel 2 Notice of Compliance, Book 6627, Page 2118 O.R. –  
Paramount Citrus Project in the City of Delano

Dear Mr. Dowling,

Meyer Civil Engineering (MCE) was retained to determine Base Flood Elevations (BFE's) for the above referenced parcel. This letter report details our methodology and summarizes our findings.

Project Location. The project is located in the southeast portion of the City of Delano between Schuster Road and Quinn Court on the west side of Lexington Street. The project falls within a "Zone A" classification by FEMA as shown on the FIRM Panel 750 community number 06029C. Please refer to attachment page 13. The FIRM is dated September 26, 2008.

Provisional Accredited Levee Program by FEMA. Recently FEMA enacted the Provisional Accredited Levee (PAL) program. This program requires the recertification of flood control devices by their maintaining entities. Some of these maintenance entities have decided not to certify facilities. In some of these cases these included canal embankments that were considered as levees but were never certified as flood control devices. Such is the case for the Friant Kern Canal which lies east of the project approximately 2 ½ miles. Revised FIRM mapping does not consider any effect of impeding flood flows from the canal banks of the Friant Kern Canal. Therefore, this study reflected the same situation as the revised FIRM.

Hydrology. Reference is made to the Flood Insurance Study (FIS) prepared by Boyle Engineering Corporation dated January 10, 1983. Please refer to attachment page 14. The reference study has overlapping study area with this study. The FIS refers to five drainages that are located to the south and southeast of the project area. The most northerly two of these also occur in the studied area for this project. Thus, these two FIS study areas provide a check against this BFE study for verification. The FIS states that drainage areas 1 and 2 have discharge rates of 1900 cubic feet per second (CFS) and 1150 CFS respectively. These values were calculated utilizing one-dimensional analysis as outlined in the Soil Conservation Service TR-20 Computer Program. The SCS Type 1 24-hour rainfall curve was used. This new BFE study utilizes a two-dimensional modeling program known as FLO-2D. The FLO-2D modeling program is accepted by FEMA for both hydraulic and hydrologic studies. FLO-2D utilizes digital elevation models for flow routing. Therefore, model interpretation, such as required for one-dimensional modeling, is kept to a minimum. Rainfall run-off relationships can be

established by applying known soils types, land uses, and land cover. SCS methods are available in the model and thus were utilized for this study.

The following parameters were assigned:

1. Digital Elevation Model – USGS 10 meter on NGVD datum.
2. Soils – SCS Soils Tables and Charts CA666, CA668 and CA669.
3. Vegetative Land Covers –
  - Natural Gulleys – 0%
  - Natural Foothills and Ag Land – 7 ½ %
  - Municipal Areas – 10%
4. Imperviousness – Developed Lands
  - Single Family Residential – 40%
  - Multiple Family Residential – 80%
  - Specific Plans – 50%
  - Commercial Uses – 90%
  - Industrial Uses – 85%

Definitions of zoning were taken from City GIS Zone Maps.

5. SCS Curve Numbers (CN's) were calculated from B, C & D soil classes for a desert type cover. Covers and imperviousness were applied as well. FLO-2D performed these calculations as well.

CN's over the project were as follows:

|                     |       |
|---------------------|-------|
| Average:            | 88.75 |
| Maximum:            | 93.00 |
| Minimum:            | 83.30 |
| Standard Deviation: | 4.30  |

6. Studied Drainage Area – 127.51 square miles
7. Mannings N Values –
  - Natural Overland (Floodplain) – 0.065
  - Natural Gulleys – 0.030
  - Urban Areas (Streets) – 0.025

8. Rainfall was taken from NOAA Atlas 2 Volume XI. Please refer to attachment page 12. Isopluvials were plotted over the drainage area. An area weighted average was computed in FLO-2D. The result was 3.048 inches for the 100 year 24-hour event. The SCS Type 1 24-hour Rainfall Curve was applied.
9. Existing large building footprints were added as these can impede flow. Effects of a new rail spur south of the Sears building were included. Effects of the channel embankment along the east side of the drainage channel, *except for project frontage*, were included. The project proposes the removal of the embankment for its frontage along the channel.

Results. A comprehensive section, Cross Section 1, was derived in FLO-2D that closely represents drainage areas 1 and 2 from the Boyle FIS. Calculated flows peaked at 3232 CFS. This compares well with the Boyle FIS value of 3050 CFS (1900+1150).

The last cross section, Cross Section 2, measures total flow out through the study area on the west. This flow peaks at 9299 CFS.

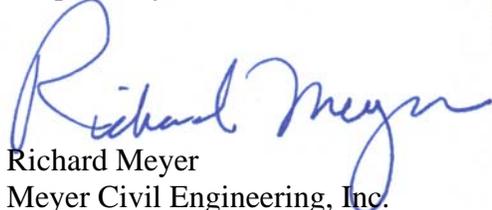
Another cross section, Cross Section 3, is provided across the project site. The section is 2100 feet long and measures 2001 CFS. Average depth is about 0.5 feet.

Locations of cross sections are shown on attachment page 1. Flows are detailed on attachment page 4. Hydrographs are shown on attachment page 9.

Base Flood Elevations. Please refer to Plate 3 attached as attachment page 3 to this letter. This plate shows depths and BFE's for the project site. Depths of flow vary from 0.36 feet on the north end of the project to 1.66 feet on the southwest corner. BFE's are provided and are based on USGS NGVD29 datum. These elevations may be converted to USGS NAVD88 by adding 2.65 vertical feet. Benchmark for the project is the top of concrete monument at the intersection of Lexington & Schuster, elevation 306.64 City of Delano datum and compares well to NGVD.

The controlling BFE elevation for the project is as shown on node 5060 and is elevation 308.11. This value is rounded up to 308.15. Finish floor for the project is to be set at no lower than elevation 309.15. Final grading plans shall be reviewed by me for verification of proper interpretation of the above information.

Respectfully Submitted,



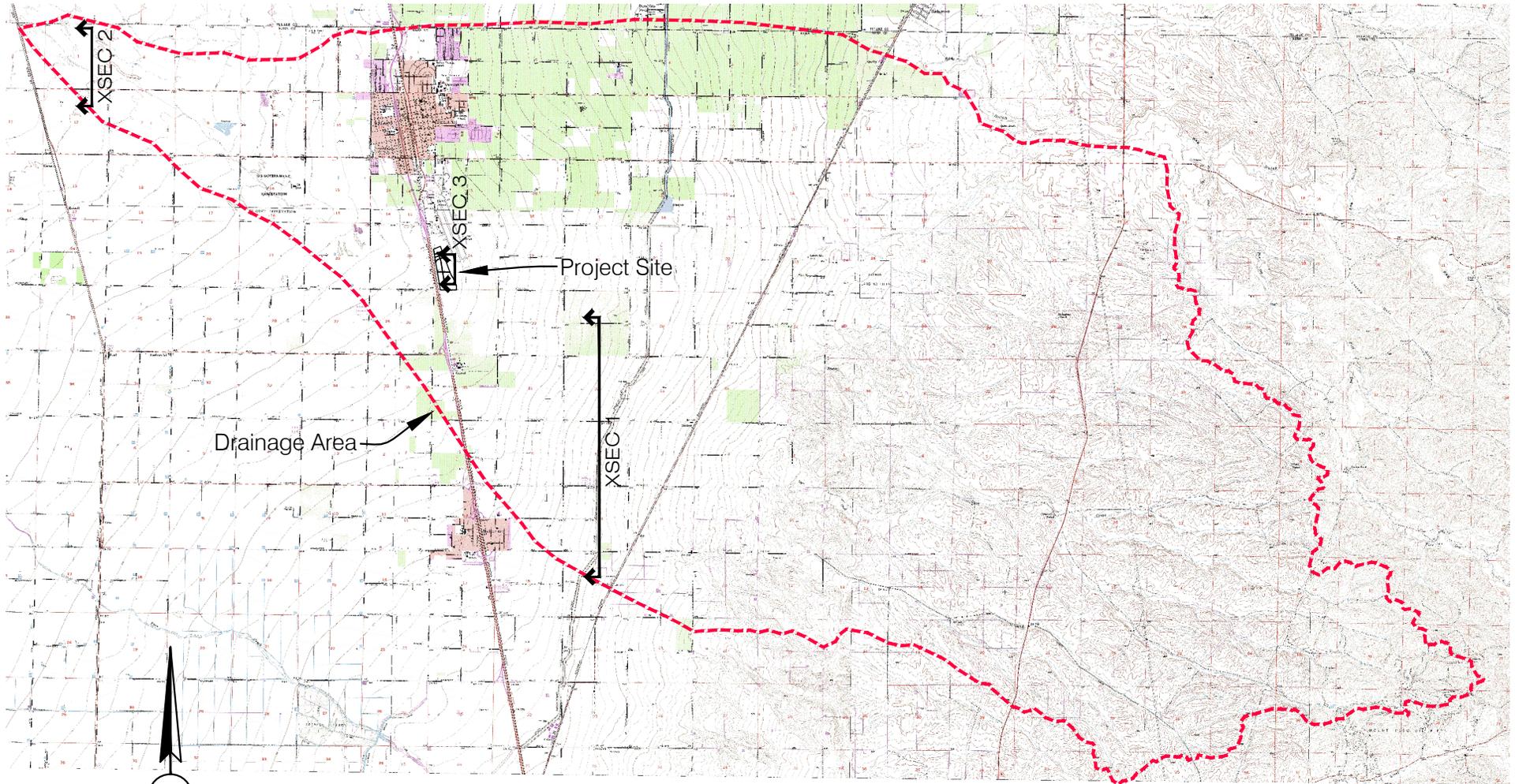
Richard Meyer  
Meyer Civil Engineering, Inc.  
RCE 28104 Exp. 3-31-12



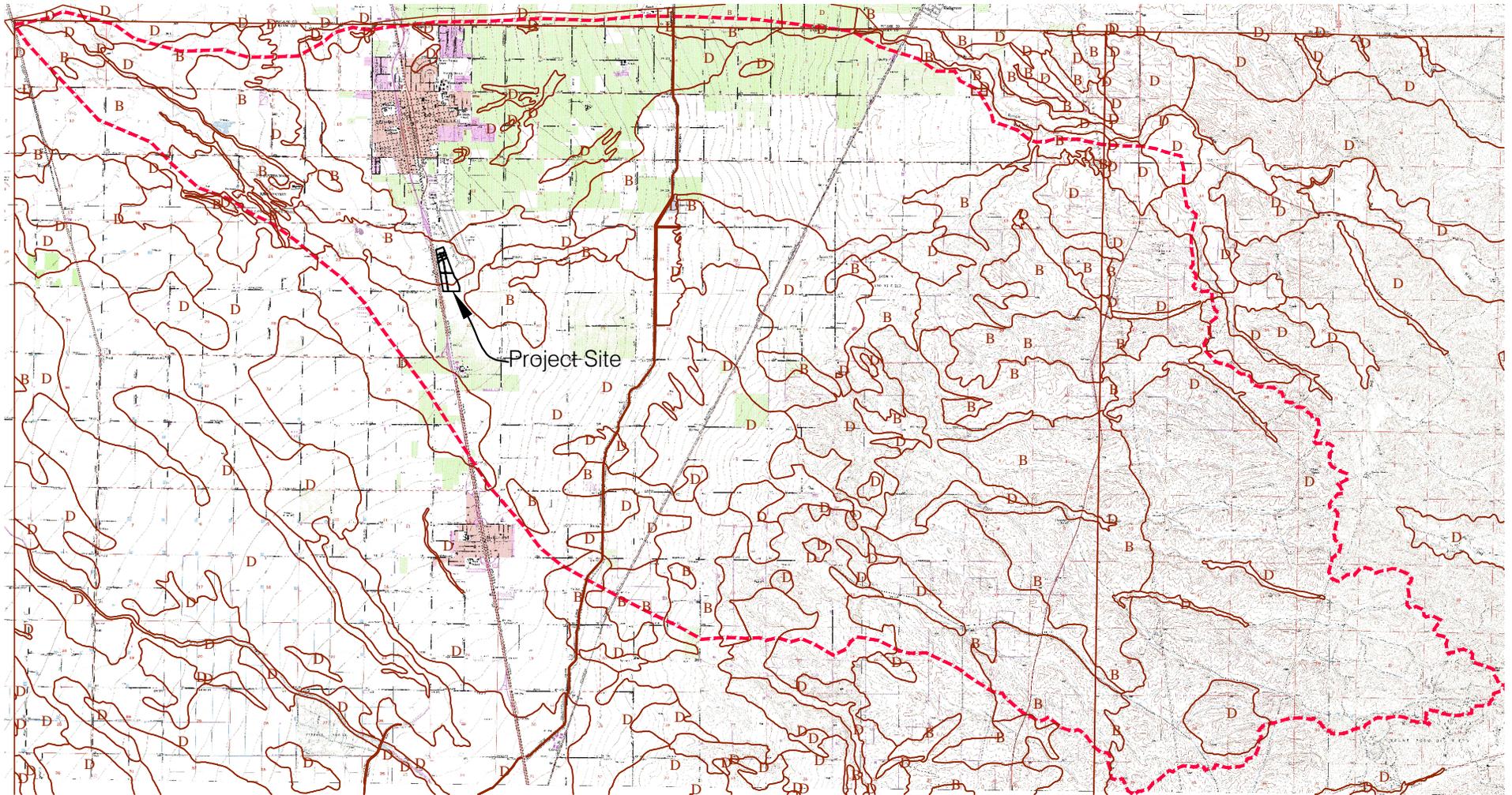
Attachments

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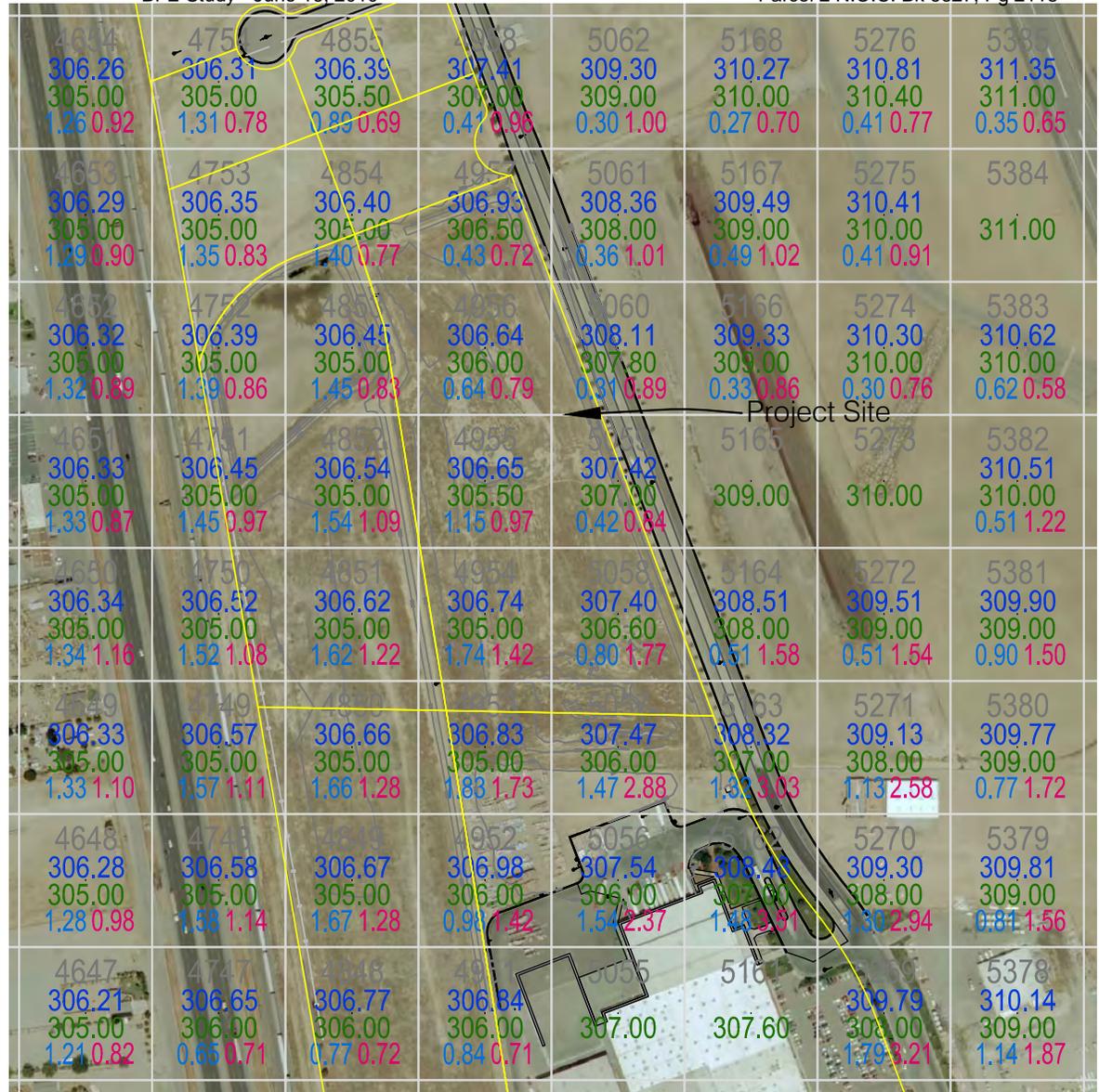
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|   |  |   |                           |
|---|--|---|---------------------------|
| <b>M Meyer</b><br>Civil Engineering, Inc.<br>110 S. Montclair St., Ste. 104, Bakersfield, CA 93309<br>Phone 661-836-9834 FAX 661-836-9761 | PM: RDM<br>Drawn By: RDM<br>AutoCAD File: SWA10001IFS1<br>File No: SWA-10-001<br>Date: 6-15-10 | PARAMOUNT CITRUS<br>LEXINGTON ROAD - CLEMENTINE EXPANSION<br>BFE STUDY - PROJECT LOCATION | SHEET NO.<br>1<br>OF<br>3 |
|---|--|---|---------------------------|



|   |  |  |                           |
|---|--|--|---------------------------|
| <b>M Meyer</b><br>Civil Engineering, Inc.<br>110 S. Montclair St., Ste. 104, Bakersfield, CA 93309<br>Phone 661-836-9834 FAX 661-836-9761 | PM: RDM  | PARAMOUNT CITRUS<br>LEXINGTON ROAD - CLEMENTINE EXPANSION<br>BFE STUDY - SCS SOIL GROUPS | SHEET NO.<br>2<br>OF<br>3 |
|   | Drawn By: RDM<br>AutoCAD File: SWA10001FS1<br>File No: SWA-10-001<br>Date: 6-15-10 |  |                           |



**LEGEND**

- FLO-2D GRID
- WATER SURFACE ELEVATION
- GROUND SURFACE ELEVATION
- DATUM IS NGVD
- VELOCITY IN FPS
- WATER DEPTH, FEET

5631  
632.38  
629.90  
2.48 2.04

|   |  |   |                                     |
|---|--|---|-------------------------------------|
| <p><b>Meyer</b><br/>Civil Engineering, Inc.<br/>110 S. Montclair St., Ste. 104, Bakersfield, CA 93309<br/>Phone 661-836-9834 FAX 661-836-9761</p> | <p>FM: RDM<br/>Drawn By: RDM<br/>AutoCAD File: SWA10001FS1<br/>File No: SWA-10-001<br/>Date: 6-15-10</p> | <p>PARAMOUNT CITRUS<br/>LEXINGTON ROAD - CLEMENTINE EXPANSION<br/>BFE STUDY - BFE'S FOR PROJECT</p> | <p>SHEET NO.<br/>3<br/>OF<br/>3</p> |
|---|--|---|-------------------------------------|

| <b>THE MAX DISC FROM CROSS SECTION</b> |           | <b>1 IS:</b>       | <b>3232.42 CFS AT TIME:</b>                 | <b>20.38 HOURS</b> |                   |           |  |
|--|-----------|--------------------|---|--------------------|-------------------|-----------|--|
| THE MAX DISC FROM NODE                 | 10447 IS: | 3.71 CFS AT TIME   | 24.01 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 FT            | AND A MAX VOL OF: | 6.12 AF   |  |
| THE MAX DISC FROM NODE                 | 10446 IS: | 32.62 CFS AT TIME  | 21.64 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.21 FT            | AND A MAX VOL OF: | 24.75 AF  |  |
| THE MAX DISC FROM NODE                 | 10445 IS: | 60.02 CFS AT TIME  | 20.40 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.26 FT            | AND A MAX VOL OF: | 66.15 AF  |  |
| THE MAX DISC FROM NODE                 | 10444 IS: | 121.58 CFS AT TIME | 20.37 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.38 FT            | AND A MAX VOL OF: | 172.05 AF |  |
| THE MAX DISC FROM NODE                 | 10443 IS: | 134.49 CFS AT TIME | 20.26 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.37 FT            | AND A MAX VOL OF: | 182.81 AF |  |
| THE MAX DISC FROM NODE                 | 10442 IS: | 145.12 CFS AT TIME | 20.24 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.41 FT            | AND A MAX VOL OF: | 196.83 AF |  |
| THE MAX DISC FROM NODE                 | 10441 IS: | 94.55 CFS AT TIME  | 20.01 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.31 FT            | AND A MAX VOL OF: | 107.46 AF |  |
| THE MAX DISC FROM NODE                 | 10440 IS: | 108.41 CFS AT TIME | 20.44 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.33 FT            | AND A MAX VOL OF: | 117.68 AF |  |
| THE MAX DISC FROM NODE                 | 10439 IS: | 158.76 CFS AT TIME | 20.43 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.45 FT            | AND A MAX VOL OF: | 184.23 AF |  |
| THE MAX DISC FROM NODE                 | 10438 IS: | 168.80 CFS AT TIME | 22.41 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.73 FT            | AND A MAX VOL OF: | 228.04 AF |  |
| THE MAX DISC FROM NODE                 | 10437 IS: | 144.63 CFS AT TIME | 20.03 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.42 FT            | AND A MAX VOL OF: | 167.53 AF |  |
| THE MAX DISC FROM NODE                 | 10436 IS: | 175.41 CFS AT TIME | 21.63 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.48 FT            | AND A MAX VOL OF: | 215.15 AF |  |
| THE MAX DISC FROM NODE                 | 10435 IS: | 181.85 CFS AT TIME | 21.69 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.81 FT            | AND A MAX VOL OF: | 234.17 AF |  |
| THE MAX DISC FROM NODE                 | 10434 IS: | 95.96 CFS AT TIME  | 22.05 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.32 FT            | AND A MAX VOL OF: | 86.12 AF  |  |
| THE MAX DISC FROM NODE                 | 10433 IS: | 40.10 CFS AT TIME  | 22.41 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.20 FT            | AND A MAX VOL OF: | 33.07 AF  |  |
| THE MAX DISC FROM NODE                 | 10432 IS: | 13.81 CFS AT TIME  | 23.36 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.13 FT            | AND A MAX VOL OF: | 19.32 AF  |  |
| THE MAX DISC FROM NODE                 | 10431 IS: | 11.17 CFS AT TIME  | 22.98 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.12 FT            | AND A MAX VOL OF: | 14.95 AF  |  |
| THE MAX DISC FROM NODE                 | 10430 IS: | 8.57 CFS AT TIME   | 22.51 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.10 FT            | AND A MAX VOL OF: | 11.78 AF  |  |
| THE MAX DISC FROM NODE                 | 10429 IS: | 13.31 CFS AT TIME  | 22.59 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.15 FT            | AND A MAX VOL OF: | 18.18 AF  |  |
| THE MAX DISC FROM NODE                 | 10428 IS: | 13.27 CFS AT TIME  | 22.51 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.15 FT            | AND A MAX VOL OF: | 18.78 AF  |  |
| THE MAX DISC FROM NODE                 | 10427 IS: | 13.07 CFS AT TIME  | 22.30 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.14 FT            | AND A MAX VOL OF: | 19.12 AF  |  |
| THE MAX DISC FROM NODE                 | 10426 IS: | 16.15 CFS AT TIME  | 22.58 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.16 FT            | AND A MAX VOL OF: | 24.19 AF  |  |
| THE MAX DISC FROM NODE                 | 10425 IS: | 24.34 CFS AT TIME  | 21.61 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.20 FT            | AND A MAX VOL OF: | 27.61 AF  |  |
| THE MAX DISC FROM NODE                 | 10424 IS: | 32.74 CFS AT TIME  | 20.47 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.22 FT            | AND A MAX VOL OF: | 31.48 AF  |  |
| THE MAX DISC FROM NODE                 | 10423 IS: | 7.76 CFS AT TIME   | 21.37 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.11 FT            | AND A MAX VOL OF: | 11.51 AF  |  |
| THE MAX DISC FROM NODE                 | 10422 IS: | 4.08 CFS AT TIME   | 10.59 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 FT            | AND A MAX VOL OF: | 4.88 AF   |  |
| THE MAX DISC FROM NODE                 | 10421 IS: | 4.52 CFS AT TIME   | 10.44 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 FT            | AND A MAX VOL OF: | 4.49 AF   |  |

|                        |       |     |       |             |       |                                       |      |                      |       |    |
|------------------------|-------|-----|-------|-------------|-------|---------------------------------------|------|----------------------|-------|----|
| THE MAX DISC FROM NODE | 10420 | IS: | 4.01  | CFS AT TIME | 10.22 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 | FT AND A MAX VOL OF: | 5.61  | AF |
| THE MAX DISC FROM NODE | 10419 | IS: | 2.39  | CFS AT TIME | 21.56 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.04 | FT AND A MAX VOL OF: | 3.26  | AF |
| THE MAX DISC FROM NODE | 10418 | IS: | 75.34 | CFS AT TIME | 19.99 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.29 | FT AND A MAX VOL OF: | 88.90 | AF |
| THE MAX DISC FROM NODE | 10417 | IS: | 71.03 | CFS AT TIME | 20.94 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.28 | FT AND A MAX VOL OF: | 83.27 | AF |
| THE MAX DISC FROM NODE | 10416 | IS: | 60.52 | CFS AT TIME | 19.35 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.25 | FT AND A MAX VOL OF: | 70.38 | AF |
| THE MAX DISC FROM NODE | 10415 | IS: | 49.67 | CFS AT TIME | 19.87 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.21 | FT AND A MAX VOL OF: | 45.03 | AF |
| THE MAX DISC FROM NODE | 10414 | IS: | 49.69 | CFS AT TIME | 18.59 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.21 | FT AND A MAX VOL OF: | 43.61 | AF |
| THE MAX DISC FROM NODE | 10413 | IS: | 76.63 | CFS AT TIME | 19.64 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.29 | FT AND A MAX VOL OF: | 92.56 | AF |
| THE MAX DISC FROM NODE | 10412 | IS: | 58.92 | CFS AT TIME | 19.64 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.25 | FT AND A MAX VOL OF: | 64.41 | AF |
| THE MAX DISC FROM NODE | 10411 | IS: | 55.83 | CFS AT TIME | 19.84 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.23 | FT AND A MAX VOL OF: | 48.38 | AF |
| THE MAX DISC FROM NODE | 10410 | IS: | 55.81 | CFS AT TIME | 21.92 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.22 | FT AND A MAX VOL OF: | 40.46 | AF |
| THE MAX DISC FROM NODE | 10409 | IS: | 62.97 | CFS AT TIME | 19.41 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.25 | FT AND A MAX VOL OF: | 61.81 | AF |
| THE MAX DISC FROM NODE | 10408 | IS: | 38.80 | CFS AT TIME | 20.59 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.20 | FT AND A MAX VOL OF: | 31.42 | AF |
| THE MAX DISC FROM NODE | 10407 | IS: | 47.59 | CFS AT TIME | 20.18 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.23 | FT AND A MAX VOL OF: | 43.66 | AF |
| THE MAX DISC FROM NODE | 10406 | IS: | 12.94 | CFS AT TIME | 19.58 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.13 | FT AND A MAX VOL OF: | 18.39 | AF |
| THE MAX DISC FROM NODE | 10405 | IS: | 37.64 | CFS AT TIME | 20.54 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.21 | FT AND A MAX VOL OF: | 32.69 | AF |
| THE MAX DISC FROM NODE | 10404 | IS: | 16.00 | CFS AT TIME | 20.07 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.14 | FT AND A MAX VOL OF: | 22.97 | AF |
| THE MAX DISC FROM NODE | 10403 | IS: | 77.32 | CFS AT TIME | 20.94 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.28 | FT AND A MAX VOL OF: | 58.60 | AF |
| THE MAX DISC FROM NODE | 10402 | IS: | 54.34 | CFS AT TIME | 19.14 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.27 | FT AND A MAX VOL OF: | 55.38 | AF |
| THE MAX DISC FROM NODE | 10401 | IS: | 51.21 | CFS AT TIME | 22.45 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.29 | FT AND A MAX VOL OF: | 59.48 | AF |
| THE MAX DISC FROM NODE | 10400 | IS: | 55.65 | CFS AT TIME | 20.59 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.25 | FT AND A MAX VOL OF: | 58.05 | AF |
| THE MAX DISC FROM NODE | 10399 | IS: | 24.60 | CFS AT TIME | 21.41 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.19 | FT AND A MAX VOL OF: | 35.32 | AF |
| THE MAX DISC FROM NODE | 10398 | IS: | 14.99 | CFS AT TIME | 19.48 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.15 | FT AND A MAX VOL OF: | 23.52 | AF |
| THE MAX DISC FROM NODE | 10397 | IS: | 8.06  | CFS AT TIME | 23.38 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.11 | FT AND A MAX VOL OF: | 14.86 | AF |
| THE MAX DISC FROM NODE | 10396 | IS: | 6.18  | CFS AT TIME | 12.00 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.09 | FT AND A MAX VOL OF: | 11.14 | AF |
| THE MAX DISC FROM NODE | 10395 | IS: | 6.74  | CFS AT TIME | 12.60 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.10 | FT AND A MAX VOL OF: | 10.36 | AF |
| THE MAX DISC FROM NODE | 10394 | IS: | 6.51  | CFS AT TIME | 11.82 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.09 | FT AND A MAX VOL OF: | 9.01  | AF |
| THE MAX DISC FROM NODE | 10393 | IS: | 5.79  | CFS AT TIME | 11.01 | HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.08 | FT AND A MAX VOL OF: | 7.03  | AF |

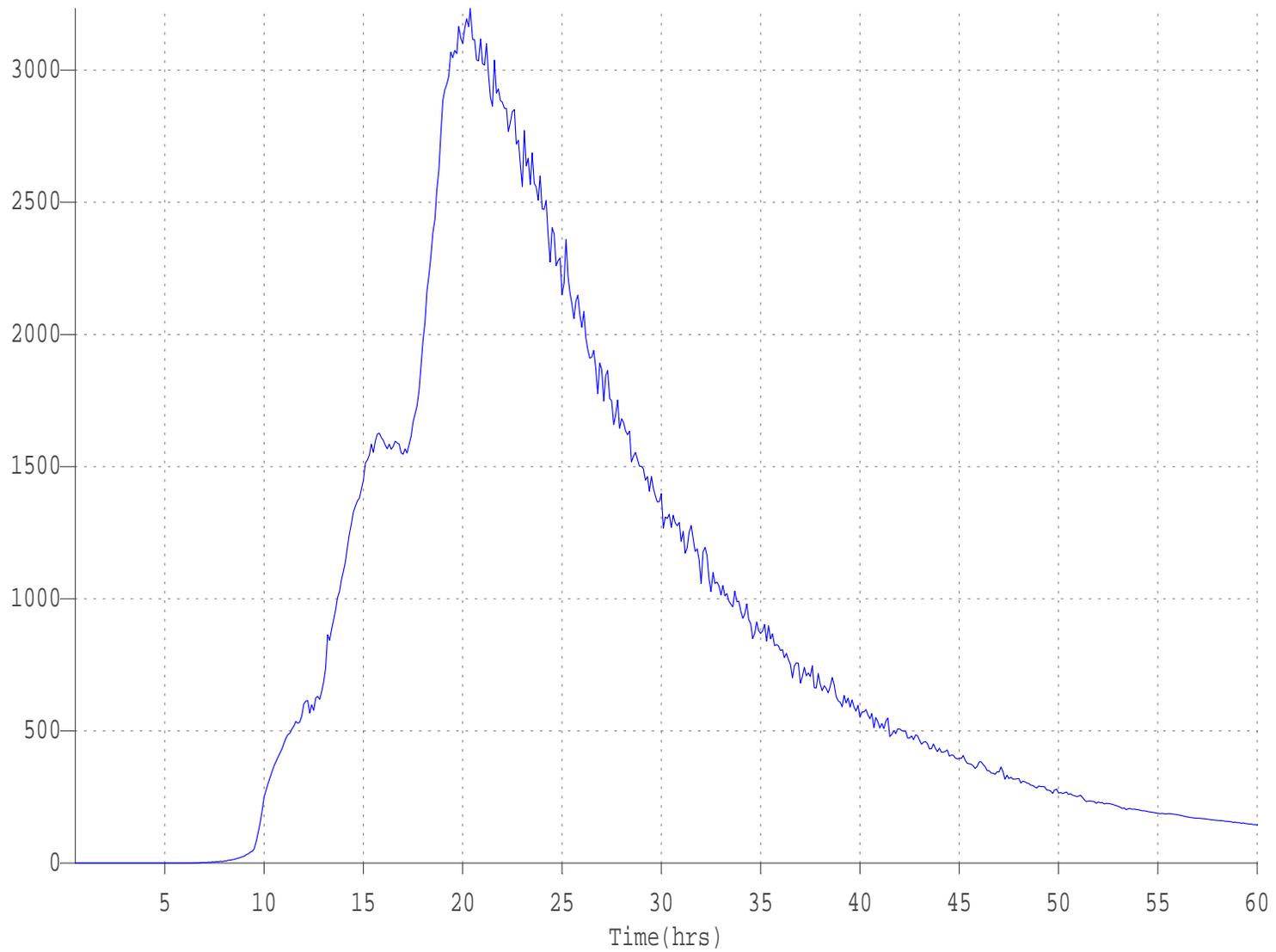
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|------------------------|-----------|--------------------|---|---------------------------|-----------|
| THE MAX DISC FROM NODE | 10392 IS: | 5.33 CFS AT TIME   | 11.01 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.08 FT AND A MAX VOL OF: | 6.10 AF   |
| THE MAX DISC FROM NODE | 10391 IS: | 5.74 CFS AT TIME   | 11.55 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.09 FT AND A MAX VOL OF: | 7.04 AF   |
| THE MAX DISC FROM NODE | 10390 IS: | 8.19 CFS AT TIME   | 12.82 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.11 FT AND A MAX VOL OF: | 12.47 AF  |
| THE MAX DISC FROM NODE | 10389 IS: | 33.27 CFS AT TIME  | 20.15 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.20 FT AND A MAX VOL OF: | 28.39 AF  |
| THE MAX DISC FROM NODE | 10388 IS: | 52.54 CFS AT TIME  | 19.83 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.24 FT AND A MAX VOL OF: | 60.32 AF  |
| THE MAX DISC FROM NODE | 10387 IS: | 87.25 CFS AT TIME  | 19.71 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.38 FT AND A MAX VOL OF: | 106.54 AF |
| THE MAX DISC FROM NODE | 10386 IS: | 83.18 CFS AT TIME  | 19.75 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.31 FT AND A MAX VOL OF: | 82.25 AF  |
| THE MAX DISC FROM NODE | 10385 IS: | 157.88 CFS AT TIME | 19.27 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.76 FT AND A MAX VOL OF: | 220.00 AF |
| THE MAX DISC FROM NODE | 10384 IS: | 145.03 CFS AT TIME | 19.48 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.96 FT AND A MAX VOL OF: | 212.60 AF |
| THE MAX DISC FROM NODE | 10383 IS: | 74.77 CFS AT TIME  | 19.30 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.40 FT AND A MAX VOL OF: | 92.68 AF  |
| THE MAX DISC FROM NODE | 10382 IS: | 46.62 CFS AT TIME  | 19.52 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.25 FT AND A MAX VOL OF: | 44.51 AF  |
| THE MAX DISC FROM NODE | 10381 IS: | 10.16 CFS AT TIME  | 19.91 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.13 FT AND A MAX VOL OF: | 12.48 AF  |
| THE MAX DISC FROM NODE | 10380 IS: | 6.35 CFS AT TIME   | 16.51 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.09 FT AND A MAX VOL OF: | 7.86 AF   |
| THE MAX DISC FROM NODE | 10379 IS: | 4.84 CFS AT TIME   | 16.77 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 FT AND A MAX VOL OF: | 6.01 AF   |
| THE MAX DISC FROM NODE | 10378 IS: | 5.10 CFS AT TIME   | 17.10 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 FT AND A MAX VOL OF: | 6.42 AF   |
| THE MAX DISC FROM NODE | 10377 IS: | 5.04 CFS AT TIME   | 19.08 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.07 FT AND A MAX VOL OF: | 5.90 AF   |

**THE MAX DISC FROM CROSS SECTION 2 IS: 9298.67 CFS AT TIME: 30.19 HOURS**

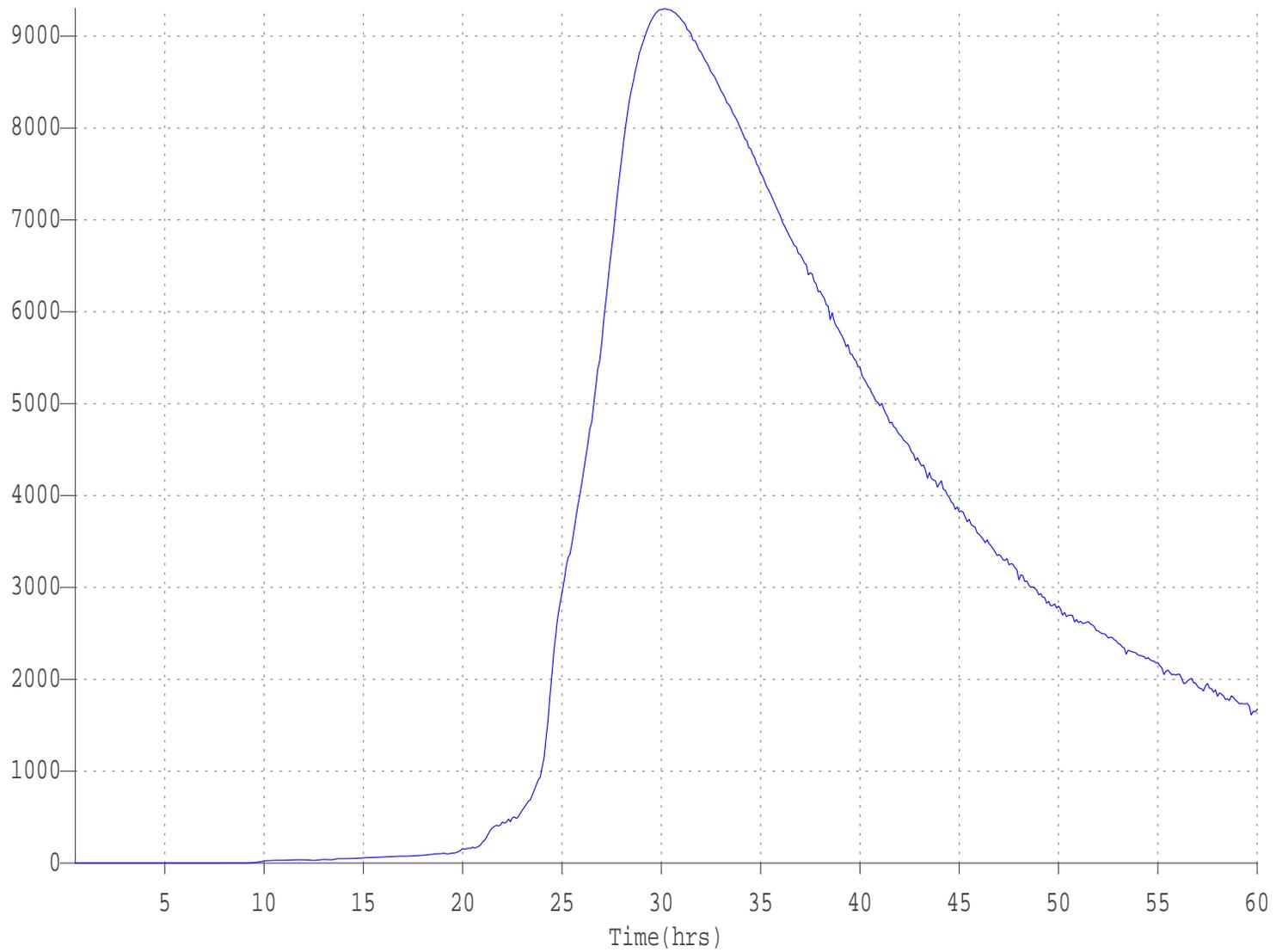
|                        |         |                    |   |                           |           |
|------------------------|---------|--------------------|---|---------------------------|-----------|
| THE MAX DISC FROM NODE | 231 IS: | 87.20 CFS AT TIME  | 31.23 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.34 FT AND A MAX VOL OF: | 142.44 AF |
| THE MAX DISC FROM NODE | 230 IS: | 65.56 CFS AT TIME  | 31.18 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.27 FT AND A MAX VOL OF: | 93.77 AF  |
| THE MAX DISC FROM NODE | 229 IS: | 76.21 CFS AT TIME  | 31.80 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.31 FT AND A MAX VOL OF: | 117.30 AF |
| THE MAX DISC FROM NODE | 228 IS: | 74.91 CFS AT TIME  | 31.80 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.37 FT AND A MAX VOL OF: | 121.60 AF |
| THE MAX DISC FROM NODE | 227 IS: | 73.40 CFS AT TIME  | 31.42 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.29 FT AND A MAX VOL OF: | 120.99 AF |
| THE MAX DISC FROM NODE | 226 IS: | 80.20 CFS AT TIME  | 31.40 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.30 FT AND A MAX VOL OF: | 118.54 AF |
| THE MAX DISC FROM NODE | 225 IS: | 85.34 CFS AT TIME  | 30.30 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.33 FT AND A MAX VOL OF: | 120.71 AF |
| THE MAX DISC FROM NODE | 224 IS: | 84.89 CFS AT TIME  | 30.31 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.33 FT AND A MAX VOL OF: | 108.81 AF |
| THE MAX DISC FROM NODE | 223 IS: | 121.27 CFS AT TIME | 30.28 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.35 FT AND A MAX VOL OF: | 154.67 AF |
| THE MAX DISC FROM NODE | 222 IS: | 311.33 CFS AT TIME | 30.25 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.17 FT AND A MAX VOL OF: | 413.24 AF |
| THE MAX DISC FROM NODE | 221 IS: | 581.17 CFS AT TIME | 30.22 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.31 FT AND A MAX VOL OF: | 801.83 AF |

|  |              |                             |   |         |                   |            |
|--|--------------|-----------------------------|---|---------|-------------------|------------|
| THE MAX DISC FROM NODE                 | 220 IS:      | 1169.92 CFS AT TIME         | 30.18 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 2.35 FT | AND A MAX VOL OF: | 1898.18 AF |
| THE MAX DISC FROM NODE                 | 219 IS:      | 1783.18 CFS AT TIME         | 30.12 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 2.54 FT | AND A MAX VOL OF: | 3128.07 AF |
| THE MAX DISC FROM NODE                 | 218 IS:      | 1554.13 CFS AT TIME         | 30.05 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 2.77 FT | AND A MAX VOL OF: | 2642.81 AF |
| THE MAX DISC FROM NODE                 | 217 IS:      | 593.27 CFS AT TIME          | 30.09 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.36 FT | AND A MAX VOL OF: | 798.89 AF  |
| THE MAX DISC FROM NODE                 | 216 IS:      | 381.07 CFS AT TIME          | 30.08 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.08 FT | AND A MAX VOL OF: | 498.31 AF  |
| THE MAX DISC FROM NODE                 | 215 IS:      | 409.73 CFS AT TIME          | 30.08 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.43 FT | AND A MAX VOL OF: | 541.90 AF  |
| THE MAX DISC FROM NODE                 | 214 IS:      | 476.48 CFS AT TIME          | 29.97 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.62 FT | AND A MAX VOL OF: | 643.28 AF  |
| THE MAX DISC FROM NODE                 | 213 IS:      | 493.16 CFS AT TIME          | 30.14 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.78 FT | AND A MAX VOL OF: | 673.29 AF  |
| THE MAX DISC FROM NODE                 | 212 IS:      | 471.57 CFS AT TIME          | 29.92 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.32 FT | AND A MAX VOL OF: | 648.61 AF  |
| THE MAX DISC FROM NODE                 | 211 IS:      | 234.24 CFS AT TIME          | 29.85 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.38 FT | AND A MAX VOL OF: | 322.46 AF  |
| THE MAX DISC FROM NODE                 | 210 IS:      | 124.90 CFS AT TIME          | 29.97 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.48 FT | AND A MAX VOL OF: | 172.99 AF  |
| <br>                                   |              |                             |   |         |                   |            |
| <b>THE MAX DISC FROM CROSS SECTION</b> | <b>3 IS:</b> | <b>2000.60 CFS AT TIME:</b> | <b>23.61 HOURS</b>                          |         |                   |            |
| THE MAX DISC FROM NODE                 | 5270 IS:     | 842.42 CFS AT TIME          | 23.59 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.30 FT | AND A MAX VOL OF: | 1338.13 AF |
| THE MAX DISC FROM NODE                 | 5271 IS:     | 713.76 CFS AT TIME          | 23.60 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 1.13 FT | AND A MAX VOL OF: | 1000.99 AF |
| THE MAX DISC FROM NODE                 | 5272 IS:     | 184.75 CFS AT TIME          | 23.59 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.51 FT | AND A MAX VOL OF: | 204.36 AF  |
| THE MAX DISC FROM NODE                 | 5273 IS:     | 35.72 CFS AT TIME           | 23.41 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.20 FT | AND A MAX VOL OF: | 41.65 AF   |
| THE MAX DISC FROM NODE                 | 5274 IS:     | 61.03 CFS AT TIME           | 23.72 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.30 FT | AND A MAX VOL OF: | 83.79 AF   |
| THE MAX DISC FROM NODE                 | 5275 IS:     | 84.57 CFS AT TIME           | 24.57 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.41 FT | AND A MAX VOL OF: | 122.85 AF  |
| THE MAX DISC FROM NODE                 | 5276 IS:     | 83.69 CFS AT TIME           | 24.29 HOURS WITH A MAX FLOODPLAIN DEPTH OF: | 0.41 FT | AND A MAX VOL OF: | 121.80 AF  |

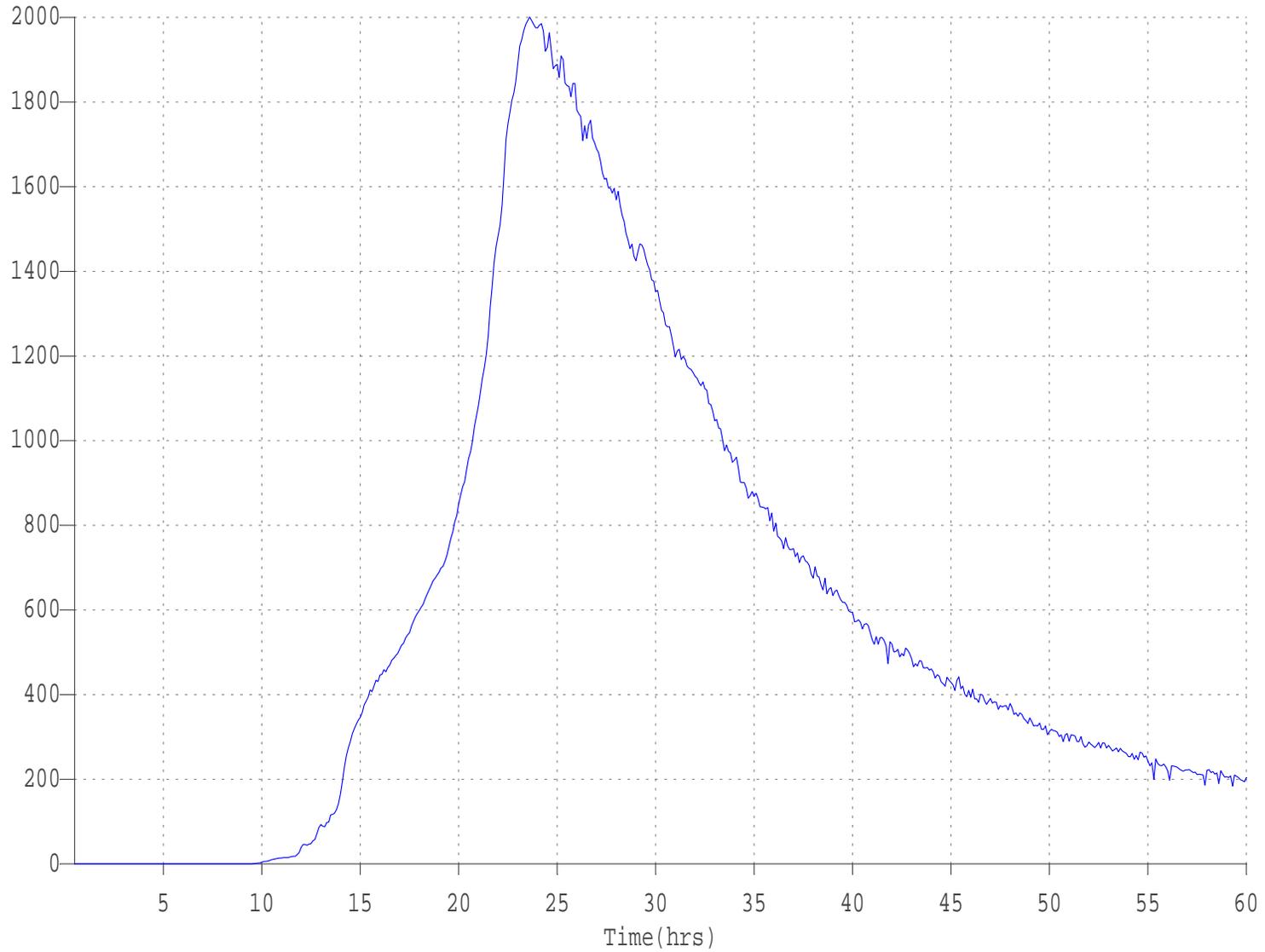
Cross Section: 1      Discharge Hydrograph (cfs)      Predicted Discharge

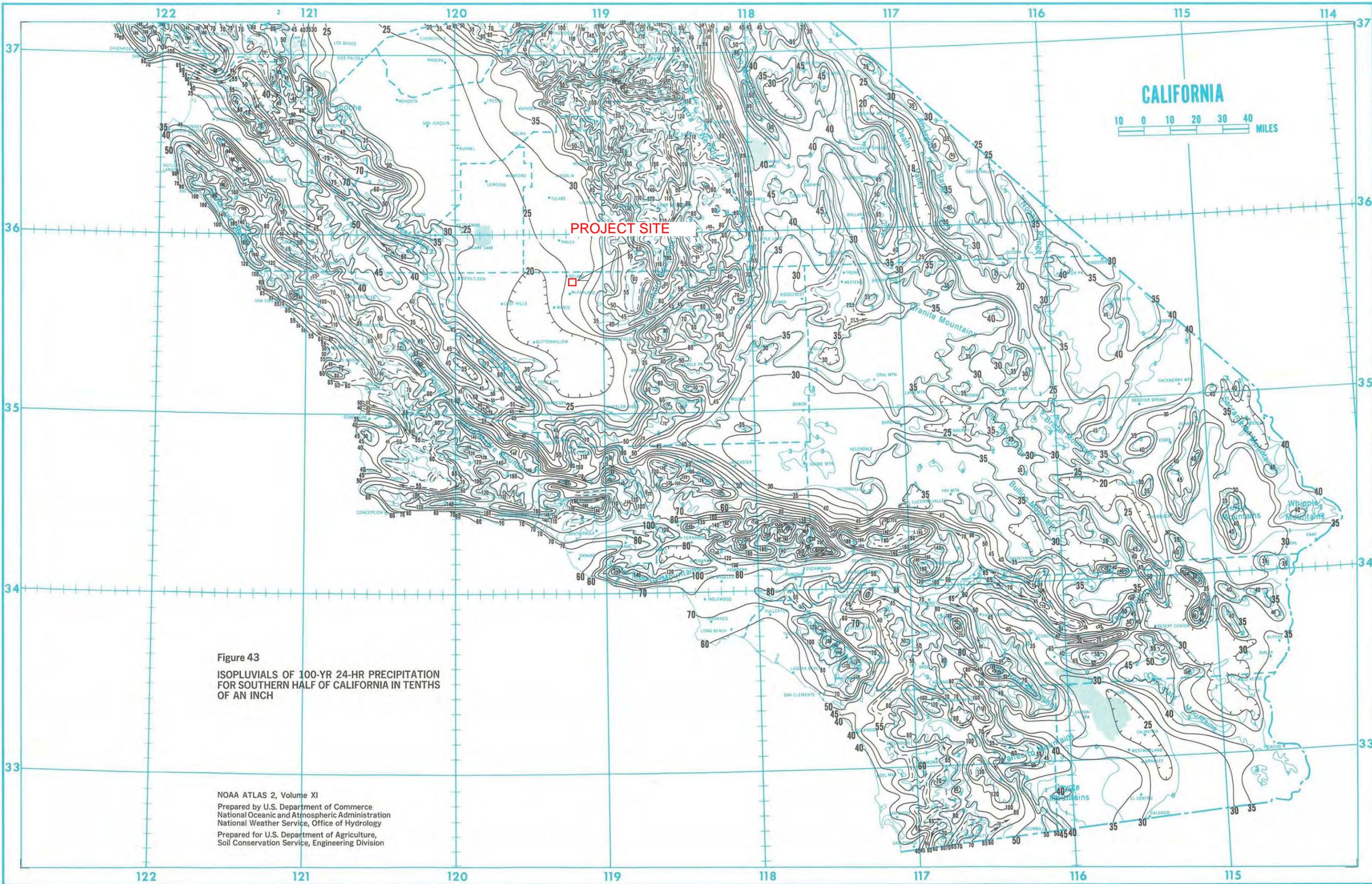


Cross Section: 2      Discharge Hydrograph (cfs)      Predicted Discharge



Cross Section: 3      Discharge Hydrograph (cfs)      Predicted Discharge





See Flood Insurance Study Report for this jurisdiction.

Insurance is available in this community, contact your insurance agent or the National Flood Insurance Program at 1-800-638-6620.



MAP SCALE 1" = 2000'

0 600 1200

PANEL 0750E

**FIRM**  
FLOOD INSURANCE RATE MAP  
KERN COUNTY,  
CALIFORNIA  
AND INCORPORATED AREAS

PANEL 750 OF 4125  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY          | NUMBER | PANEL | SUFFIX |
|--------------------|--------|-------|--------|
| KERN COUNTY        | 060075 | 0750  | E      |
| DELANO, CITY OF    | 060078 | 0750  | E      |
| MCFARLAND, CITY OF | 060080 | 0750  | E      |

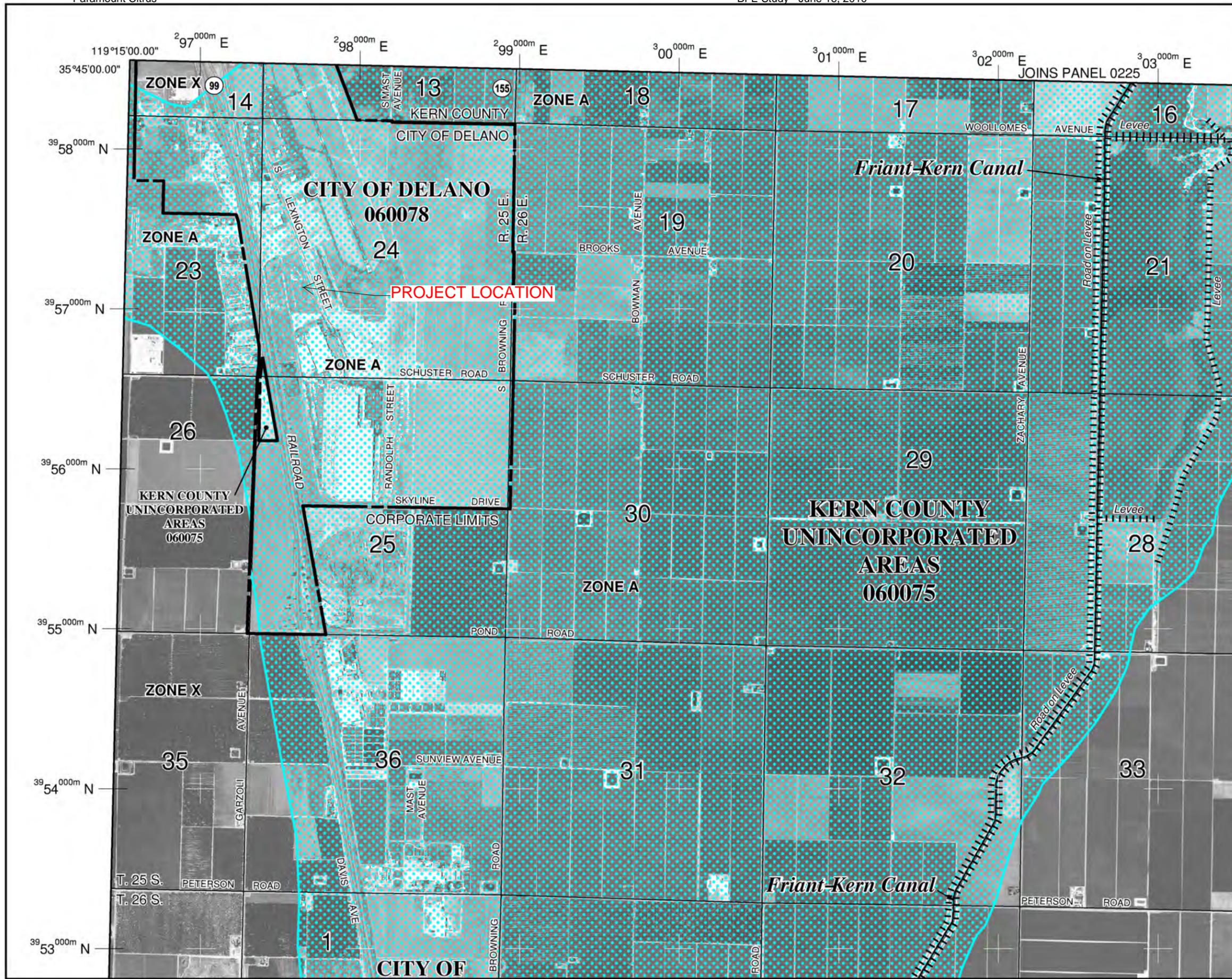
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



MAP NUMBER  
06029C0750E  
EFFECTIVE DATE  
SEPTEMBER 26, 2008

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM



This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

PUBLIC WORKS - SURVEYOR

|                                   |       |            |     |
|-----------------------------------|-------|------------|-----|
| NO.                               | IN-C. | CF.        | IF. |
| Project 2 N.O.C. BK 6627, Pg 2118 |       |            |     |
| DIR. CIV.                         |       |            |     |
| DEP. DIR. (P.W.)                  |       |            |     |
| DEP. DIR. (ROADS)                 |       |            |     |
| ROADS                             |       |            |     |
| U. I. D.                          |       |            |     |
| consulting engineers              |       | architects |     |
| REGULATIONS                       |       |            |     |
| 714 7266-8000                     |       |            |     |

# Boyle Engineering Corporation

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7807 Convoy Court  
San Diego, California 92111

Mr. Terry Paxton  
Dept. of Public Works  
County of Kern  
2601 O Street  
Bakersfield, CA 93301

## FLOOD INSURANCE STUDY CITY OF MCFARLAND, KERN COUNTY, CALIFORNIA

Boyle Engineering Corporation is conducting a Flood Insurance Study (FIS) for the City of McFarland, Kern County, California. This study is being conducted under a contract with the Federal Emergency Management Agency (FEMA).

As a portion of the FIS, Boyle was asked to investigate the possibility of the one-percent chance (100-year) flood from the foothills east of McFarland, overtopping the Friant-Kern Canal. The investigation has been completed and in this letter, we will present the methodology and results.

### BACKGROUND

Historically, runoff from the foothills east of McFarland ponds against the east bank of the Friant-Kern Canal. As the ponding increases, water flows southerly along the canal to a point near the Southern Pacific Railroad and State Highway 99. Here, the canal water flows into a siphon and the embankment stops. At this point, some of the runoff from the foothills continues west to Highway 99, and some flows northerly along the railroad towards McFarland.

In collecting data for this study, the following sources were contacted: the County of Kern, the Kern County Water Agency, Caltrans in Fresno, the Southern Pacific Railroad in Bakersfield, the U.S. Bureau of Reclamation in Delano and Fresno, the Soil Conservation Service (SCS) in Bakersfield and Fresno, the Corps of Engineers in Sacramento, and the City Engineer for the City of McFarland. The following was learned from these sources:

1. Flooding has never overtopped the canal bank in the study area.
2. The most extreme event on record for this area was estimated to be a 30-year flood.
3. Flood water has entered the canal through inlets in the east bank.
4. The drainage area contributing runoff to the study area is bordered by Poso creek on the south but the northerly limit is not well defined. Most of the sources felt the northerly limit would be either Dyer Creek or the watershed adjacent to Sherwood Ave. (McFarland-Woody Road). These areas are numbered (1) and (2) respectively on Figure 1.

January 10, 1983 *TLP*

*N.C. 7/24/83*

Mr. Terry Paxton

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January 10, 1983

HYDROLOGY

The 100-year flood hydrographs from areas 1 through 5, Figure 1, were computed using the Soil Conservation Service TR-20 Computer Program (SCS, 1965). This methodology was selected because portions of the watersheds had been previously studied by the SCS (SCS, 1971), and the curve numbers could be readily obtained and updated. A 24-hour storm was used with an SCS Type 1 temporal distribution of rainfall. The results are shown in Table 1 below.

TABLE 1  
SUMMARY OF 100-YEAR HYDROLOGY

| Area # | Drainage Area<br>(sq.mi.) | 24-Hour Precip.<br>(in.) | Peak Discharge<br>(cfs) | Peak Discharge<br>(csm) | Volume<br>(ac.-ft.) |
|--------|---------------------------|--------------------------|-------------------------|-------------------------|---------------------|
| 1      | 24.3                      | 3.6                      | 1900                    | 78                      | 1540                |
| 2      | 12.8                      | 3.6                      | 1150                    | 90                      | 810                 |
| 3      | 5.2                       | 3.0                      | 700                     | 135                     | 300                 |
| 4      | 22.3                      | 3.6                      | 2750                    | 123                     | 1790                |
| 5      | 7.1                       | 3.0                      | 800                     | 113                     | 410                 |

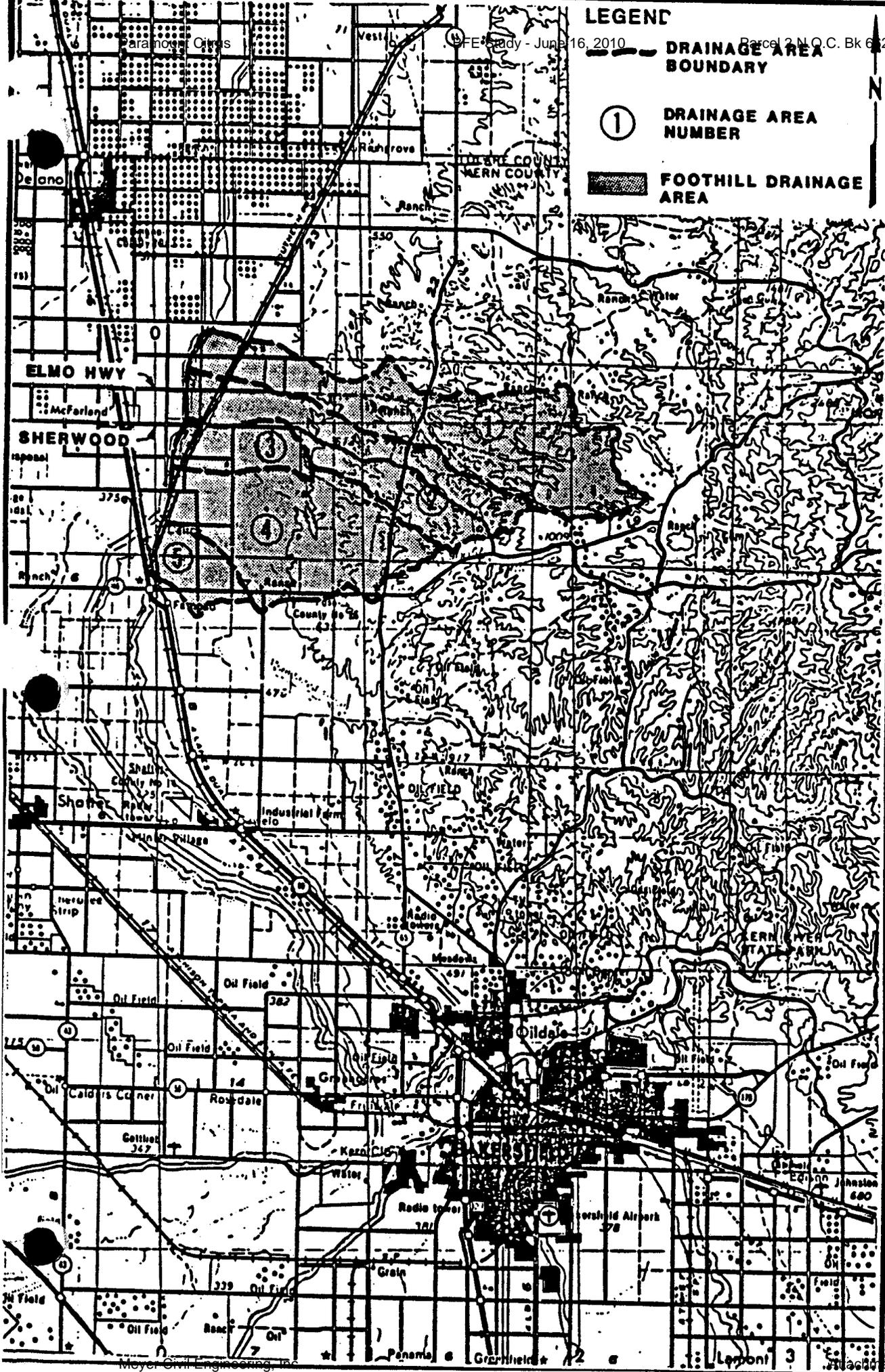
These results appear to be reasonable when compared to other hydrology studies done in Kern County (Boyle, 1979).

The peak discharges may be slightly low but if overtopping occurs using these results, the certainty of overtopping during a 100-year flood will be enforced. ✓

OVERTOPPING ANALYSIS

Flood routing was performed along the Friant-Kern Canal's east bank using surveyed cross-sections perpendicular to the bank. The hydrographs for areas 1 through 5 were added into the routing at the appropriate locations along the canal. Two cases were investigated, first, only areas 1 through 4 were included and second, areas 1 through 5 (Dyer Creek) were included.

In the first case, the water surface elevation during routing exceeded the top of the east bank by approximately 0.8 feet between Sherwood Avenue and Elmo Highway. In the second case, the overtopping occurred over a longer length of canal bank with the maximum water surface elevation rising approximately 3 feet above the top of the bank between Sherwood Avenue and Elmo Highway.



**LEGEND**

**DRAINAGE AREA BOUNDARY**

**① DRAINAGE AREA NUMBER**

**FOOTHILL DRAINAGE AREA**

DATE: JAN 1983

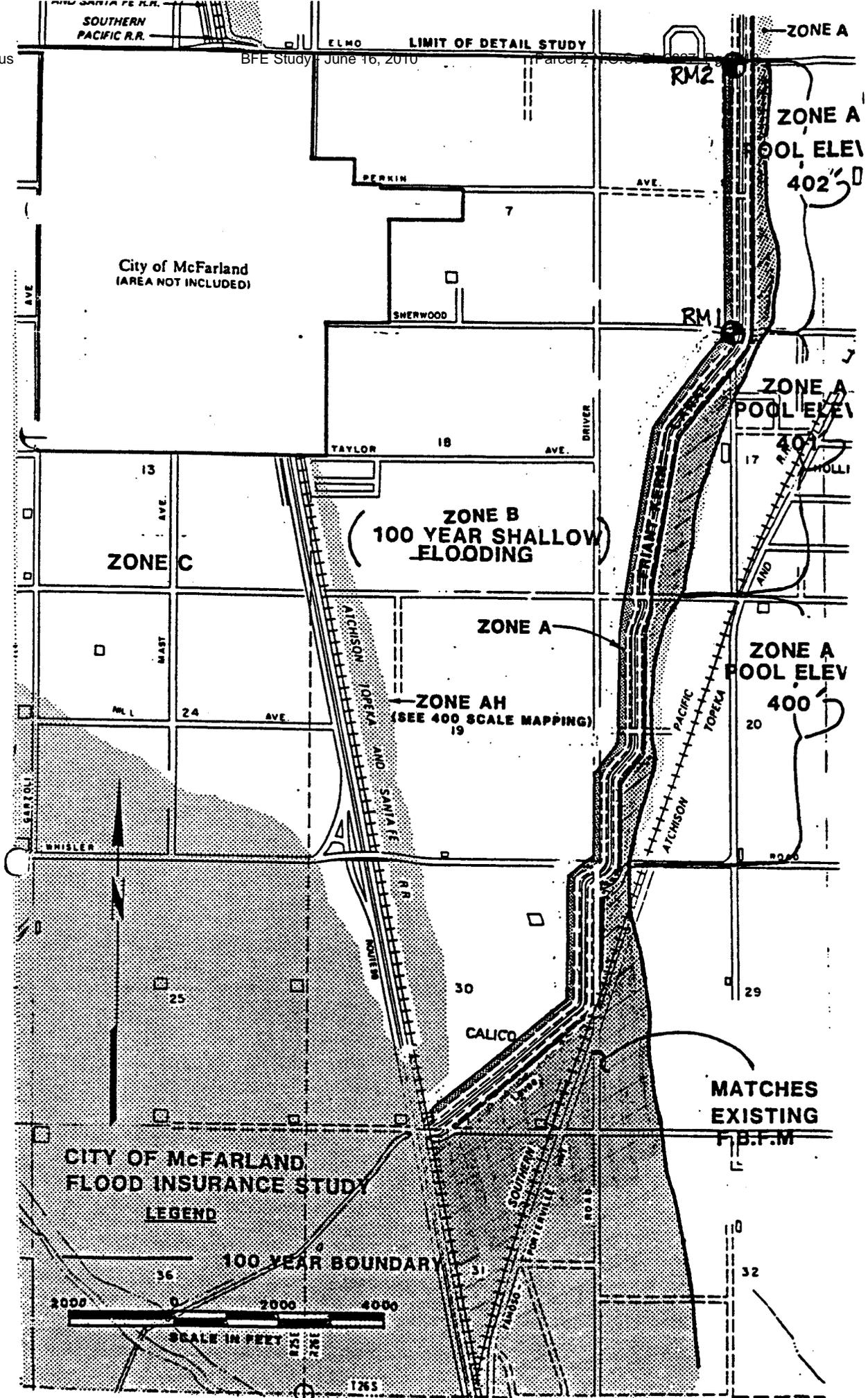
SD-F23-100-05

**B. Boise Engineering Corporation**  
consulting engineers / architects

**CITY OF MCFARLAND  
FLOOD INSURANCE STUDY**

**FIGURE**

**1**



Mr. Terry Paxton

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January 10, 1983

The calculated water surface elevations are higher than what would actually occur because the top of the bank was extended vertically to contain the flow for the routing analysis. With flow overtopping the banks, a more reasonable range of depths would be 0.5 to 2.0 feet. An estimate of the peak discharge flowing over the bank is 500 to 2000 cfs.

In accordance with FEMA guidelines, we request your comments on the methodology and results. If we do not hear from you by January 24, 1983, we will assume you agree with our results. If you have any questions, please call Don MacFarlane or me.

BOYLE ENGINEERING CORPORATION

*Gordon K. Lutes*  
Gordon K. Lutes, P.E.  
Senior Engineer

DLM/11g

SD-F23-100-05

cc: Ray Lenaburg, FEMA  
Ernie Kartinen, BEC

Enclosure: References

## REFERENCES

Boyle Engineering Corporation, 1979, Kern County Flood Insurance Study, Summary of Hydrologic Analysis, Bakersfield Flooding Sources.

Soil Conservation Service, 1965, Computer Program for Project Formulation - Hydrology, Technical Release No.20.

Soil Conservation Service, 1971, East McFarland Environmental Conservation Group Project.