2012P007

DRAINAGE REPORT
FOR
EASTMARK
MASTER PLANNED COMMUNITY
SIGNAL BUTTE CHANNEL CONNECTION TO THE POWERLINE FLOODWAY CHANNEL
City of Mesa, Arizona

Prepared:
February 7, 2012
April 26, 2012
July 17, 2012

Prepared for:

DMB Mesa Proving Grounds, LLC
7600 E. Doubletree Ranch Road, Suite 300
Scottsdale, Arizona 85258

Prepared by:

Hoskin Ryan Consultants, Inc.
6245 N. 24th Parkway, Suite 100
Phoenix, AZ 85016
602.252.8384

HRC 11-023-01

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FOR
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SIGNAL BUTTE CHANNEL CONNECTION
TO THE POWERLINE FLOODWAY CHANNEL

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REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
51491
PENG
ZHANG
Date Signed 07/17/12
ARIZONA, U.S.A.

EXPIRES 09/30/13

1.0 Introduction

Hoskin Ryan Consultants, Inc. (HRC) has been contracted by DMB Mesa Proving Grounds, LLC to prepare the final engineering for the first phase of the infrastructure for EASTMARK, a Master Planned Community. The proposed improvements include infrastructure roads that provide access to Development Unit 7 (DU7). Infrastructure roads include Ray Road, Signal Butte Road, Spine West and East Roads, and DU7 Drive.

The purpose of this Drainage Report submittal is to accompany the final design plans for the outfall of the Signal Butte Channel to the existing Powerline Floodway Channel (PFC). This report provides offsite hydrology, channel and culvert hydraulic calculations, and final design for the proposed improvements.

2.0 Location

The first phase of development is located north of Ray Road and south of Warner Road, between Ellsworth Road and Signal Butte Road. Eastmark Parkway, Kinnet Parkway and Everton Terrace are paved north/south roads that are accessed from Ray Road (Figure 1).

The proposed drainage outfall locations for the first phase of development include an outfall for the Signal Butte Channel and an outfall for the parcel and infrastructure improvements. The first phase of development outfalls west to the Ellsworth Road storm drain through a bleed-off storm drain system; whereas, the Signal Butte Channel outfalls to the PFC south of Ray Road, approximately 980 feet west of Signal Butte Road.

3.0 Site Description

3.1 Existing Drainage Features

An existing channel west of Signal Butte Road conveys offsite flow south to the existing Powerline Floodway Channel (PFC), located just south of the Ray Road alignment. The PFC, which provides an outfall for the upstream Powerline Flood Retarding Structure (PFRS), follows the alignment of Ray Road from Signal Butte Road to Ellsworth Road. The FRS is located approximately three miles east of the site.

The watershed areas east of Signal Butte Road and north of the PFC have been developed primarily into single family home subdivisions. Offsite drainage reaching the existing Signal Butte Channel is limited to flow from an existing channel and culvert which crosses Signal Butte Road approximately 4,680 feet north of Ray Road.

3.2 Proposed Development

EASTMARK is a mixed-use development consisting of single-family residential, multi-family residential, commercial mixed use, resort, golf, and open space. The first phase of development, DU7, encompasses approximately 202 acres. The Phase 1 Infrastructure improvements include the arterial streets of Ray Road and Signal Butte Road, the district streets of Eastmark Parkway and Kinnet Parkway, and the local street of Everton Terrace.

The drainage analysis and design of these infrastructure streets and their associated storm drainage systems, which include the drainage channel along the west side of Signal Butte Road, the retention basins for street runoff, and basin bleed pipes for the adjacent DU7 subdivision parcels, are addressed in the *Final Drainage Report for EASTMARK Master Planned Community, Phase 1 Infrastructure Improvements* (Ref. 1). Excerpts from Ref. 1, including an overall drainage map, are included in Appendix D.

The subdivisions north of Ray Road are designed to drain to internal retention basins while Ray Road, and the Phase 1 infrastructure streets, will drain to a series of retention basins along Ray Road via a storm drain system. The storm drain system along Ray Road will also provide an outfall for bleed-off for the subdivision retention basins. The bleed-off storm drain ultimately connects to a 60-inch storm drain in Ellsworth Road, discharging a maximum flow rate of 11.4 cfs. The design and analysis of the DU7 subdivisions and drainage systems are under design by others (Ref. 4).

3.3 Development Standards

The infrastructure will be developed in accordance with the current City of Mesa standards and the applicable standards of the Flood Control District of Maricopa County. Storm drainage standards are addressed in the *City of Mesa, Engineering and Design Standards Manual,* 2009 (Ref. 5), *Drainage Policies and Standards for Maricopa County, Arizona,* 2007 (Ref. 6), *Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology,* 2011 (Ref. 7) and *Drainage Design Manual for Maricopa County, Arizona, Volume 2 Hydraulics, 1996* (Ref. 8).

4.0 Offsite Drainage

4.1 Existing Condition

The *Master Drainage Report for Mesa Proving Grounds* (Ref. 2) *and the Master Drainage Report for Development Unit 7 at Mesa Proving Grounds* (Ref. 3) each provide guidance as to the offsite drainage impacts and proposed onsite drainage systems. These reports include hydrology models for pre, interim, and post- development conditions.

In the existing condition, a 100-year peak discharge of 419 cfs (Ref. 3) crosses Signal Butte Road, south of Warner Road, through an existing double-barrel 10-feet x 3-feet box culvert. After crossing Signal Butte Road, it then flows south and enters the PFC through an existing concrete rectangular channel. The rectangular channel connects to an existing one-barrel, 4.67-feet x 3.83-feet, box culvert which is adjacent to an existing one-barrel, 14-feet x 6.4-feet, box culvert within the PFC. Both culverts have a total length of 400 feet (Figures 2 and 3) and will be removed by this project.

4.2 Interim and Future Conditions

In the interim and future conditions, the offsite 100-year peak flow of 441 cfs will be conveyed south in a new channel located on the west side of Signal Butte Road to the existing PFC (Figure 3). This unlined trapezoidal channel will only convey offsite drainage, with the exception of one area located at the north end of this design phase.

At Ray Road, the flow will be conveyed through a proposed triple barrel, 8-feet x 4-feet box culvert and then outlet into a detention/sedimentation basin. The purpose of the detention/sediment basin is to collect sediment and to attenuate flow prior to its release into the PFC. The detention/sedimentation basin outfalls into the PFC through a concrete weir then a rectangular concrete side channel located approximately 980 feet west of Signal Butte Road (Figure 3). The rectangular concrete side channel ties into the PFC at an angle of 10 degrees to minimize the impact to the PFC flow.

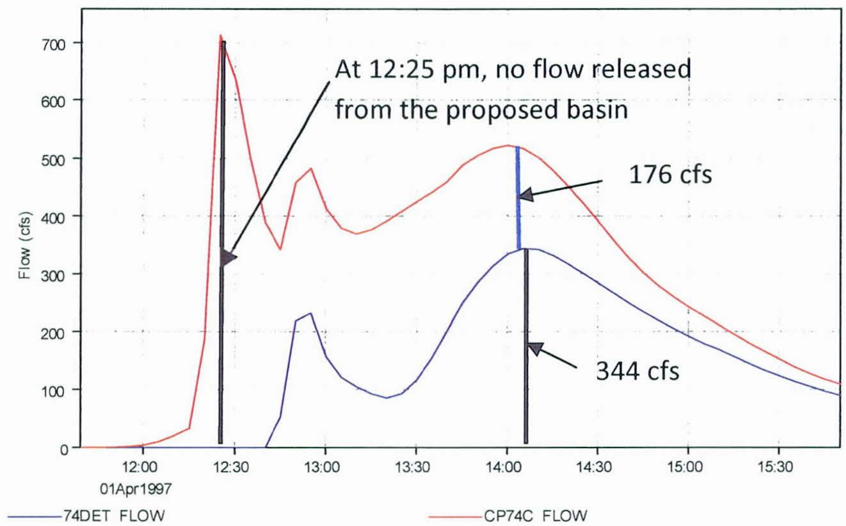
4.3 Offsite Hydrology

An interim post-development condition HEC-1 model was prepared for the developed condition after DU7 is constructed with residential, commercial and open space land uses. The retention volume for DU7 was calculated using the 100-year, 2-hour precipitation of 2.19 inches, which is based on NOAA Atlas 14 point precipitation frequency estimates (Ref. 9).

The impact of the proposed design on the peak flow within the PFC was analyzed using a post-development condition HEC-1 model (Appendix B) that is based on the interim condition HEC-1 model from Ref. 3. Changes were made to the model to include modifications to the Signal Butte Channel and the detention/sediment basin south of Ray Road.

A rating curve was established for the concrete weir structure at the detention/sediment basin. The concrete weir is a trapezoidal weir with a 60-feet wide crest at an elevation of 1433.0 feet. An 8-inch orifice at an elevation of 1431.8 feet is designed to drain the detention/sediment basin. Weir and orifice equations were used to obtain the rating curve. The spreadsheet is provided in Appendix A.

The model results indicate that flow from the Signal Butte Channel will be released into the PFC after the peak flow has passed. A hydrograph simulation (Graph 1) represents the effect of the basin on the PFC at various times. According to Graph 1, the peak flow in the PFC of 713 cfs occurs at 12:25 pm and passes through the box culvert prior to any contribution of flow from the proposed Signal Butte Channel and the detention/sediment basin. Therefore, the proposed design will not increase the peak discharge in the PFC. The HEC-1 model output is included in Appendix B.



Graph 1. Hydrograph Released from Detention/Sediment Basin (74DET) and Combined Hydrograph at the Powerline Floodway Channel

Note: 74DET is the Concentration Point immediately upstream of the PFC, 980 feet west of Signal Butte Road.

The 100-year peak discharge from the detention/sediment basin is 344 cfs, corresponding to a high water surface elevation of 1434.5 feet in the basin, 6 inches below the basin bank. Therefore, no flow will overtop the bank and all flow will be released through the outlet structure in a controlled manner.

According to the existing condition HEC-1 model provided in the *Master Drainage Report for Mesa Proving Grounds* (Ref. 2), the PFC collects excess runoff from EASTMARK and reaches a 100-year peak flow of 661 cfs at Ellsworth Road (CP75). The full build-out condition HEC-1 indicates that upon development of the entire EASTMARK development the 100-year peak flow of the PFC at Ellsworth Road will reduce from 661 cfs to 616 cfs.

The HEC-1 model results (Appendix B) indicate that the development of DU7 and the Phase 1 infrastructure (the interim condition) will reduce the 100-year peak flow of the PFC at Ellsworth Road from 661 cfs to 638 cfs, which will be further reduced to 616 cfs with future development. Therefore, the development of the Phase 1 infrastructure will not increase the peak discharge of the PFC at both Signal Butte Road and Ellsworth Road.

4.4 Offsite Hydraulics

4.4.1 PFC Existing Condition

The PFC slopes at 0.0035 ft/ft along the project site resulting generally in supercritical flows. However, under the existing condition, the 400-feet box culvert causes the flow to back up and create a hydraulic jump upstream of the culvert. The flow depth upstream of the box culvert could reach 6.88 feet for a 100-year peak flow of 713 cfs. This is above the concrete liner which is only 5.75 feet deep. To contain the water below the concrete liner, the maximum flow allowed is 530 cfs. The existing condition HEC-RAS model is included in Appendix C.

4.4.2 PFC Proposed Condition

Under the proposed condition, the 400-feet box culvert and 100-linear feet of the transition upstream/downstream of the box culvert will be removed and replaced with a 500-linear feet concrete lined trapezoidal channel. Most of the new channel (440 feet) will slope at 0.0014 ft/ft and the remaining 60-feet will slope at 0.0200 ft/ft. The potential hydraulic jumps caused by the confluence can be controlled at this 60-feet section.

A HEC-RAS model was created to analyze the hydraulic performance of the 500 linear feet channel (Appendix C). Three scenarios with three different discharges in the PFC were analyzed with the assumption that no flow from the side channel combines. These three discharges include the potential release of 600 cfs from the PFRS (Ref. 10), the 100-year peak of 713 cfs and the maximum capacity of the PFC. The results indicate that the PFC's capacity has significantly increased from 530 cfs to 950 cfs, and a minimum freeboard of 2-feet is provided for the 500-feet concrete channel for the 100-year event of 713 cfs.

4.4.3 Proposed Condition with Side Channel

The concrete side channel ties to the PFC immediately downstream of the 60-feet steep section at a 10-degree angle to combine the flow released from the detention/sediment basin. A peak flow of 344 cfs released from the basin will combine with the flow of 176 cfs in the PFC for a combined flow of 520 cfs (Graph 1). To illustrate the hydraulic performance of the junction, a HEC-RAS model was created (Appendix C). The results indicate that the flow regime at the junction structure is subcritical and the backwater effect extends upstream approximately 500 feet. The flow is completely contained below the concrete liner with a minimum freeboard of 2.71 feet and 1.55 feet for the new channel and existing channel, respectively.

5.0 Conclusions

1. All drainage design is in accordance with the approved *Master Drainage Report for Mesa Proving Grounds* and the *Master Drainage Report for Development Unit 7 at Mesa Proving Grounds,* prepared by Wood/Patel (Ref. 2 and Ref. 3).

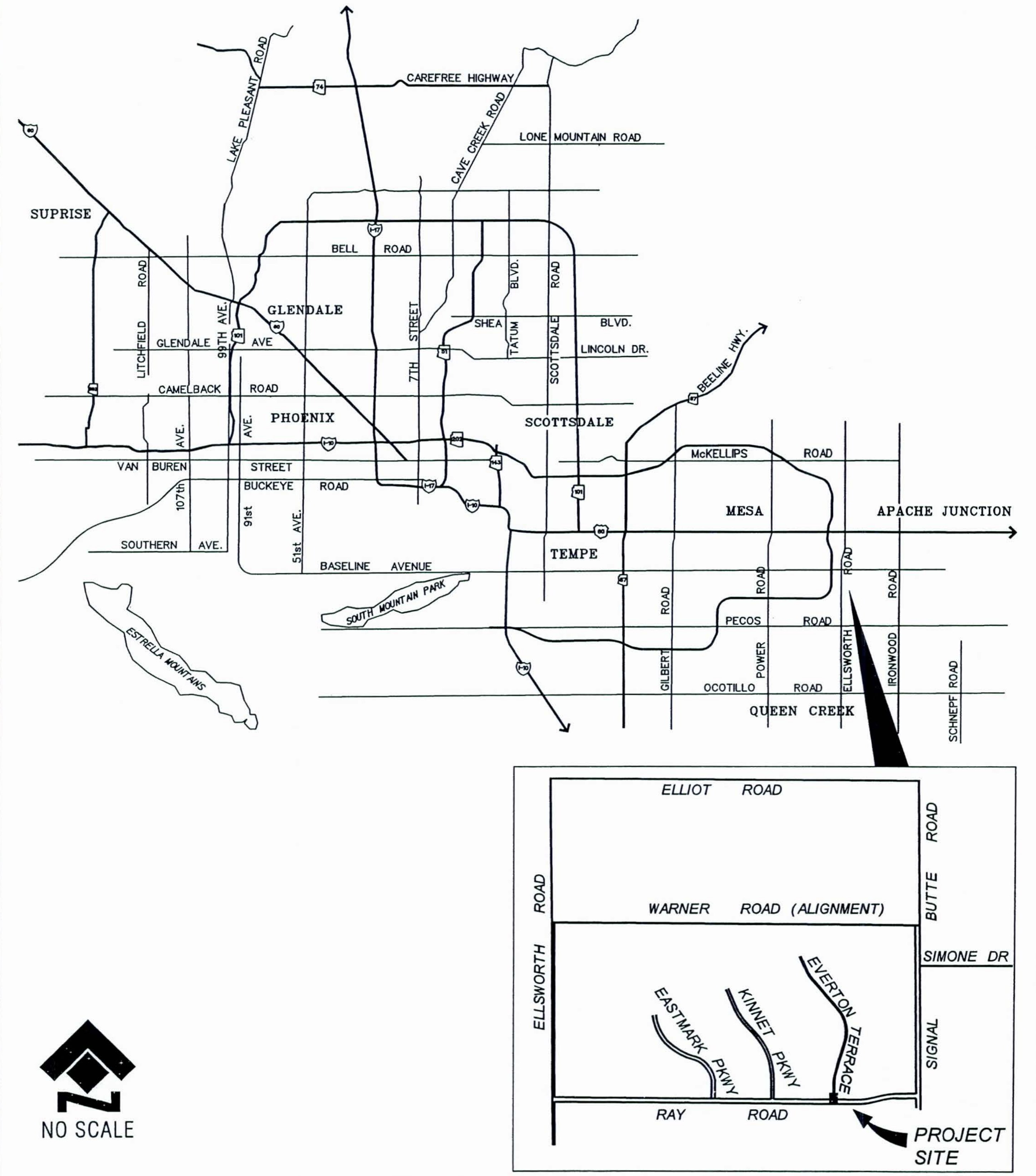
2. Offsite flow will be collected and routed around DU7, by a drainage channel along the west side of Signal Butte Road. The offsite flow is then routed through a detention/sediment basin and released into the Powerline Floodway Channel through a concrete weir structure with an 8-inch orifice. The existing 400 feet long box culverts and the transition section upstream and downstream of the box culvert will be removed and replaced with a 500-feet trapezoidal concrete channel.

3. With the removal of the box culvert and the improvement of new channel, the capacity of the PFC increases from 530 cfs to 950 cfs.

4. During the 100-year event, there are two peak discharges conveyed by the proposed 500-feet concrete channel. One is the peak discharge of 713 cfs from PFC upstream. This peak discharge will pass the confluence before any flow is released from the side channel. The flow is completely contained within the channel and a minimum freeboard of 2 feet is provided for the newly constructed channel. The other peak discharge of 520 cfs is a combination of the peak discharge of 344 cfs from the proposed detention/sediment basin and a flow of 176 cfs from the PFC upstream. The flow is completely contained within the PFC with a minimum freeboard of 2.71 feet and 1.55 feet for the new channel and existing channel, respectively.

6.0 References

1. Hoskin Ryan Consultant, inc., *Final Drainage Report for EASTMARK Master Planned Community, Phase 1 Infrastructure Improvements*, January 31, 2012.
2. Wood, Patel and Associates, Inc., *Master Drainage Report for Mesa Proving Grounds,* dated December 20, 2011.
3. Wood, Patel and Associates, Inc., *Master Drainage Report for Development Unit 7 at Mesa Proving Grounds,* dated September 29, 2011.
4. Entellus, *Preliminary Drainage Report for Mesa Proving Grounds DU7*, November, 2011.
5. City of Mesa, *Engineering and Design Standards Manual*, 2009.
6. Flood Control District of Maricopa County, *Drainage Standards and Policies Manual for Maricopa County, Arizona,* January 11, 2007.
7. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona - Volume I Hydrology,* February, 2011.
8. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona - Volume 2 Hydraulics,* January, 1996.
9. NOAA, *NOAA Atlas 14, Volume 1, Version 5*, retrieved from NOAA website on 11/4/2011.
10. Flood Control District of Maricopa County, *East Mesa Area Drainage Master Plan Update, Hydrologic Analysis,* 9/30/2011.



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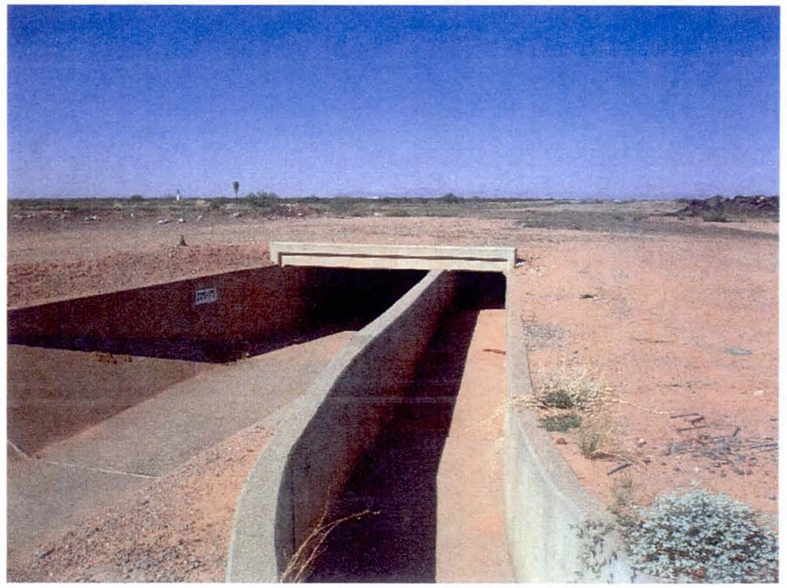
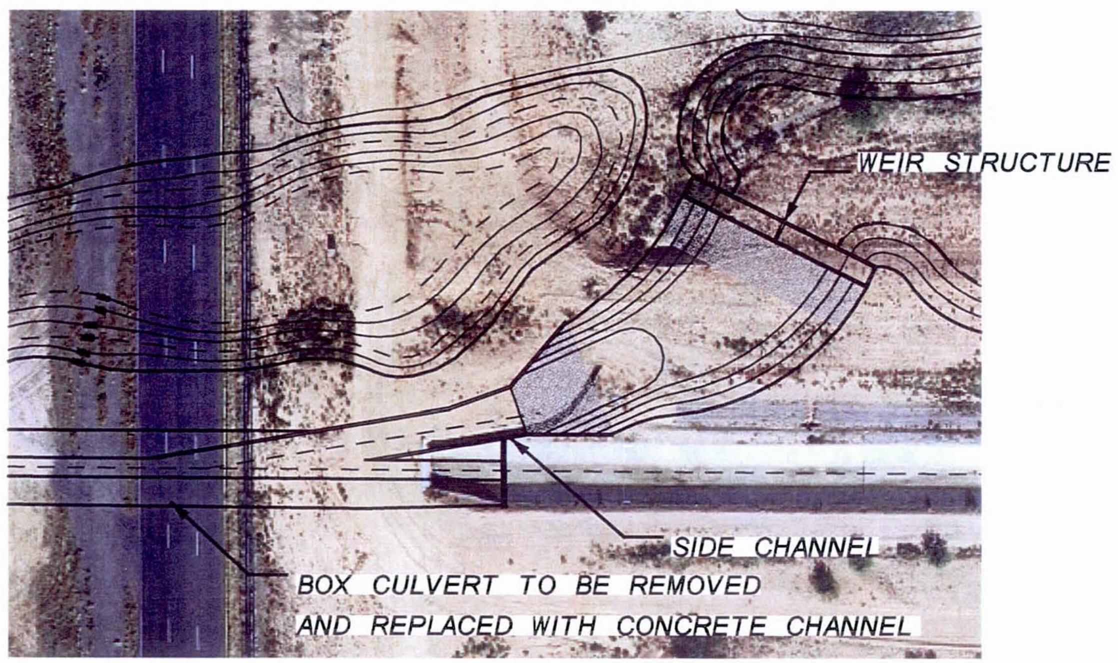
EASTMARK
LOCATION AND VICINITY MAP

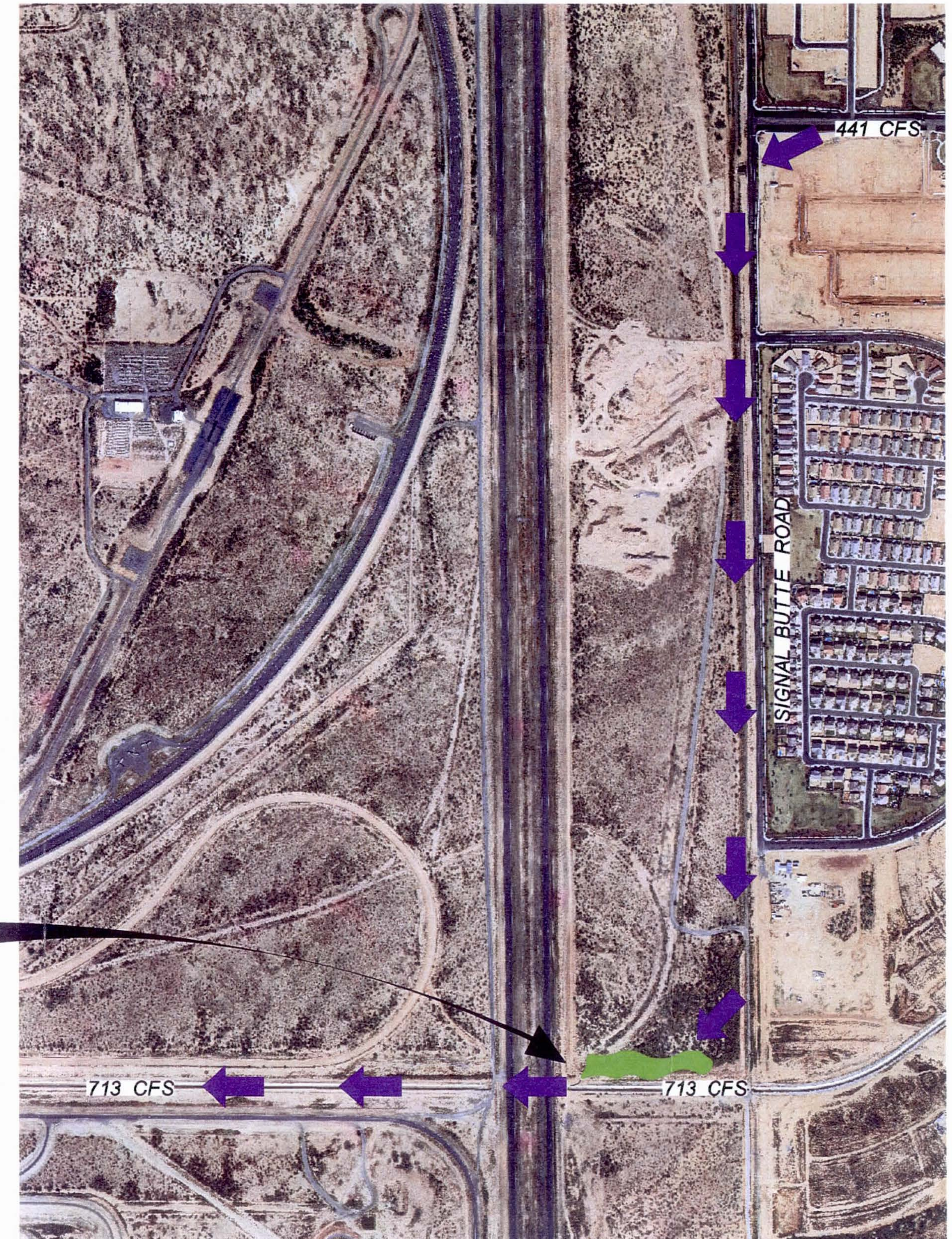
FIGURE 1



EXISTING OUTLET STRUCTURE (LOOKING WEST)
BOX CULVERT TO BE REMOVED AND REPLACED
WITH A TRAPEZOIDAL CONCRETE CHANNEL



PROPOSED OUTLET STRUCTURE
WEIR STRUCTURE AND SPILLWAY
TIE-INTO CONCRETE CHANNEL AT AN ANGLE OF 10 DEGREE



SCALE: 1"= 800 '

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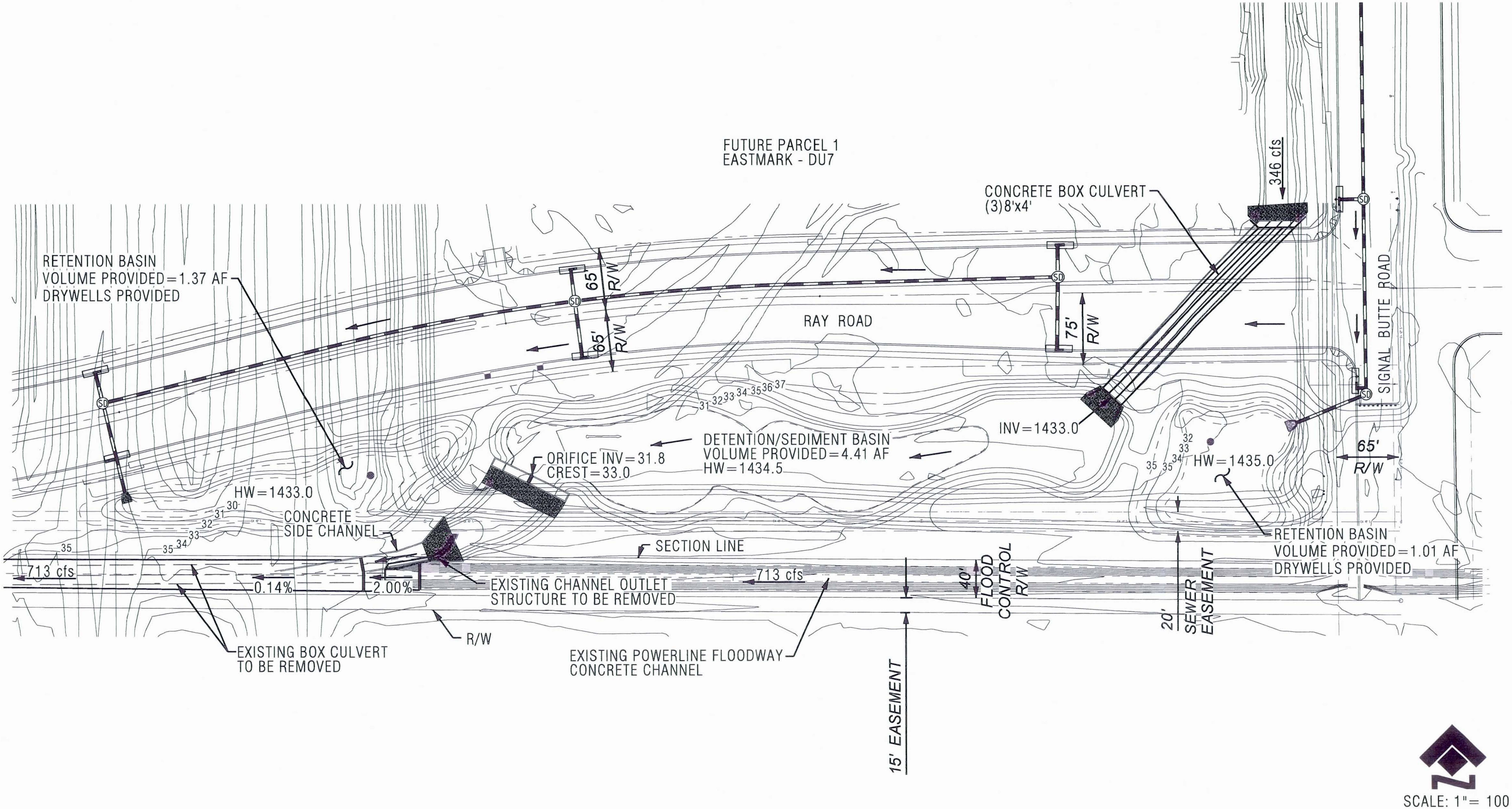
LEGEND

- OFF-SITE FLOW
- PROPOSED DETENTION/SEDIMENT BASIN

EASTMARK
OFF-SITE DRAINAGE

FIGURE 2



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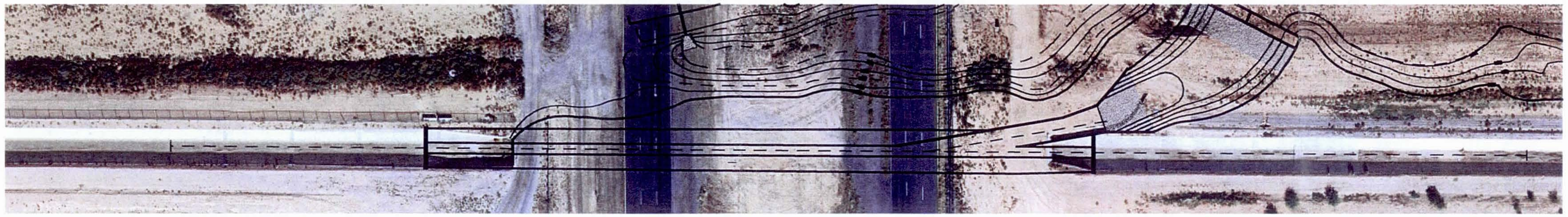
LEGEND

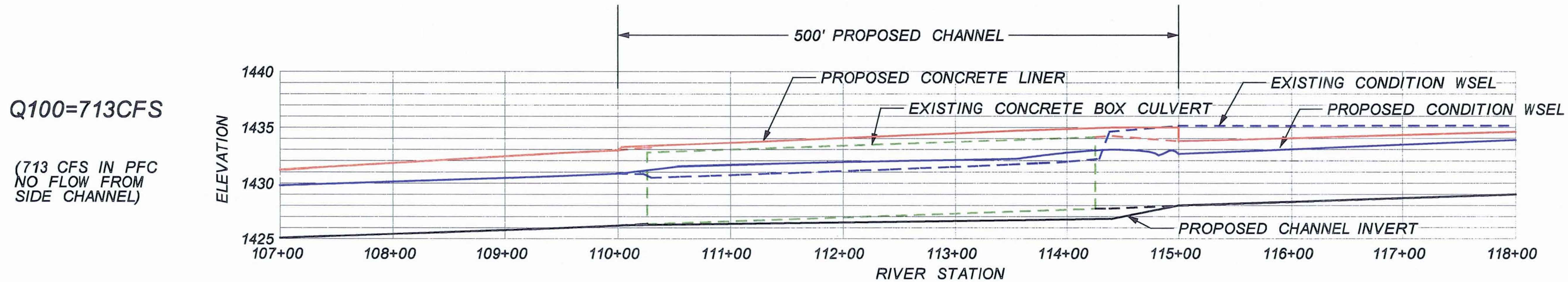
- ● DRYWELL
- EXISTIN CONTOUR
- —32— PROPOSED CONTOUR
- FLOW DIRECTION
- PROPOSED STORM DRAIN
- PROPOSED CATCH BASIN
- (SD) PROPOSED STORM DRAIN MANHOLE

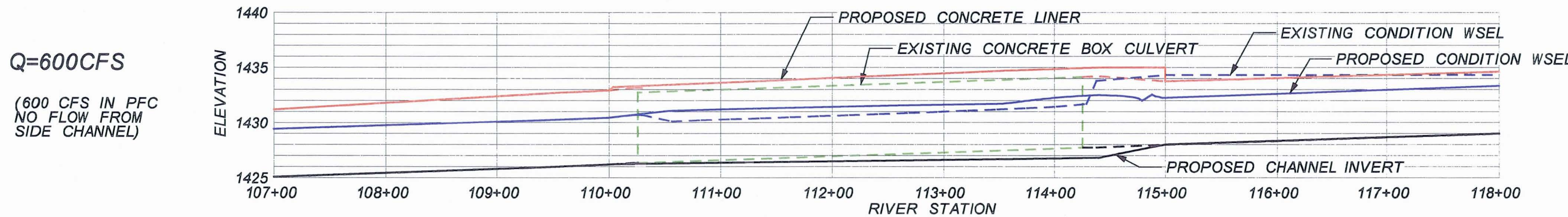
EASTMARK

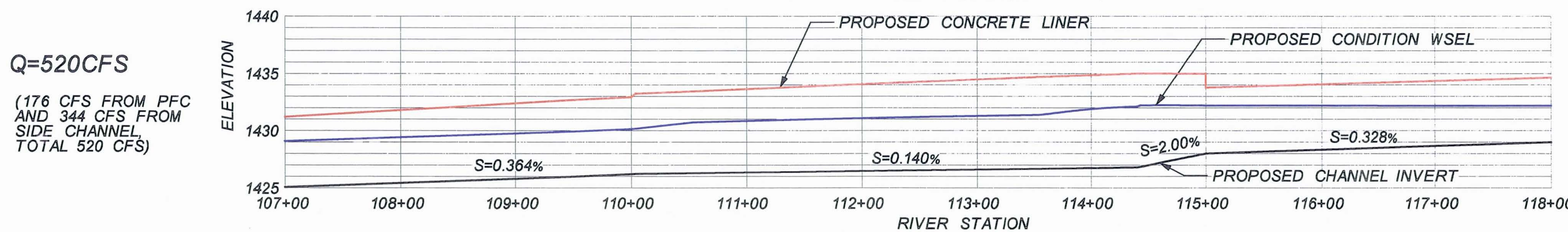
SIGNAL BUTTE CHANNEL CONNECTION TO THE POWERLINE FLOODWAY CHANNEL

FIGURE 3









N

SCALE: 1"= 100'

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LEGEND

EASTMARK

PFC WSEL PROFILE

FIGURE 4

Appendix A

Rating Curve for Detention/Sediment Basin

EASTMARK
Off-Site Detention Basin Rating Curve

Ratiing Curve for Detention Basin

Elevation (ft)	Storage * (AF)	Orifice Discharge ** (cfs)	Weir Discharge *** (cfs)	Total Discharge (cfs)
1431.8	0	0	0	0
1432	0.16	0.3	0	0.3
1433	1.23	1.57	0	1.57
1434	2.61	2.30	180	182
1435	4.22	2.85	509	512

* See Detention Basin Storage
** See Orifice Stage-Discharge Relationship
*** See Weir Stage-Discharge Relationship

Detention Basin Storage

Elevation	Area (sq. ft.)	Area (Ac.)	Volume Provided (AF)	Accumulate Volume (AF)
31.8	34065	0.78		
32.0	37078	0.85	0.16	0.16
33.0	56124	1.29	1.06	1.23
34.0	64937	1.49	1.39	2.61
35.0	75279	1.73	1.61	4.22

Weir Stage-Discharge Relationship

60' outlet weir

Q=CLH^1.5=3x60xH^1.5

Elevation	Discharge (cfs)
31.8	0
32	0
33	0
34	180
35	509

Orifice Stage-Discharge Relationship

8" orifice

Q=CA(2gH)^0.5=0.6x0.35x(64H)^0.5

Elevation	Discharge (cfs)
31.8	0
32	0.3
33	1.57
34	2.30
35	2.85

Appendix B

HEC-1 Output

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*           VERSION 4.1                 *
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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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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

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1                                   HEC-1 INPUT                                          PAGE  1

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ID        20 WERE UPDATED TO REFLECT THE INCORPORATION OF THE FIRST SOLAR SITE
ID        IN THE NORTHEAST CORNER OF DU-6.  WATERSHED 02 WAS SPLIT INTO 02A AND
ID        02B.  LAND USE WAS CHANGED TO INDUSTRIAL FOR 02B AND ENTIRELEY
ID        RESIDENTIAL FOR 02A.
ID        THE FIRST SOLAR SITE RUNOFF WILL NOW BE RETAINED ENTIRELY ONSITE.
ID
ID        MODEL REVISED BY:
ID        WOOD, PATEL & ASSOCIATES, INC.
ID        STEPHEN M. SCINTO, P.E.
ID
ID        FILE PATH:
ID        R:\MESA PROVING GROUNDS\2010\103564.04\PROJECT SUPPORT\REPORTS\
ID        DRAINAGE\HYDROLOGY\POST-DEVELOPED 100YR2HR RETENTION MODEL\
ID        MPG20RT2.DAT
ID
ID   ****************************************************************************
ID
ID        FILE: MPG20RT2.DAT
```



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

ID
ID        MODEL REVISED: 09-16-08
ID
ID        PROJECT: MESA PROVING GROUNDS
ID
ID        THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE
ID        BELOW.  REFERENCING WS2-NEM.DSS IS STILL REQUIRED.
ID
ID        THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING
ID        THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED
ID        BY SWABACK PARTNERS ON 12/12/07.
ID
ID        MODEL REVISION DESCRIPTION:
ID
ID        THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL
ID        DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT).  ONSITE WATERSHEDS 01, 02,
ID        03, AND 06 WERE UPDATED TO REFLECT THE CURRENT GOLF COURSE
ID        CONFIGURATION.
ID
ID        MODEL REVISED BY:
ID        WOOD, PATEL & ASSOCIATES, INC.
ID        DANIEL W. MATTHEWS, E.I.T.
ID
ID        FILE PATH:
ID        R:\MESA PROVING GROUNDS\2006\062753\PROJECT SUPPORT\HYDRO\MDR-20-15 LAND
ID        PLAN\2ND SUBMITTAL(COM)\HYDROLOGY\MPG20RT2.DAT
ID
ID   ****************************************************************************
ID
ID        FILE: MPG20RT2.DAT
ID
ID        MODEL REVISED: 05-15-08
ID
ID        PROJECT: MESA PROVING GROUNDS
ID
ID        MODEL REVISION DESCRIPTION:
ID
ID        THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE
ID        BELOW.  REFERENCING WS2-NEM.DSS IS STILL REQUIRED.
ID
ID
ID        THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING
ID        THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED
ID        BY SWABACK PARTNERS ON 12/12/07.
ID
ID
ID        THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL
ID        DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT).  WATERSHED 79A WAS UPDATED
ID        AS REQUESTED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY TO REDUCE THE
ID        PERCENT IMPERVIOUS VALUE FROM 80% TO 0% TO MATCH THE LAND USE AS MODELED
ID        WITHIN THE EAST MESA ADMP.
ID
ID        MODEL REVISED BY:
ID        WOOD, PATEL & ASSOCIATES, INC.
ID        DANIEL W. MATTHEWS, E.I.T.
```

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

          ID
          ID        FILE PATH:
          ID        R:\MESA PROVING GROUNDS\2006\062753\PROJECT SUPPORT\HYDRO\MDR-20-15 LAND
          ID        PLAN\2ND SUBMITTAL\POST-DEVELOPED 100YR2HR RETENTION MODEL (MPG20RT2)\
          ID        MPG20RT2.DAT
          ID
          ID   *****************************************************************************
          ID
          ID        FILE: MPG20RT2.DAT
          ID
          ID        MODEL REVISED: 01-08-08
          ID
          ID        PROJECT: MESA PROVING GROUNDS
          ID
          ID        MODEL REVISION DESCRIPTION:
          ID
          ID        THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE
          ID        BELOW.  REFERENCING WS2-NEM.DSS IS STILL REQUIRED.
          ID
          ID
          ID        THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING
          ID        THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED
          ID        BY SWABACK PARTNERS ON 12/12/07.
          ID
          ID
          ID        THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL
          ID        DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT).  WATERSHEDS 68A, 68B,
          ID        70A, 70B, 71, 73B, 73C, 74B, 74C, 75, 77B, 77C, 78B, 78C, AND 79A
          ID        HAVE ALL BEEN UPDATED TO REFLECT CURRENT WATERSHED DELINEATIONS,
          ID        NEW DEVELOPMENT, CURRENT RETENTION,AND FLOOD ROUTING.  BASIN 75
          ID        HAS BEEN UPDATED TO REFLECT PLANNED DEVELOPEMENT FOR THE MESA
          ID        PROVING GROUNDS SITE.
          ID
          ID        MODEL REVISED BY:
          ID        WOOD, PATEL & ASSOCIATES, INC.
          ID        DANIEL W. MATTHEWS, E.I.T.
          ID
          ID        FILE PATH:
          ID        R:\MESA PROVING GROUNDS\2006\062753\PROJECT SUPPORT\HYDRO\MDR-20-15 LAND
          ID        PLAN\HYDROLOGY\POST-DEVELOPED 100YR2HR RETENTION MODEL (MPG20RT2)\
          ID        MPG20RT2.DAT
          ID
          ID   *****************************************************************************
          ID
          ID
          ID    ID  Kirkham Michael:
          ID    Last Revised Date:  1/22/03
          ID    Filename:  WS4-SEM.DAT
          ID
          ID    Comments Dated 1/22/03 (CJ)
          ID
          ID    This model should be used ONLY for the Rittenhouse and Chandler Heights
          ID    Basin Design Project - Final Design Analyses.
          ID
          ID    This model is one of several models that represent the EMF watershed.
```



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

          ID    This model covers the Southeast Mesa Area and should reference as a DSS
          ID    the watershed model for the Northeast Mesa Area (Filename WS2-NEM.DAT).
          ID
          ID    This model is necessary to determine the input hydrographs for the
          ID    Rittenhouse Basin Design HEC-RAS Unsteady State analysis.  To develop
          ID    the necessary input hydrographs the following models should be run in order.
          ID    Because the files utilize a TAPE21 file to export import hydrographs
          ID    between models, prior to running the FIRST model (WS1-NWM.DAT) any existing
          ID    TAPE21 file in the directory should be deleted.  The run procedure order is:
          ID
          ID        1)  WS1-NWM.DAT
          ID        2)  WS2-NEM.DAT
          ID        3)  WS3-QCSW.DAT
          ID        4)  WS4-SEM.DAT (referencing WS2-NEM.DSS for the DSS file)
          ID        5)  RT1-BASE.DAT
          ID
          ID    The necessary input hydrographs for the Rittenhouse Basin analysis
          ID    are determined in RT1-BASE.  In that output file, the hydrograph at
          ID    RWFLD1 should be exported and used as the input hydrograph at the
          ID    EMF Reach 4 Cross Section 17.082.  And the hydrograph at RITTEN should
          ID    be exported and used as the input hydrograph for the Rittenhouse Main
          ID    Channel at Cross Section 820.00
          ID
          ID
          ID    ******************************************************************************
          ID    **** NOTE BY PRIMATECH ENGINEERS:                                         ****
          ID    **** DATE: 06/12/2001                                                     ****
          ID    **** THE NEW FILE NAME IS: SEBTALT2.DAT                                   ****
          ID    **** THE FILE WAS RENAMED AS <<RTBTALT2.DAT>> FOR THE EAST MARICOPA       ****
          ID    **** FLOODWAY CAPACITY MITIGATION PROJECT, BY FLOOD CONTROL DISTRICT OF   ****
          ID    **** MARICOPA COUNTY.                                                     ****
          ID    **** THE FILE WAS RENAMED <<RTBTALT3.DAT>> AND UPDATED USING GREEN AND    ****
          ID    **** AMPT FUTURE CONDITIONS FOR BASINS 258 TO 268.                        ****
          ID    ******************************************************************************
          ID
          ID
          ID
          ID
          ID     THIS MODEL WAS ORIGINALLY MIDDOUT.DAT
          ID     IT HAS BEEN MODIFIED BY CPE (7/2000)
          ID     FOR ALTERNATIVE 2 FOR THE EAST MARICOPA FLOOWAY
          ID     CAPACITY MITIGATION AND MULTI-USE CORRIDOR STUDY
          ID     TO ROUTE BOTH THE POWERLINE FLOOWAY
          ID     AND THE SANTAN FREEWAY CHANNEL INTO THE RAY BASIN PRIOR THEIR OUTFALL
          ID     INTO THE EMF
```

```
ID
ID  ********************************************************************
ID
ID        Model files changed by Collins/Pina Engineering
ID        to reflect multi-use design concepts (recreation
ID        and environment) proposed throughout the entire
ID        EMF Corridor.    July 2000
ID
ID
ID    VERSION 8.06  CPE 7/31/00
ID
1                                  HEC-1 INPUT                                        PAGE  6

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

ID  ********************************************************************************
ID
ID
ID  ********************************************************************************
ID   FILENAME: MIDDOUT.DAT
ID
ID   ALL CIP INFRASTRUCTURE IS IN PLACE, FUTURE CONDITIONS LANDUSE IS IN PLACE
ID   FLOW IS ROUTED UP ELLSWORTH ROAD IN A EARTH LINED CHANNEL
ID
ID  ********************************************************************************
ID   PRODUCED BY DIBBLE AND ASSOCIATES AND HOSKIN ENGINEERING CONSULTANTS.
ID   File Name: Final8.Dat
ID   Revised - Jan. 2000 by SZ (Wood/Patel) From Final7.dat - new Z-V & Sideweir
ID   Revised - Jan. 2000 by SZ (Wood/Patel) from Final6.dat - 60% review comments
ID   Revised - Dec. 1999 by SZ (Wood/Patel) from Final5.dat
ID   Revised - Dec. 1999 by SZ (Wood/Patel) from Final4.dat
ID   Revised - Nov. 1999 by SZ (Wood/Patel) from Final3.dat
ID   Revised - June 1999 by SZ (Wood/Patel) for Final Model from Opt1.dat.
ID   Revised - May 1999 by SZ (Wood/Patel) for Option 1, Based on Model SDIB.DAT
ID   REVISED - MAY, 1999 BY VAS TO INCORPORATE INCREASE OF SUBBASIN RETENTION AND
ID               REVISIONS TO THE REGIONAL DETENTION BASIN STORAGE
ID   REVISED - FEB, 1999 BY VALERIE SWICK, FCD OF MARICOPA COUNTY
ID   REVISED - MAY, 1998 BY D&A
ID
ID   REVISED BY VALERIE SWICK, FEB. 26, 1998
ID
ID   FLOWS FROM DETENTION BASIN LOCATED AT NE CORNER OF ELLIOT AND ELLSWORTH ROADS
ID   IS ROUTED TO THE SOUTHWEST BY SIPHON DRAW TO SUBBASIN 70A. FROM THERE THEY
ID   WILL BE ROUTED BY A CHANNEL TO THE EMF. FLOWS FROM SUBBASINS ADJACENT TO
ID   SANTAN FREEWAY ALIGNMENT WILL BE ROUTED SOUTH TO SUBBASIN 70A WHERE THEY WILL
ID   BE COMBINED WITH FLOW IN SIPHON DRAW.
ID
ID   EAST MESA AREA DRAINAGE MASTER PLAN
ID   AREA SOUTH OF SUPERSTITION (U.S. HWY 60)
ID   AUGUST 1997
ID   SOUTHEAST MESA HIGH RESOLUTION MODEL
ID
ID   ***********FUTURE CONDITION MODEL OF THE WATERSHED*************************
ID
ID  ************ATTENTION*********************************************************
ID    SUBBASINS 75, 79A, 79B, 78E,  LANDUSES WERE NOT
ID    CHANGED BECAUSE IT WAS FELT THAT THEIR FUTURE CONDITIONS LANDUSES WOULD BE
ID    SIMILAR TO THE EXISTING CONDITIONS LANDUSES.
ID    RETENTION VOLUMES WILL ALSO NOT BE UTILIZED FOR SUBBASINS 75, 79A, 79B, 78E
ID    SOME QUEEN CREEK SUBBASINS WILL ALSO NOT HAVE RETENTION VOLUMES, EITHER
ID    BECAUSE THEY LIE IN PINAL COUNTY AND WE DONT KNOW PINAL COUNTIES PLANS OR
ID    THEY LIE IN THE SANTAN MOUNTAINS AND WON'T GET DEVELOPED
ID    WILLIAMS GATEWAY AIRPORT (SUBBASINS 80A, 80B, 81A, AND 81B) ARE MODELED AS
ID    FUTURE CONDITIONS AND HAVE RETENTION VOLUMES FOR THE 100YR 2HR STORM
ID  ********************************************************************************
ID   FILENAME:  SDIBB.DAT
ID
ID   THIS MODEL REPRESENTS THE FUTURE CONDITION OF THE WATERSHED.
ID   TOTAL DRAINAGE AREA IS APPROXIMATELY 213 SQ. MI.
ID   THIS MODEL USES A Kn VALUE OF 0.09 FOR DESERT LAND USE DUE TO SHEET FLOW
1                                  HEC-1 INPUT                                        PAGE  7

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

ID   CONDITIONS.
ID
ID   100-YEAR 24-HOUR FREQUENCY
ID   AREAL REDUCTIONS FROM FCD HYDROLOGY MANUAL
ID   THIS MODEL INCLUDES INFLOW FROM NORTH OF THE SUPERSTITION FREEWAY
ID   AND EAST OF THE CAP
ID
ID   DATA FROM THE QUEEN CREEK ADMS HAS BEEN ADDED TO CALCULATE FLOWS INTO THE
ID   EMF.   MUSKINGUM ROUTING NSTEPS WERE ADJUSTED TO BE WITHIN THE SUGGESTED
ID   RANGE.
ID
ID   METHODOLOGY
ID   THE US CORPS OF ENGINEERS FLOOD HYDROLOGY MODEL HEC-1 DATED SEP1990 VER 4.0
ID   SCS TYPE II RAINFALL DISTRIBUTION
ID   S-GRAPH HYDROGRAPH
ID   GREEN AND AMPT INFILTRATION EQUATION USED FOR CALCULATING LOSSES
ID   NORMAL DEPTH STORAGE CHANNEL ROUTING
ID   APPROXIMATE DIRECTION, LOCATION, AND LENGTH OF THE WASHES HAVE BEEN
ID   EVALUATED BASED ON FIELD INVESTIGATION, USGS MAPS, LANDIS AERIAL SURVEYS
ID   DATED 1994
ID   THE NOAA TECHNICAL MEMORANDUM NOAA ATLAS 2 DEPTH AREA RATIOS
ID
ID   ORIGINAL STUDY PERFORMED BY LISA C. YOUNG AND AFSHIN AHOURAIYAN, UPDATED BY
ID   DAVID DEGERNESS (OCT-DEC, 1996). REVIEWED BY VALERIE A. SWICK
ID   AND AMIR MOTAMEDI OF THE FLOOD CONTROL DISTRICT
ID   HYDROLOGY BRANCH ENGINEERING DIVISION, FLOOD CONTROL
ID   DISTRICT OF MARICOPA COUNTY, DECEMBER - JULY 1995.
ID
ID   ASSUMED VELOCITY OF 1 FT/SEC FOR SHEET FLOW, 2-3 FT/SEC FOR WASH/NATURAL
ID   CHANNEL, 3 FT/SEC FOR ROAD AND GRASS CHANNEL, 10FT/SEC FOR CONCRETE CHANNEL
ID
ID   VELOCITIES FOR ADMP IMPROVEMENT CHANNELS FROM DIBBLE AND ASSOCIATES
```

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363          ID   SUGGESTED ALTERNATIVES (JULY 1, 1997)
364          ID
365          ID   ***************************************************************************
366          ID   **** THE FOLLOWING NOTE WAS ADDED BY PRIMATECH ENGINEERS ON 06-12-2001 ****
367          ID   ***************************************************************************
368          ID   NOTE: MUST USE NEBUILD.DSS AS THE DSS FILE TO IMPORT FLOWS ACROSS THE
369          ID         SUPERSTITION FREEWAY.
370          ID   ***************************************************************************
371          ID
372          ID
373          ID   NOTE: MUST USE NDIBF.DSS AS THE DSS FILE TO IMPORT FLOWS ACROSS THE
374          ID         SUPERSTITION FREEWAY.
375          ID
376          ID   DDM MCUHP2 SE MESA ADMP - SOUTH OF SUPERSTITION FWY, FUTURE CONDITIONS
             *DIAGRAM
377          IT        5  1APR97     0000     600
378          IO        5
379          IN       15
380          JD     3.60     0.01
381          PC     .000     .002     .005     .008     .011     .014     .017     .020     .023     .026
382          PC     .029     .032     .035     .038     .041     .044     .048     .052     .056     .060
383          PC     .064     .068     .072     .076     .080     .085     .090     .095     .100     .105
384          PC     .110     .115     .120     .126     .133     .140     .147     .155     .163     .172
```



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

385          PC     .181     .191     .203     .218     .236     .257     .283     .387     .663     .707
386          PC     .735     .758     .776     .791     .804     .815     .825     .834     .842     .849
387          PC     .856     .863     .869     .875     .881     .887     .893     .898     .903     .908
388          PC     .913     .918     .922     .926     .930     .934     .938     .942     .946     .950
389          PC     .953     .956     .959     .962     .965     .968     .971     .974     .977     .980
390          PC     .983     .986     .989     .992     .995     .998    1.000
391          JD     3.58      1.0
392          JD     3.49      5.0
393          JD     3.38     10.0
394          JD     3.24     30.0
395          JD     3.10     60.0
396          JD     3.05     90.0
397          JD     3.00    120.0
398          JD     2.97    150.0
             * ****************************************************************************
             *


399          KK      73A
400          KM    BASIN 73A
401          KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
402          KM     L=       2.3  Lca=       1.0   S=    34.9  Kn= .093   LAG=  94.5
403          KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
404          BA      .95
405          LG      .35      .36     5.00      .27      .00
406          UI      34.      34.      34.      34.      84.     117.     134.     158.     171.     185.
407          UI     197.     214.     232.     254.     274.     317.     381.     429.     424.     369.
408          UI     332.     303.     282.     263.     240.     220.     202.     185.     169.     157.
409          UI     134.     107.      90.      60.      60.      57.      55.      54.      34.      34.
410          UI      34.      34.      16.      10.      10.      10.      10.      10.      10.      10.
411          UI      10.      10.      10.      10.      10.      10.       0.       0.       0.       0.
412          UI       0.       0.       0.       0.       0.       0.       0.       0.       0.       0.
             *
             *


413          KK     73ATB    ROUTE
414          KM     ROUTE FLOW FROM BASIN 73A THROUGH THE MOUNTAIN HEIGHTS DEVELOPEMENT FROM
415          KM     MERIDIAN ROAD TO MOUNTAIN ROAD.
416          RS        2     FLOW       -1
417          RC    0.045    0.040    0.045     2830   0.0050     0.00
418          RX     0.00     5.00    10.00    20.00   120.00   130.00   135.00   140.00
419          RY     4.00     3.00     2.50     0.00     0.00     2.50     3.00     4.00
             *
             *


420          KK      73B    BASIN
421          KM     BASIN 73B
422          KM      THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
423          KM      L=0.56  Lca=0.28  S=30.4  Kn=0.040  LAG=14.9
424          KM      PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
425          BA    0.425
426          LG     0.25     0.25     5.40     0.27       30
427          UI      169      530      973      829      481      180       73       30        0        0
428          UI        0        0        0        0        0        0        0        0        0        0
             *
             *
```



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

429          KK   RET73B  DIVERT
430          KM    RETAIN 80% OF THE 100 YR 2 HR RUNOFF VOLUME
431          DT   73BRET     39.5      0.0
432          DI        0    10000
433          DQ        0    10000
             *
             *


434          KK    CP73B COMBINE
435          KM    COMBINE HYDROGRAPHS 73ATB AND BASIN 73B
436          HC        2
             *
             *


437          KK    73BTC    ROUTE
438          KM    ROUTE FLOW THROUGH THE NOVA VISTA DEVELOPEMENT FROM MOUNTAIN ROAD TO
439          KM    SIGNAL BUTTE ROAD.
440          RS        4     FLOW       -1
441          RC    0.045    0.040    0.045     4500   0.0050     0.00
```

```
442    RX    0.00    5.00   10.00   22.00  122.00  134.00  139.00  144.00
443    RY    4.00    3.50    3.00    0.00    0.00    3.00    3.50    4.00
       *
       *

444    KK     73C   BASIN
445    KM    BASIN 73C
446    KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
447    KM     L=1.33  Lca=0.30  S=22.6  Kn=0.040  LAG=22.5
448    KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
449    BA    0.585
450    LG     0.25     0.25    5.40    0.27      30
451    UI       88      344     512     764    1019     695     488     287     149      88
452    UI       31       27      26       0       0       0       0       0       0       0
453    UI        0        0       0       0       0       0       0       0       0       0
       *
       *

454    KK   RET73C  DIVERT
455    KM    RETAIN 80% OF THE 100 YR 2 HR RUNOFF VOLUME
456    DT   73CRET    37.2     0.0
457    DI        0   10000
458    DQ        0   10000
       *
       *

459    KK    CP73C COMBINE
460    KM    COMBINE HYDROGRAPHS 73BTC AND BASIN 73C
461    ZW    A=MPG B=CP73C C=FLOW
462    HC        2
       *
       *  *************UPDATED CHANNEL SECTION*****************************************
       *  ******************DWM 09/07/2011********************************************
       *  6:1 SS EAST BANK, 3:1 SS WEST BANK, 38FT BOTTOM, 3.5 FT DEEP
       *
       * KK73T74C    ROUTE
       * KM ROUTE FLOW SOUTH ALONG THE WEST SIDE OF SIGNAL BUTTE ROAD IN AN
       * KM ENGINEERED CHANNEL FROM WARNER ROAD TO THE POWERLINE FLOODWAY.
       * RS    20      FLOW      -1
       * RC 0.032    0.032    0.032    4370    .0024
       * RX    0        5       10       31       69     79.5     84.5     89.5
       * RY   3.5      3.5      3.5       0        0      3.5      3.5      3.5
       *
       * ****************************************************************************
       *
       * ****************************************************************************
       * ****************************************************************************
       * UPDATED BY HOSKIN RYAN CONSULTANTS TO REFLECT CHANNEL/BASIN DESIGN 01/16/2012
       * CHANNEL GEOMETRY VARIES, A NARROW SECTION OF 16FT BOTTOM 4:1 SS IS USED
       * ****************************************************************************
       *
1                                  HEC-1 INPUT                                          PAGE 10

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

463    KK   73T74C    ROUTE
464    KM    ROUTE FLOW SOUTH ALONG THE WEST SIDE OF SIGNAL BUTTE ROAD IN AN
465    KM    ENGINEERED CHANNEL FROM WARNER ROAD TO THE POWERLINE FLOODWAY.
466    ZW    A=MPG B=73T74C C=FLOW
467    RS       20     FLOW      -1
468    RC    0.032    0.032   0.032    4600   .0027
469    RX        0        5      10      30      46      66      80      90
470    RY        5        5       5       0       0       5       5       5
       *

471    KK    74DET
472    KM    DETENTION DESIGN TO ATTENUATE FLOW INTO POWERLINE FLOODWAY
473    ZW    A=MPG B=74DET C=FLOW
474    RS        1     STOR
475    SV        0     0.16    1.23    2.61    4.22
476    SQ        0      0.3    1.57     182     512
477    SE   1431.8     1432    1433    1434    1435
       *
       * ****************************************************************************
       * ****************************************************************************
       *

478    KK      74A
479    KM     BASIN 74A
480    KM      THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
481    KM      L=      2.4  Lca=      1.0   S=    42.2  Kn= .095  LAG=   92.9
482    KM      PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
       * KO      2        2
483    BA      .75
484    LG      .35      .36    5.00     .27     .00
485    UI      27.      27.     27.     27.     73.     96.    111.    129.    140.    151.
486    UI     163.     175.    193.    208.    228.    268.    317.    362.    327.    287.
487    UI     260.     239.    222.    206.    187.    171.    160.    142.    132.    118.
488    UI      99.      79.     56.     48.     47.     45.     45.     32.     27.     27.
489    UI      27.      19.      8.      8.      8.      8.      8.      8.      8.      8.
490    UI       8.       8.      8.      8.      8.      0.      0.      0.      0.      0.
491    UI       0.       0.      0.      0.      0.      0.      0.      0.      0.      0.
       *
       *

492    KK    74ATB    ROUTE
493    KM    ROUTE FLOW FROM BASIN 74A VIA THE POWERLINE FLOODWAY FROM MERIDIAN ROAD TO
494    KM    MOUNTAIN ROAD. FLOW ENTERS THE POWERLINE FLOODWAY VIA A 75FT WEIR ON THE
495    KM    NORTHWEST CORNER OF THE MERIDIAN ROAD AND POWERLINE FLOODWAY INTERSECTION.
496    RS        1     FLOW      -1
497    RC    0.013    0.013   0.013    3200  0.0060    0.00
498    RX     0.00     7.00   21.50   30.00   36.00   44.50   59.00   66.00
499    RY     6.00     5.50    5.50    0.00    0.00    5.50    5.50    6.00
       *
       *
```

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

  500       KK     74B   BASIN
  501       KM    BASIN 74B
  502       KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  503       KM     L=1.31  Lca=0.41  S=23.7  Kn=0.040  LAG=24.9
  504       KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  505       BA    0.333
  506       LG     0.25    0.25    5.80    0.22      30
  507       UI       45     154     245     330     528     430     318     229     122      76
  508       UI       44      18      14      14       0       0       0       0       0       0
  509       UI        0       0       0       0       0       0       0       0       0       0
            *
            *

  510       KK   RET74B  DIVERT
  511       KM    RETAIN 80% OF THE 100 YR 2 HR RUNOFF VOLUME
  512       DT   74BRET    17.8     0.0
  513       DI        0   10000
  514       DQ        0   10000
            *
            *

  515       KK    CP74B COMBINE
  516       KM    COMBINE HYDROGRAPHS 74ATB AND BASIN 74B
  517       HC        2
            *
            *

  518       KK    74BTC    ROUTE
  519       KM    ROUTE FLOW VIA THE POWERLINE FLOODWAY FROM MOUNTAIN ROAD TO SIGNAL BUTTE
  520       KM    ROAD.
  521       RS        1    FLOW      -1
  522       RC    0.013   0.013   0.013    3100  0.0055    0.00
  523       RX     0.00    7.00   21.50   30.00   36.00   44.50   59.00   66.00
  524       RY     6.00    5.50    5.50    0.00    0.00    5.50    5.50    6.00
            *
            *

  525       KK     74C   BASIN
  526       KM    BASIN 74C
  527       KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  528       KM     L=1.22  Lca=0.40  S=25.4  Kn=0.040  LAG=23.7
  529       KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  530       BA    0.345
  531       LG     0.25    0.17    6.80    0.15      30
  532       UI       48     180     276     386     588     428     310     211      97      65
  533       UI       35      15      15      16       0       0       0       0       0       0
  534       UI        0       0       0       0       0       0       0       0       0       0
            *
            *
```



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

  535       KK   RET74C  DIVERT
  536       KM    RETAIN 80% OF THE 100 YR 2 HR RUNOFF VOLUME
  537       DT   74CRET    22.6     0.0
  538       DI        0   10000
  539       DQ        0   10000
            *
            *

  540       KK    CP74C COMBINE
  541       KM    COMBINE HYDROGRAPHS 73T74C, 74BTC, AND BASIN 74C
  542       ZW     A=MPG B=CP74C C=FLOW
            * KO      2
  543       HC        3
            *
            *
            *  ***********************************DU 7 MASTER REPORT***************************
            *  **************************************DWM 09/28/2011****************************
            *

  544       KK   74CT10
  545       KM   ROUTE FLOW FROM IN THE POWERLINE FLOODWAY FROM CP74C TO CP10
  546       RS        2    FLOW      -1
  547       RC    0.030   0.013   0.030    5050   .0036
  548       RX        0      15    16.5      25      33    41.5      43      58
  549       RY      6.6     6.6     5.6       0       0     5.6     6.6     6.6
            *
            *

  550       KK      10   BASIN
  551       KM     BASIN 10
  552       KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
  553       KM     L=1.16  Lca=0.85  S=21.6  Kn=0.045  LAG=36.0
  554       KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
  555       BA    0.186
  556       LG     0.22    0.21    6.40    0.20      31
  557       UI        0      17      31      71      93     113     143     208     188     148
  558       UI      119      95      73      40      30      22      17       7       5       5
  559       UI        5       5       0       0       0       0       0       0       0       0
  560       UI        0       0       0       0       0       0       0       0       0       0
  561       UI        0       0       0       0       0       0       0       0       0       0
            *
            *

  562       KK    RET10  DIVERT
  563       KM    RETAIN 100 YR 2 HR RUNOFF VOLUME
            * KO      2
  564       DT    10RET    14.5     0.0
```

```
 565          DI        0   10000
 566          DQ        0   10000
              *
              *
1                                         HEC-1 INPUT                                        PAGE 13

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

 567          KK     CP10
 568          KM     COMBINE HYDROGRAPHS 74CT10 AND RET10
 569          HC        2
              *
              *

 570          KK    10T75    ROUTE
 571          KM   ROUTE FLOW FROM CP10 TO CP75 WITHIN THE POWERLINE FLOODWAY
 572          RS        1     FLOW      -1
 573          RC    0.030    0.013   0.030    5590   .0056
 574          RX        0       15    16.5      26      34    43.5      45      60
 575          RY      7.3      7.3     6.3       0       0     6.3     7.3     7.3
              *
              *

 576          KK      02B    BASIN
 577          KM     BASIN 02B
 578          KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 579          KM     L=0.53  Lca=0.23  S=22.6  Kn=0.040  LAG=14.3
 580          KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 581          BA    0.117
 582          LG     0.15     0.25    5.00    0.36      56
 583          UI        0       51     156     288     221     118      42      16       8       0
 584          UI        0        0       0       0       0       0       0       0       0       0
 585          UI        0        0       0       0       0       0       0       0       0       0
 586          UI        0        0       0       0       0       0       0       0       0       0
 587          UI        0        0       0       0       0       0       0       0       0       0
              *
              *

 588          KK   RET02B   DIVERT
 589          KM    RETAIN 100 YR 2 HR RUNOFF VOLUME
              * KO      2
 590          DT   02BRET     15.5     0.0
 591          DI        0    10000
 592          DQ        0    10000
              *
              *

 593          KK    2BT75    ROUTE
 594          KM   ROUTE OVERLAND FLOW FROM RET02B TO CP75
 595          RS       20     FLOW      -1
 596          RC    0.035    0.035   0.035   16485   .0036
 597          RX        0        5      10      15    1015    1020    1025    1030
 598          RY        2      1.5       1       0       0       1     1.5       2
              *
              *

 599          KK       08    BASIN
 600          KM     BASIN 08
 601          KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 602          KM     L=1.37  Lca=1.09  S=21.9  Kn=0.043  LAG=40.1
 603          KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 604          BA    0.724
1                                         HEC-1 INPUT                                        PAGE 14

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

 605          LG     0.24     0.25    5.70    0.25      32
 606          UI        0       61      82     225     302     360     436     558     765     630
 607          UI      513      425     346     278     186     107     100      64      58      19
 608          UI       19       19      19      19       0       0       0       0       0       0
 609          UI        0        0       0       0       0       0       0       0       0       0
 610          UI        0        0       0       0       0       0       0       0       0       0
              *
              *

 611          KK    RET08   DIVERT
 612          KM    RETAIN 100 YR 2 HR RUNOFF VOLUME
              * KO      2
 613          DT    08RET     59.2     0.0
 614          DI        0    10000
 615          DQ        0    10000
              *
              *

 616          KK    08T75    ROUTE
 617          KM   ROUTE OVERLAND FLOW FROM RET08 TO CP75
 618          RS       20     FLOW      -1
 619          RC    0.035    0.035   0.035    5770   .0043
 620          RX        0        5      10      15    1015    1020    1025    1030
 621          RY        2      1.5       1       0       0       1     1.5       2
              *
              *

 622          KK       75    BASIN
 623          KM     BASIN 75
 624          KM     THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 625          KM     L=3.52  Lca=0.65  S=17.0  Kn=0.087  LAG=100.2
 626          KM     PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 627          BA    2.980             0.19
 628          LG     0.34     0.35    6.80    0.13       3
 629          UI        0       98      98      98      98     165     323     369     425     469
 630          UI      510      545     582     624     671     737     781     884    1050    1178
 631          UI     1305     1150    1028     937     867     811     764     697     642     597
 632          UI      551      501     469     423     362     282     226     174     174     163
 633          UI      161      161      98      98      98      98      78      30      30      30
```

```
634          UI     30     30     30     30     30     30     30     30     30     30
635          UI     30     30      0      0      0      0      0      0      0      0
             *
             *
636          KK    CP75 COMBINE
637          KM  COMBINE HYDROGRAPHS 10T7B, 2BT75, 8T75, AND SUB 75
             * KO      2
638          HC        4
             * ************************************************************************************
639          ZZ
1
        SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE   (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

 399      73A
           V
           V
 413    73ATB
           .
           .
 420       .         73B
           .          .
           .          .
 431       .          .-------> 73BRET
 429       .      RET73B
           .          .
           .          .
 434    CP73B............
           V
           V
 437    73BTC
           .
           .
 444       .         73C
           .          .
           .          .
 456       .          .-------> 73CRET
 454       .      RET73C
           .          .
           .          .
 459    CP73C............
           V
           V
 463   73T74C
           V
           V
 471    74DET
           .
           .
 478       .         74A
           .          V
           .          V
 492       .       74ATB
           .          .
           .          .
 500       .          .          74B
           .          .           .
           .          .           .
 512       .          .           .-------> 74BRET
 510       .          .       RET74B
           .          .           .
           .          .           .
 515       .       CP74B............
           .          V
           .          V
 518       .       74BTC
           .          .
           .          .
 525       .          .          74C
           .          .           .
           .          .           .
 537       .          .           .-------> 74CRET
 535       .          .       RET74C
           .          .           .
           .          .           .
 540    CP74C.........................
           V
           V
 544   74CT10
           .
           .
 550       .          10
           .          .
           .          .
 564       .          .-------> 10RET
 562       .       RET10
           .          .
           .          .
 567     CP10............
           V
           V
 570    10T75
           .
           .
 576       .         02B
           .          .
           .          .
 590       .          .-------> 02BRET
 588       .      RET02B
           .          V
           .          V
```

```
593            .        2BT75
               .          .
599            .          .          08
               .          .          .
613            .          .          .-------->    08RET
611            .          .        RET08
               .          .          V
               .          .          V
616            .          .        08T75
               .          .          .
622            .          .          .          75
               .          .          .          .
636          CP75.....................................

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                        *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*            JUN   1998                  *
*          VERSION 4.1                   *
*                                        *
*  RUN DATE   10MAY12  TIME  14:50:07    *
*                                        *
******************************************

******************************************
*                                        *
*     U.S. ARMY CORPS OF ENGINEERS       *
*     HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616          *
*          (916) 756-1104                *
*                                        *
******************************************
```

UPDATED BY HOSKIN RYAN CONSULTANTS TO REFLECT THE CHANNEL/BASIN DESIGN
TO CONVEY OFF-SITE FLOW INTO POWERLINE FLOODWAY
01-16-2012

****

FILE: DU7INT.DAT

MODEL REVISED: 09-28-2011

PROJECT: DEVELOPMENT UNIT 7 AT MESA PROVING GROUNDS (MPG)

THIS MODEL IS AN EXERPT OF THE FULL BUILD OUT MODEL. NO REFERENCE TO OTHER MODELS IS REQUIRED TO RUN THIS MODEL.

THIS IS AN INTERIM CONDITION MODEL WHICH REFLECTS THE FLOOD CONTROL DISTRICT'S FULL BUILD OUT MODEL FOR AREA OUTSIDE OF MESA PROVING GROUNDS IT REFLECTS A POINT IN TIME WHERE PHASE 1 OF THE FIRST SOLAR MANUFACTURING FACILITY IS CONSTRUCTED ALONG WITH THE PROPOSED DU 7. ALTHOUGH ALL WATERSHEDS WITHIN THE MODEL ARE CURRENTLY NOT FULLY BUILT OUT, IT WAS CHOSEN AS THE INTERIM CONDITION BASE MODEL DUE TO UNCERTAINTY OF DEVELOPMENT PHASING OUTSIDE THE PROJECT AND ALSO TO ENSURE THE INTERIM DEVELOPMENT CONDITION WITHIN THE MESA PROVING GROUNDS PROJECT IS NOT NEGATIVELY IMPACTING DOWNSTREAM FLOOD CONTROL INFRASTRUCTURE.

MODEL REVISION DESCRIPTION:

THE MOST CURRENT POST-DEVELOPED MPG MODEL(MPGDU7.DAT) WAS USED AS THE START TO THIS MODEL. THE MODEL UTILIZES POST DEVELOPED WATERSHEDS FOR FIRST SOLAR PHASE 1 AS WELL AS DU 7. A REDUCTION FACTOR OF 0.75 WAS MULTIPLIED TO THE WATERSHED 75 RUNOFF RATIO TO ACCOUNT FOR 25% OF THE WATERSHED BEING DEVELOPED AND PROVIDING RETENTION.

MODEL REVISED BY:
WOOD, PATEL & ASSOCIATES, INC.
DANIEL W. MATTHEWS, E.I.T.

FILE PATH:
R:\MESA PROVING GROUNDS\2011\113697\PROJECT SUPPORT\REPORTS\DRAINAGE\DU 7 DRAINAGE\HYDROLOGY\INTERIM\DU7INT.DAT

****

FILE: MPGDU7.DAT

MODEL REVISED: 09-07-2011

PROJECT: MESA PROVING GROUNDS

THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE BELOW. REFERENCING WS2-NEM.DSS IS STILL REQUIRED.

MODEL REVISION DESCRIPTION:

THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT). ONSITE WATERSHEDS WERE UPDATED TO REFLECT A GRADING PLAN.
MODELING OF THE POWERLINE FLOODWAY HAS BEEN UPDATED TO REFLECT THE EXISTING SECTIONS AND SLOPE PER AS-BUILT DRAWINGS ACROSS THE MPG SITE.

MODEL REVISED BY:
WOOD, PATEL & ASSOCIATES, INC.
DANIEL W. MATTHEWS, E.I.T.

FILE PATH:
R:\MESA PROVING GROUNDS\2011\113697\PROJECT SUPPORT\REPORTS\DRAINAGE\HYDROLOGY\MPGDU7.DAT

****

FILE: MPG20RT2.DAT

MODEL REVISED: 04-25-2011

PROJECT: MESA PROVING GROUNDS

THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE BELOW. REFERENCING WS2-NEM.DSS IS STILL REQUIRED.

THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED BY SWABACK PARTNERS ON 12/12/07.

MODEL REVISION DESCRIPTION:

THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT). ONSITE WATERSHEDS 01 AND 20 WERE UPDATED TO REFLECT THE INCORPORATION OF THE FIRST SOLAR SITE IN THE NORTHEAST CORNER OF DU-6. WATERSHED 02 WAS SPLIT INTO 02A AND 02B. LAND USE WAS CHANGED TO INDUSTRIAL FOR 02B AND ENTIRELEY RESIDENTIAL FOR 02A.
THE FIRST SOLAR SITE RUNOFF WILL NOW BE RETAINED ENTIRELY ONSITE.

MODEL REVISED BY:
WOOD, PATEL & ASSOCIATES, INC.
STEPHEN M. SCINTO, P.E.

FILE PATH:
R:\MESA PROVING GROUNDS\2010\103564.04\PROJECT SUPPORT\REPORTS\DRAINAGE\HYDROLOGY\POST-DEVELOPED 100YR2HR RETENTION MODEL\MPG20RT2.DAT

****

FILE: MPG20RT2.DAT

MODEL REVISED: 09-16-08

PROJECT: MESA PROVING GROUNDS

THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE BELOW. REFERENCING WS2-NEM.DSS IS STILL REQUIRED.

THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED BY SWABACK PARTNERS ON 12/12/07.

MODEL REVISION DESCRIPTION:

THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT). ONSITE WATERSHEDS 01, 02, 03, AND 06 WERE UPDATED TO REFLECT THE CURRENT GOLF COURSE CONFIGURATION.

MODEL REVISED BY:
WOOD, PATEL & ASSOCIATES, INC.
DANIEL W. MATTHEWS, E.I.T.

FILE PATH:
R:\MESA PROVING GROUNDS\2006\062753\PROJECT SUPPORT\HYDRO\MDR-20-15 LAND PLAN\2ND SUBMITTAL(COM)\HYDROLOGY\MPG20RT2.DAT

****

FILE: MPG20RT2.DAT

MODEL REVISED: 05-15-08

PROJECT: MESA PROVING GROUNDS

MODEL REVISION DESCRIPTION:

THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE BELOW. REFERENCING WS2-NEM.DSS IS STILL REQUIRED.

THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED BY SWABACK PARTNERS ON 12/12/07.

THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT). WATERSHED 79A WAS UPDATED AS REQUESTED BY FLOOD CONTROL DISTRICT OF MARICOPA COUNTY TO REDUCE THE PERCENT IMPERVIOUS VALUE FROM 80% TO 0% TO MATCH THE LAND USE AS MODELED WITHIN THE EAST MESA ADMP.

MODEL REVISED BY:
WOOD, PATEL & ASSOCIATES, INC.
DANIEL W. MATTHEWS, E.I.T.

FILE PATH:
R:\MESA PROVING GROUNDS\2006\062753\PROJECT SUPPORT\HYDRO\MDR-20-15 LAND PLAN\2ND SUBMITTAL\POST-DEVELOPED 100YR2HR RETENTION MODEL (MPG20RT2)\MPG20RT2.DAT

****

FILE: MPG20RT2.DAT

MODEL REVISED: 01-08-08

PROJECT: MESA PROVING GROUNDS

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MODEL REVISION DESCRIPTION:

THIS MODEL SHOULD REPLACE WS4-SEM.DAT IN THE HEC-1 RUN SEQUENCE SPECIFIE
BELOW.  REFERENCING WS2-NEM.DSS IS STILL REQUIRED.


THIS IS A 100-YEAR, 2-HOUR RETENTION SCENARIO MODEL USING
THE 20MSF COMMERCIAL SPACE AND 15K DU LAND PLAN PROVIDED
BY SWABACK PARTNERS ON 12/12/07.


THIS MODEL IS AN EXERPT OF THE MODEL PROVIDED BY THE FLOOD CONTROL
DISTRICT OF MARICOPA COUNTY (WS4-SEM.DAT).  WATERSHEDS 68A, 68B,
70A, 70B, 71, 73B, 73C, 74B, 74C, 75, 77B, 77C, 78B, 78C, AND 79A
HAVE ALL BEEN UPDATED TO REFLECT CURRENT WATERSHED DELINEATIONS,
NEW DEVELOPMENT, CURRENT RETENTION,AND FLOOD ROUTING.  BASIN 75
HAS BEEN UPDATED TO REFLECT PLANNED DEVELOPEMENT FOR THE MESA
PROVING GROUNDS SITE.

MODEL REVISED BY:
WOOD, PATEL & ASSOCIATES, INC.
DANIEL W. MATTHEWS, E.I.T.

FILE PATH:
R:\MESA PROVING GROUNDS\2006\062753\PROJECT SUPPORT\HYDRO\MDR-20-15 LAND
PLAN\HYDROLOGY\POST-DEVELOPED 100YR2HR RETENTION MODEL (MPG20RT2)\
MPG20RT2.DAT

*****************************************************************************


ID  Kirkham Michael:
Last Revised Date:  1/22/03
Filename:  WS4-SEM.DAT

Comments Dated 1/22/03 (CJ)

This model should be used ONLY for the Rittenhouse and Chandler Heights
Basin Design Project - Final Design Analyses.

This model is one of several models that represent the EMF watershed.
This model covers the Southeast Mesa Area and should reference as a DSS
the watershed model for the Northeast Mesa Area (Filename WS2-NEM.DAT).

This model is necessary to determine the input hydrographs for the
Rittenhouse Basin Design HEC-RAS Unsteady State analysis.  To develop
the necessary input hydrographs the following models should be run in order.
Because the files utilize a TAPE21 file to export import hydrographs
between models, prior to running the FIRST model (WS1-NWM.DAT) any existing
TAPE21 file in the directory should be deleted.  The run procedure order is:

    1)  WS1-NWM.DAT
    2)  WS2-NEM.DAT
    3)  WS3-QCSW.DAT
    4)  WS4-SEM.DAT (referencing WS2-NEM.DSS for the DSS file)
    5)  RT1-BASE.DAT

The necessary input hydrographs for the Rittenhouse Basin analysis
are determined in RT1-BASE.  In that output file, the hydrograph at
RWFLD1 should be exported and used as the input hydrograph at the
EMF Reach 4 Cross Section 17.082.  And the hydrograph at RITTEN should
be exported and used as the input hydrograph for the Rittenhouse Main
Channel at Cross Section 820.00


*****************************************************************************
**** NOTE BY PRIMATECH ENGINEERS:                                       ****
**** DATE: 06/12/2001                                                   ****
**** THE NEW FILE NAME IS: SEBTALT2.DAT                                 ****
**** THE FILE WAS RENAMED AS <<RTBTALT2.DAT>> FOR THE EAST MARICOPA     ****
**** FLOODWAY CAPACITY MITIGATION PROJECT, BY FLOOD CONTROL DISTRICT OF ****
**** MARICOPA COUNTY.                                                   ****
**** THE FILE WAS RENAMED <<RTBTALT3.DAT>> AND UPDATED USING GREEN AND  ****
**** AMPT FUTURE CONDITIONS FOR BASINS 258 TO 268.                      ****
*****************************************************************************


 THIS MODEL WAS ORIGINALLY MIDDOUT.DAT
 IT HAS BEEN MODIFIED BY CPE (7/2000)
 FOR ALTERNATIVE 2 FOR THE EAST MARICOPA FLOOWAY
 CAPACITY MITIGATION AND MULTI-USE CORRIDOR STUDY
 TO ROUTE BOTH THE POWERLINE FLOOWAY
 AND THE SANTAN FREEWAY CHANNEL INTO THE RAY BASIN PRIOR THEIR OUTFALL
 INTO THE EMF

*******************************************************************

      Model files changed by Collins/Pina Engineering
      to reflect multi-use design concepts (recreation
      and environment) proposed throughout the entire
      EMF Corridor.     July 2000


 VERSION 8.06  CPE 7/31/00

*****************************************************************************


*****************************************************************************
 FILENAME: MIDDOUT.DAT

 ALL CIP INFRASTRUCTURE IS IN PLACE, FUTURE CONDITIONS LANDUSE IS IN PLACE
 FLOW IS ROUTED UP ELLSWORTH ROAD IN A EARTH LINED CHANNEL

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PRODUCED BY DIBBLE AND ASSOCIATES AND HOSKIN ENGINEERING CONSULTANTS.
File Name: Final8.Dat
Revised - Jan. 2000 by SZ (Wood/Patel) From Final7.dat - new Z-V & Sideweir
Revised - Jan. 2000 by SZ (Wood/Patel) from Final6.dat - 60% review comments
Revised - Dec. 1999 by SZ (Wood/Patel) from Final5.dat
Revised - Dec. 1999 by SZ (Wood/Patel) from Final4.dat
Revised - Nov. 1999 by SZ (Wood/Patel) from Final3.dat
Revised - June 1999 by SZ (Wood/Patel) for Final Model from Opt1.dat.
Revised - May 1999 by SZ (Wood/Patel) for Option 1, Based on Model SDIB.DAT
REVISED - MAY, 1999 BY VAS TO INCORPORATE INCREASE OF SUBBASIN RETENTION AND
          REVISIONS TO THE REGIONAL DETENTION BASIN STORAGE
REVISED - FEB, 1999 BY VALERIE SWICK, FCD OF MARICOPA COUNTY
REVISED - MAY, 1998 BY D&A

REVISED BY VALERIE SWICK, FEB. 26, 1998

FLOWS FROM DETENTION BASIN LOCATED AT NE CORNER OF ELLIOT AND ELLSWORTH ROADS
IS ROUTED TO THE SOUTHWEST BY SIPHON DRAW TO SUBBASIN 70A. FROM THERE THEY
WILL BE ROUTED BY A CHANNEL TO THE EMF. FLOWS FROM SUBBASINS ADJACENT TO
SANTAN FREEWAY ALIGNMENT WILL BE ROUTED SOUTH TO SUBBASIN 70A WHERE THEY WILL
BE COMBINED WITH FLOW IN SIPHON DRAW.

EAST MESA AREA DRAINAGE MASTER PLAN
AREA SOUTH OF SUPERSTITION (U.S. HWY 60)
AUGUST 1997
SOUTHEAST MESA HIGH RESOLUTION MODEL

***********FUTURE CONDITION MODEL OF THE WATERSHED*************************

************ATTENTION*********************************************************
 SUBBASINS 75, 79A, 79B, 78E,  LANDUSES WERE NOT
 CHANGED BECAUSE IT WAS FELT THAT THEIR FUTURE CONDITIONS LANDUSES WOULD BE
 SIMILAR TO THE EXISTING CONDITIONS LANDUSES.
 RETENTION VOLUMES WILL ALSO NOT BE UTILIZED FOR SUBBASINS 75, 79A, 79B, 78E
 SOME QUEEN CREEK SUBBASINS WILL ALSO NOT HAVE RETENTION VOLUMES, EITHER
 BECAUSE THEY LIE IN PINAL COUNTY AND WE DONT KNOW PINAL COUNTIES PLANS OR
 THEY LIE IN THE SANTAN MOUNTAINS AND WON'T GET DEVELOPED
 WILLIAMS GATEWAY AIRPORT (SUBBASINS 80A, 80B, 81A, AND 81B) ARE MODELED AS
 FUTURE CONDITIONS AND HAVE RETENTION VOLUMES FOR THE 100YR 2HR STORM
******************************************************************************
FILENAME:  SDIBB.DAT

THIS MODEL REPRESENTS THE FUTURE CONDITION OF THE WATERSHED.
TOTAL DRAINAGE AREA IS APPROXIMATELY 213 SQ. MI.
THIS MODEL USES A Kn VALUE OF 0.09 FOR DESERT LAND USE DUE TO SHEET FLOW
CONDITIONS.

100-YEAR 24-HOUR FREQUENCY
AREAL REDUCTIONS FROM FCD HYDROLOGY MANUAL
THIS MODEL INCLUDES INFLOW FROM NORTH OF THE SUPERSTITION FREEWAY
AND EAST OF THE CAP

DATA FROM THE QUEEN CREEK ADMS HAS BEEN ADDED TO CALCULATE FLOWS INTO THE
EMF.   MUSKINGUM ROUTING NSTEPS WERE ADJUSTED TO BE WITHIN THE SUGGESTED
RANGE.

METHODOLOGY
THE US CORPS OF ENGINEERS FLOOD HYDROLOGY MODEL HEC-1 DATED SEP1990 VER 4.0
SCS TYPE II RAINFALL DISTRIBUTION
S-GRAPH HYDROGRAPH
GREEN AND AMPT INFILTRATION EQUATION USED FOR CALCULATING LOSSES
NORMAL DEPTH STORAGE CHANNEL ROUTING
APPROXIMATE DIRECTION, LOCATION, AND LENGTH OF THE WASHES HAVE BEEN
EVALUATED BASED ON FIELD INVESTIGATION, USGS MAPS, LANDIS AERIAL SURVEYS
DATED 1994
THE NOAA TECHNICAL MEMORANDUM NOAA ATLAS 2 DEPTH AREA RATIOS

ORIGINAL STUDY PERFORMED BY LISA C. YOUNG AND AFSHIN AHOURAIYAN, UPDATED BY
DAVID DEGERNESS (OCT-DEC, 1996). REVIEWED BY VALERIE A. SWICK
AND AMIR MOTAMEDI OF THE FLOOD CONTROL DISTRICT
HYDROLOGY BRANCH ENGINEERING DIVISION, FLOOD CONTROL
DISTRICT OF MARICOPA COUNTY, DECEMBER - JULY 1995.

ASSUMED VELOCITY OF 1 FT/SEC FOR SHEET FLOW, 2-3 FT/SEC FOR WASH/NATURAL
CHANNEL, 3 FT/SEC FOR ROAD AND GRASS CHANNEL, 10FT/SEC FOR CONCRETE CHANNEL

VELOCITIES FOR ADMP IMPROVEMENT CHANNELS FROM DIBBLE AND ASSOCIATES
SUGGESTED ALTERNATIVES (JULY 1, 1997)

*****************************************************************************
**** THE FOLLOWING NOTE WAS ADDED BY PRIMATECH ENGINEERS ON 06-12-2001 ****
*****************************************************************************
NOTE: MUST USE NEBUILD.DSS AS THE DSS FILE TO IMPORT FLOWS ACROSS THE
        SUPERSTITION FREEWAY.
*****************************************************************************


NOTE: MUST USE NDIBF.DSS AS THE DSS FILE TO IMPORT FLOWS ACROSS THE
        SUPERSTITION FREEWAY.

DDM MCUHP2 SE MESA ADMP - SOUTH OF SUPERSTITION FWY, FUTURE CONDITIONS

378 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    1APR97  STARTING DATE
                      ITIME      0000  STARTING TIME
                         NQ       600  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    3APR97  ENDING DATE
                     NDTIME      0155  ENDING TIME
                      ICENT        19  CENTURY MARK
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            COMPUTATION INTERVAL      .08 HOURS
                 TOTAL TIME BASE    49.92 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
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380 JD INDEX STORM NO. 1

STRM	3.60	PRECIPITATION DEPTH
TRDA	.01	TRANSPOSITION DRAINAGE AREA

381 PI PRECIPITATION PATTERN

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.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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391 JD INDEX STORM NO. 2

STRM	3.58	PRECIPITATION DEPTH
TRDA	1.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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392 JD INDEX STORM NO. 3

STRM	3.49	PRECIPITATION DEPTH
TRDA	5.00	TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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393 JD INDEX STORM NO. 4
STRM 3.38 PRECIPITATION DEPTH
TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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394 JD INDEX STORM NO. 5
STRM 3.24 PRECIPITATION DEPTH
TRDA 30.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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395 JD INDEX STORM NO. 6
STRM 3.10 PRECIPITATION DEPTH
TRDA 60.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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396 JD INDEX STORM NO. 7
STRM 3.05 PRECIPITATION DEPTH
TRDA 90.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
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397 JD INDEX STORM NO. 8
STRM 3.00 PRECIPITATION DEPTH
TRDA 120.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
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.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.01	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00		

398 JD INDEX STORM NO. 9
STRM 2.97 PRECIPITATION DEPTH
TRDA 150.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.01	.00	.01
.01	.01	.01	.01	.01	.01	.01	.01	.03	.03
.03	.09	.09	.09	.01	.01	.01	.01	.01	.01
.01	.01	.01	.01	.01	.01	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

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                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00        .00        .00
                .00        .00        .00        .00        .00        .00        .00        .00
    -----DSS---ZOPEN:  Existing File Opened,  File: MPG.DSS
                       Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.     3:  /MPG/CP73C/FLOW/31MAR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     3:  /MPG/CP73C/FLOW/01APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     3:  /MPG/CP73C/FLOW/02APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     3:  /MPG/CP73C/FLOW/03APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/73T74C/FLOW/31MAR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/73T74C/FLOW/01APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/73T74C/FLOW/02APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/73T74C/FLOW/03APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/74DET/FLOW/31MAR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/74DET/FLOW/01APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/74DET/FLOW/02APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     8:  /MPG/74DET/FLOW/03APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     6:  /MPG/CP74C/FLOW/31MAR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     6:  /MPG/CP74C/FLOW/01APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     6:  /MPG/CP74C/FLOW/02APR1997/5MIN//
 -----DSS---ZWRITE Unit  71; Vers.     6:  /MPG/CP74C/FLOW/03APR1997/5MIN//

                                                     HYDROGRAPH MULTIPLIED BY    .19
         WARNING EXCESS AT PONDING LESS THAN ZERO FOR PERIOD. EXCESS SET TO ZERO

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19

                                                     HYDROGRAPH MULTIPLIED BY    .19
1
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RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	73A	378.	13.33	96.	24.	12.	.95		
+	ROUTED TO	73ATB	355.	13.50	96.	24.	12.	.95		
+	HYDROGRAPH AT	73B	748.	12.08	68.	20.	10.	.43		
+	DIVERSION TO	73BRET	748.	12.08	68.	20.	10.	.43		
+	HYDROGRAPH AT	RET73B	4.	20.75	2.	1.	0.	.43		
+	2 COMBINED AT	CP73B	355.	13.50	96.	25.	12.	1.38		
+	ROUTED TO	73BTC	332.	13.83	95.	24.	12.	1.38		
+	HYDROGRAPH AT	73C	822.	12.25	94.	28.	14.	.58		
+	DIVERSION TO	73CRET	822.	12.25	70.	19.	9.	.58		
+	HYDROGRAPH AT	RET73C	501.	12.42	33.	10.	5.	.58		
+	2 COMBINED AT	CP73C	441.	12.42	124.	33.	16.	1.96		
+	ROUTED TO	73T74C	346.	14.08	123.	33.	16.	1.96		
+	ROUTED TO	74DET	344.	14.08	120.	33.	16.	1.96		
+	HYDROGRAPH AT	74A	306.	13.33	77.	19.	9.	.75		
+	ROUTED TO	74ATB	300.	13.42	77.	19.	9.	.75		
+	HYDROGRAPH AT	74B	455.	12.25	55.	16.	8.	.33		
+	DIVERSION TO	74BRET	455.	12.25	33.	9.	4.	.33		
+	HYDROGRAPH AT									

+		RET74B	382.	12.33	27.	8.	4.	.33
+	2 COMBINED AT	CP74B	445.	12.33	103.	27.	13.	1.08
+	ROUTED TO	74BTC	410.	12.42	103.	27.	13.	1.08
+	HYDROGRAPH AT	74C	516.	12.25	62.	18.	9.	.34
+	DIVERSION TO	74CRET	516.	12.25	42.	11.	5.	.34
+	HYDROGRAPH AT	RET74C	360.	12.42	25.	7.	3.	.34
+	3 COMBINED AT	CP74C	713.	12.42	238.	64.	31.	3.39
+	ROUTED TO	74CT10	615.	12.58	237.	64.	31.	3.39
+	HYDROGRAPH AT	10	207.	12.50	32.	10.	5.	.19
+	DIVERSION TO	10RET	207.	12.50	27.	7.	4.	.19
+	HYDROGRAPH AT	RET10	66.	13.00	7.	2.	1.	.19
+	2 COMBINED AT	CP10	615.	12.58	243.	66.	32.	3.57
+	ROUTED TO	10T75	522.	14.17	241.	66.	32.	3.57
+	HYDROGRAPH AT	02B	220.	12.17	23.	8.	4.	.12
+	DIVERSION TO	02BRET	220.	12.17	23.	8.	4.	.12
+	HYDROGRAPH AT	RET02B	0.	.00	0.	0.	0.	.12
+	ROUTED TO	2BT75	0.	.00	0.	0.	0.	.12
+	HYDROGRAPH AT	08	723.	12.58	119.	36.	17.	.72
+	DIVERSION TO	08RET	723.	12.58	111.	30.	14.	.72
+	HYDROGRAPH AT	RET08	96.	13.42	19.	6.	3.	.72
+	ROUTED TO	08T75	34.	16.33	18.	6.	3.	.72
+	HYDROGRAPH AT	75	247.	13.58	71.	18.	9.	2.98
+	4 COMBINED AT	CP75	647.	14.08	298.	84.	40.	7.40

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

```
-----DSS---ZCLOSE Unit:  71,   File: MPG.DSS
        Pointer Utilization:   .18
        Number of Records:     20
        File Size:      67.1  Kbytes
        Percent Inactive:  23.3
```

Appendix C

HEC-RAS Output

Existing Condition

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX        XXXX      XX     XXXX
X     X  X       X    X       X   X    X  X   X
X     X  X       X            X   X   X    X  X
XXXXXXX  XXXX    X      XXX   XXXX    XXXXXX   XXXX
X     X  X       X            X X     X    X       X
X     X  X       X    X       X  X    X    X       X
X     X  XXXXXX   XXXX        X   X   X    X  XXXXX
```

****

PROJECT DATA
Project Title: Powerline Floodway Existing
Project File : ExistCond.prj
Run Date and Time: 6/19/2012 2:26:39 PM

Project in English units

Project Description:
Powerline Floodway 100-Year HEC-RAS
Hoskin Ryan Consultants, Inc.

****

PLAN DATA

Plan Title: Plan 01
Plan File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ExistCond.p01

Geometry Title: Powerline Floodway
Geometry File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ExistCond.g01

Flow Title : Flow 01
Flow File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ExistCond.f01

Plan Summary Information:

Number of:					
Cross Sections	=	40	Multiple Openings	=	0
Culverts	=	4	Inline Structures	=	0
Bridges	=	0	Lateral Structures	=	0

Computational Information
- Water surface calculation tolerance = 0.01
- Critical depth calculation tolerance = 0.01
- Maximum number of iterations = 20
- Maximum difference tolerance = 0.3
- Flow tolerance factor = 0.001

Computation Options
- Critical depth computed only where necessary
- Conveyance Calculation Method: At breaks in n values only
- Friction Slope Method: Average Conveyance
- Computational Flow Regime: Subcritical Flow

****

FLOW DATA

Flow Title: Flow 01
Flow File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ExistCond.f01

Flow Data (cfs)

River	Reach	RS	713CFS	600CFS	Capacity
Powerline Floodw	Reach#1	14000	713	600	530

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Powerline Floodw	Reach#1	713CFS	Normal S = 0.0057	Normal S = 0.0057
Powerline Floodw	Reach#1	600CFS	Normal S = 0.0057	Normal S = 0.0057

****

SUMMARY OF MANNING'S N VALUES

River:Powerline Floodw

Reach	River Sta.	n1	n2	n3
Reach#1	14000	.016	.016	.016
Reach#1	13500	.016	.016	.016
Reach#1	13000	.016	.016	.016
Reach#1	12500	.016	.016	.016
Reach#1	12448	.016	.016	.016
Reach#1	12435	Culvert		
Reach#1	12420	.016	.016	.016
Reach#1	12350	.016	.016	.016
Reach#1	12000	.016	.016	.016
Reach#1	11500	.016	.016	.016
Reach#1	11438	.016	.016	.016
Reach#1	11229	Culvert		
Reach#1	11023	.016	.016	.016

*Reach#1	11000	.016*	.016*	.016*
*Reach#1	10950	.016*	.016*	.016*
*Reach#1	10700	.016*	.016*	.016*
*Reach#1	10200	.016*	.016*	.016*
*Reach#1	9700	.016*	.016*	.016*
*Reach#1	9200	.016*	.016*	.016*
*Reach#1	8700	.016*	.016*	.016*
*Reach#1	8200	.016*	.016*	.016*
*Reach#1	7700	.016*	.016*	.016*
*Reach#1	7200	.016*	.016*	.016*
*Reach#1	6700	.016*	.016*	.016*
*Reach#1	6200	.016*	.016*	.016*
*Reach#1	5700	.016*	.016*	.016*
*Reach#1	5200	.016*	.016*	.016*
*Reach#1	4700	.016*	.016*	.016*
*Reach#1	4200	.016*	.016*	.016*
*Reach#1	3700	.016*	.016*	.016*
*Reach#1	3250	.016*	.016*	.016*
*Reach#1	3221	.016*	.016*	.016*
*Reach#1	3164	*Culvert *	*	*
*Reach#1	3108	.016*	.016*	.016*
*Reach#1	3050	.016*	.016*	.016*
*Reach#1	2800	.016*	.016*	.016*
*Reach#1	2400	.016*	.016*	.016*
*Reach#1	2000	.016*	.016*	.016*
*Reach#1	1924	.016*	.016*	.016*
*Reach#1	1848	*Culvert *	*	*
*Reach#1	1771	.016*	.016*	.016*
*Reach#1	1700	.016*	.016*	.016*
*Reach#1	1500	.016*	.016*	.016*
*Reach#1	1000	.016*	.016*	.016*

SUMMARY OF REACH LENGTHS

River: Powerline Floodw

Reach	River Sta.	Left	Channel	Right
*Reach#1	14000	500*	500*	500*
*Reach#1	13500	500*	500*	500*
*Reach#1	13000	507*	500*	493*
*Reach#1	12500	52*	52*	52*
*Reach#1	12448	28*	28*	28*
*Reach#1	12435	*Culvert *	*	*
*Reach#1	12420	70*	70*	70*
*Reach#1	12350	350*	350*	350*
*Reach#1	12000	500*	500*	500*
*Reach#1	11500	62*	62*	62*
*Reach#1	11438	415*	415*	415*
*Reach#1	11229	*Culvert *	*	*
*Reach#1	11023	23*	23*	23*
*Reach#1	11000	50*	50*	50*
*Reach#1	10950	250*	250*	250*
*Reach#1	10700	500*	500*	500*
*Reach#1	10200	500*	500*	500*
*Reach#1	9700	500*	500*	500*
*Reach#1	9200	500*	500*	500*
*Reach#1	8700	500*	500*	500*
*Reach#1	8200	500*	500*	500*
*Reach#1	7700	500*	500*	500*
*Reach#1	7200	500*	500*	500*
*Reach#1	6700	500*	500*	500*
*Reach#1	6200	500*	500*	500*
*Reach#1	5700	500*	500*	500*
*Reach#1	5200	500*	500*	500*
*Reach#1	4700	500*	500*	500*
*Reach#1	4200	500*	500*	500*
*Reach#1	3700	450*	450*	450*
*Reach#1	3250	29*	29*	29*
*Reach#1	3221	113*	113*	113*
*Reach#1	3164	*Culvert *	*	*
*Reach#1	3108	58*	58*	58*
*Reach#1	3050	250*	250*	250*
*Reach#1	2800	400*	400*	400*
*Reach#1	2400	400*	400*	400*
*Reach#1	2000	76*	76*	76*
*Reach#1	1924	153*	153*	153*
*Reach#1	1848	*Culvert *	*	*
*Reach#1	1771	71*	71*	71*
*Reach#1	1700	200*	200*	200*
*Reach#1	1500	500*	500*	500*
*Reach#1	1000	0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Powerline Floodw

Reach	River Sta.	Contr.	Expan.
*Reach#1	14000	.1*	.3*
*Reach#1	13500	.1*	.3*
*Reach#1	13000	.1*	.3*
*Reach#1	12500	.1*	.3*
*Reach#1	12448	.1*	.3*
*Reach#1	12435	*Culvert *	*
*Reach#1	12420	.1*	.3*
*Reach#1	12350	.1*	.3*
*Reach#1	12000	.1*	.3*
*Reach#1	11500	.1*	.3*
*Reach#1	11438	.1*	.3*

*Reach#1	*	11229	*Culvert	*		*
*Reach#1	*	11023	*	.1*		.3*
*Reach#1	*	11000	*	.1*		.3*
*Reach#1	*	10950	*	.1*		.3*
*Reach#1	*	10700	*	.1*		.3*
*Reach#1	*	10200	*	.1*		.3*
*Reach#1	*	9700	*	.1*		.3*
*Reach#1	*	9200	*	.1*		.3*
*Reach#1	*	8700	*	.1*		.3*
*Reach#1	*	8200	*	.1*		.3*
*Reach#1	*	7700	*	.1*		.3*
*Reach#1	*	7200	*	.1*		.3*
*Reach#1	*	6700	*	.1*		.3*
*Reach#1	*	6200	*	.1*		.3*
*Reach#1	*	5700	*	.1*		.3*
*Reach#1	*	5200	*	.1*		.3*
*Reach#1	*	4700	*	.1*		.3*
*Reach#1	*	4200	*	.1*		.3*
*Reach#1	*	3700	*	.1*		.3*
*Reach#1	*	3250	*	.1*		.3*
*Reach#1	*	3221	*	.1*		.3*
*Reach#1	*	3164	*Culvert	*		*
*Reach#1	*	3108	*	.1*		.3*
*Reach#1	*	3050	*	.1*		.3*
*Reach#1	*	2800	*	.1*		.3*
*Reach#1	*	2400	*	.1*		.3*
*Reach#1	*	2000	*	.1*		.3*
*Reach#1	*	1924	*	.1*		.3*
*Reach#1	*	1848	*Culvert	*		*
*Reach#1	*	1771	*	.1*		.3*
*Reach#1	*	1700	*	.1*		.3*
*Reach#1	*	1500	*	.1*		.3*
*Reach#1	*	1000	*	.1*		.3*

****

HEC-RAS Plan: powerline River: Powerline Floodw Reach: Reach#1

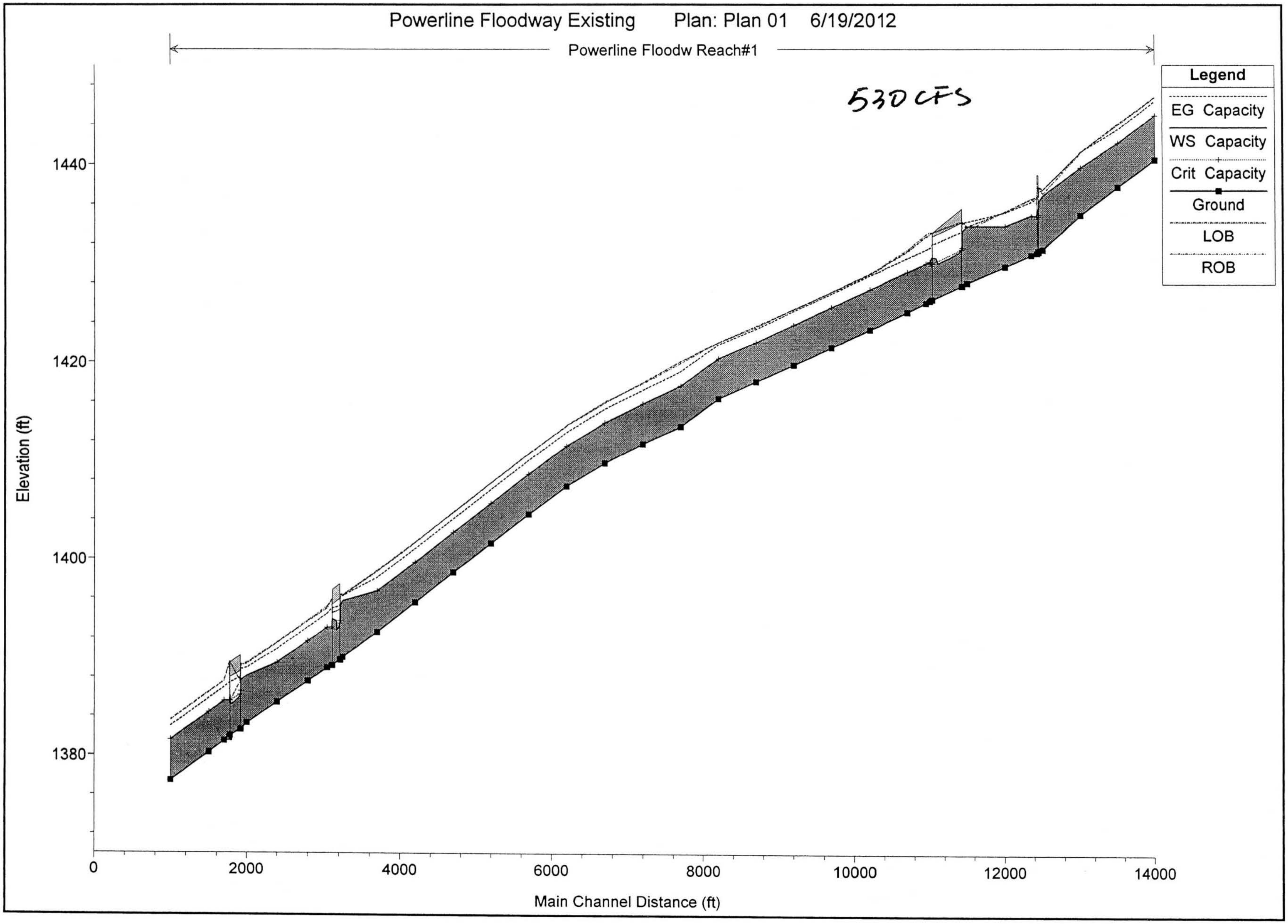
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#1	1000	713.00	1377.46	1382.26	1382.26	1383.84	0.002971	10.08	70.74	22.43	1.00
Reach#1	1000	600.00	1377.46	1381.85	1381.85	1383.32	0.003033	9.71	61.80	21.11	1.00
Reach#1	1000	530.00	1377.46	1381.56	1381.56	1382.96	0.003123	9.50	55.80	20.19	1.01
Reach#1	1500	713.00	1380.31	1385.06	1385.06	1386.65	0.003008	10.10	70.58	22.58	1.01
Reach#1	1500	600.00	1380.31	1384.66	1384.66	1386.13	0.003068	9.73	61.68	21.26	1.01
Reach#1	1500	530.00	1380.31	1384.39	1384.39	1385.78	0.003100	9.45	56.08	20.39	1.00
Reach#1	1700	713.00	1381.45	1386.20	1386.20	1387.79	0.003011	10.11	70.50	22.52	1.01
Reach#1	1700	600.00	1381.45	1385.79	1385.79	1387.26	0.003074	9.74	61.59	21.21	1.01
Reach#1	1700	530.00	1381.45	1385.52	1385.52	1386.91	0.003124	9.48	55.88	20.32	1.01
Reach#1	1771	713.00	1381.73	1386.35	1386.35	1388.56	0.004411	11.93	59.75	13.64	1.00
Reach#1	1771	600.00	1381.73	1385.86	1385.86	1387.84	0.004350	11.29	53.13	13.56	1.01
Reach#1	1771	530.00	1381.73	1385.54	1385.54	1387.37	0.004316	10.85	48.84	13.50	1.01
Reach#1	1848	Culvert									
Reach#1	1924	713.00	1382.59	1388.95	1387.36	1390.15	0.002070	8.80	81.04	16.84	0.71
Reach#1	1924	600.00	1382.59	1388.13	1386.86	1389.33	0.002222	8.79	68.28	14.36	0.71
Reach#1	1924	530.00	1382.59	1387.63	1386.51	1388.78	0.002210	8.61	61.54	12.87	0.69
Reach#1	2000	713.00	1383.27	1389.65		1390.30	0.000883	6.45	110.47	26.94	0.56
Reach#1	2000	600.00	1383.27	1388.75		1389.49	0.001214	6.90	86.93	24.82	0.65
Reach#1	2000	530.00	1383.27	1388.11		1388.96	0.001604	7.41	71.51	22.70	0.74
Reach#1	2400	713.00	1385.38	1390.15	1390.15	1391.72	0.002964	10.05	70.93	22.60	1.00
Reach#1	2400	600.00	1385.38	1389.73	1389.73	1391.20	0.003077	9.74	61.59	21.22	1.01
Reach#1	2400	530.00	1385.38	1389.47	1389.47	1390.85	0.003075	9.43	56.22	20.39	1.00
Reach#1	2800	713.00	1387.56	1392.33	1392.33	1393.90	0.002960	10.05	70.93	22.57	1.00
Reach#1	2800	600.00	1387.56	1391.91	1391.91	1393.38	0.003076	9.75	61.57	21.19	1.01
Reach#1	2800	530.00	1387.56	1391.65	1391.65	1393.03	0.003064	9.42	56.27	20.37	1.00
Reach#1	3050	713.00	1388.95	1393.69	1393.69	1395.28	0.003003	10.12	70.42	22.36	1.01
Reach#1	3050	600.00	1388.95	1393.29	1393.29	1394.75	0.003031	9.71	61.79	21.09	1.00
Reach#1	3050	530.00	1388.95	1393.00	1393.00	1394.40	0.003111	9.49	55.85	20.18	1.01
Reach#1	3108	713.00	1389.19	1393.88	1393.88	1396.18	0.004565	12.18	58.53	12.78	1.00
Reach#1	3108	600.00	1389.19	1393.37	1393.37	1395.43	0.004487	11.53	52.03	12.72	1.00
Reach#1	3108	530.00	1389.19	1393.04	1393.04	1394.94	0.004431	11.08	47.85	12.68	1.00
Reach#1	3164	Culvert									
Reach#1	3221	713.00	1389.74	1396.42	1394.51	1397.48	0.001763	8.25	86.42	17.67	0.66
Reach#1	3221	600.00	1389.74	1395.60	1394.00	1396.65	0.001889	8.23	72.93	15.17	0.66
Reach#1	3221	530.00	1389.74	1395.10	1393.67	1396.11	0.001885	8.07	65.68	13.60	0.65
Reach#1	3250	713.00	1390.01	1397.09		1397.56	0.000550	5.51	129.48	26.87	0.44
Reach#1	3250	600.00	1390.01	1396.25		1396.74	0.000687	5.61	106.88	26.83	0.50
Reach#1	3250	530.00	1390.01	1395.68		1396.19	0.000804	5.76	91.96	25.10	0.53
Reach#1	3700	713.00	1392.54	1397.36	1397.36	1398.93	0.002969	10.07	70.84	22.53	1.00
Reach#1	3700	600.00	1392.54	1396.95	1396.95	1398.41	0.003035	9.70	61.84	21.19	1.00
Reach#1	3700	530.00	1392.54	1396.68	1396.68	1398.06	0.003075	9.44	56.16	20.30	1.00
Reach#1	4200	713.00	1395.52	1400.33	1400.33	1401.89	0.002946	10.02	71.12	22.66	1.00
Reach#1	4200	600.00	1395.52	1399.90	1399.90	1401.37	0.003061	9.72	61.73	21.27	1.01
Reach#1	4200	530.00	1395.52	1399.63	1399.63	1401.02	0.003108	9.46	56.03	20.38	1.01
Reach#1	4700	713.00	1398.57	1403.35	1403.35	1404.93	0.002998	10.09	70.66	22.58	1.01
Reach#1	4700	600.00	1398.57	1402.96	1402.96	1404.41	0.003021	9.67	62.03	21.30	1.00
Reach#1	4700	530.00	1398.57	1402.69	1402.69	1404.06	0.003062	9.41	56.32	20.41	1.00
Reach#1	5200	713.00	1401.56	1406.34	1406.34	1407.90	0.002959	10.05	70.94	22.56	1.00
Reach#1	5200	600.00	1401.56	1405.91	1405.91	1407.38	0.003059	9.72	61.70	21.20	1.00
Reach#1	5200	530.00	1401.56	1405.64	1405.64	1407.03	0.003108	9.47	55.99	20.32	1.01
Reach#1	5700	713.00	1404.53	1409.30	1409.30	1410.90	0.003014	10.13	70.39	22.41	1.01
Reach#1	5700	600.00	1404.53	1408.90	1408.90	1410.37	0.003068	9.75	61.56	21.11	1.01
Reach#1	5700	530.00	1404.53	1408.62	1408.62	1410.02	0.003117	9.49	55.86	20.23	1.01
Reach#1	6200	713.00	1407.38	1412.19	1412.19	1413.78	0.003012	10.13	70.40	22.39	1.01
Reach#1	6200	600.00	1407.38	1411.78	1411.78	1413.26	0.003063	9.74	61.58	21.09	1.00

HEC-RAS Plan: powerline River: Powerline Floodw Reach: Reach#1 (Continued)

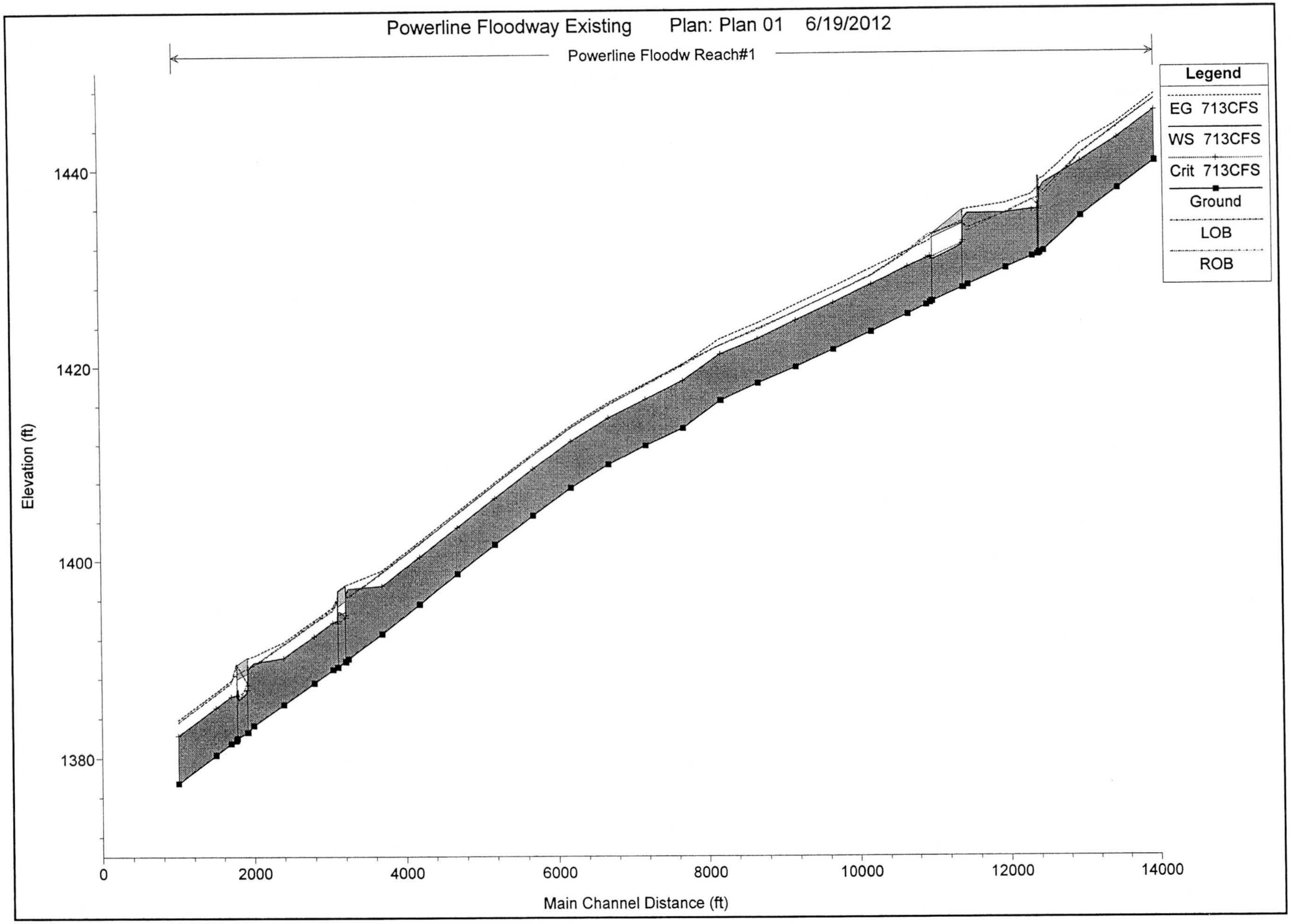
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#1	6200	530.00	1407.38	1411.50	1411.50	1412.90	0.003120	9.50	55.81	20.19	1.01
Reach#1	6700	713.00	1409.73	1414.54	1414.54	1416.13	0.003015	10.13	70.39	22.40	1.01
Reach#1	6700	600.00	1409.73	1414.13	1414.13	1415.61	0.003079	9.76	61.48	21.08	1.01
Reach#1	6700	530.00	1409.73	1413.85	1413.85	1415.26	0.003126	9.50	55.79	20.19	1.01
Reach#1	7200	713.00	1411.70	1416.47	1416.47	1418.06	0.003001	10.12	70.46	22.37	1.00
Reach#1	7200	600.00	1411.70	1416.06	1416.06	1417.53	0.003061	9.74	61.59	21.09	1.00
Reach#1	7200	530.00	1411.70	1415.78	1415.78	1417.18	0.003109	9.48	55.91	20.22	1.00
Reach#1	7700	713.00	1413.49	1418.34	1418.34	1419.98	0.003044	10.28	69.38	21.47	1.01
Reach#1	7700	600.00	1413.49	1417.92	1417.92	1419.44	0.003102	9.89	60.69	20.28	1.01
Reach#1	7700	530.00	1413.49	1417.64	1417.64	1419.07	0.003147	9.61	55.13	19.48	1.01
Reach#1	8200	713.00	1416.33	1421.06	1421.06	1422.65	0.003009	10.10	70.60	22.60	1.01
Reach#1	8200	600.00	1416.33	1420.66	1420.66	1422.13	0.003071	9.72	61.71	21.30	1.01
Reach#1	8200	530.00	1416.33	1420.39	1420.39	1421.78	0.003116	9.46	56.03	20.43	1.01
Reach#1	8700	713.00	1418.05	1422.66	1422.66	1424.22	0.002996	10.02	71.17	23.19	1.01
Reach#1	8700	600.00	1418.05	1422.27	1422.27	1423.71	0.003057	9.63	62.32	21.97	1.01
Reach#1	8700	530.00	1418.05	1422.00	1422.00	1423.36	0.003102	9.35	56.66	21.15	1.01
Reach#1	9200	713.00	1419.73	1424.47	1424.47	1426.04	0.002973	10.06	70.90	22.63	1.00
Reach#1	9200	600.00	1419.73	1424.07	1424.07	1425.52	0.003035	9.69	61.94	21.30	1.00
Reach#1	9200	530.00	1419.73	1423.79	1423.79	1425.17	0.003082	9.43	56.21	20.41	1.00
Reach#1	9700	713.00	1421.47	1426.22	1426.22	1427.79	0.002968	10.05	70.93	22.63	1.00
Reach#1	9700	600.00	1421.47	1425.81	1425.81	1427.27	0.003028	9.68	61.99	21.32	1.00
Reach#1	9700	530.00	1421.47	1425.54	1425.54	1426.92	0.003076	9.42	56.26	20.43	1.00
Reach#1	10200	713.00	1423.30	1428.05	1428.05	1429.63	0.003009	10.10	70.57	22.59	1.01
Reach#1	10200	600.00	1423.30	1427.64	1427.64	1429.11	0.003071	9.73	61.66	21.27	1.01
Reach#1	10200	530.00	1423.30	1427.37	1427.37	1428.76	0.003118	9.47	55.96	20.38	1.01
Reach#1	10700	713.00	1425.06	1429.80	1429.80	1431.40	0.003017	10.15	70.25	22.28	1.01
Reach#1	10700	600.00	1425.06	1429.39	1429.39	1430.88	0.003080	9.77	61.38	20.98	1.01
Reach#1	10700	530.00	1425.06	1429.12	1429.12	1430.52	0.003128	9.51	55.70	20.11	1.01
Reach#1	10950	713.00	1425.97	1430.65	1430.65	1432.26	0.003021	10.18	70.05	22.08	1.01
Reach#1	10950	600.00	1425.97	1430.24	1430.24	1431.73	0.003077	9.79	61.30	20.85	1.01
Reach#1	10950	530.00	1425.97	1429.97	1429.97	1431.37	0.003123	9.52	55.66	20.01	1.01
Reach#1	11000	713.00	1426.18	1430.86	1430.86	1432.47	0.003021	10.18	70.07	22.09	1.01
Reach#1	11000	600.00	1426.18	1430.45	1430.45	1431.94	0.003085	9.80	61.24	20.84	1.01
Reach#1	11000	530.00	1426.18	1430.18	1430.18	1431.59	0.003129	9.53	55.63	20.01	1.01
Reach#1	11023	713.00	1426.33	1430.84	1430.52	1432.57	0.002471	10.58	67.37	18.66	0.89
Reach#1	11023	600.00	1426.33	1430.70	1430.07	1432.01	0.001926	9.19	65.27	18.52	0.79
Reach#1	11023	530.00	1426.33	1430.59	1429.78	1431.67	0.001622	8.33	63.65	18.42	0.72
Reach#1	11229	Culvert									
Reach#1	11438	713.00	1427.71	1434.62	1432.38	1435.52	0.001365	7.61	93.71	17.63	0.58
Reach#1	11438	600.00	1427.71	1433.78	1431.88	1434.67	0.001500	7.57	79.27	16.28	0.60
Reach#1	11438	530.00	1427.71	1433.26	1431.56	1434.12	0.001509	7.44	71.22	14.66	0.60
Reach#1	11500	713.00	1427.98	1435.16		1435.61	0.000513	5.43	131.39	25.37	0.42
Reach#1	11500	600.00	1427.98	1434.31		1434.77	0.000610	5.45	110.00	25.37	0.46
Reach#1	11500	530.00	1427.98	1433.75		1434.23	0.000719	5.54	95.74	25.36	0.50
Reach#1	12000	713.00	1429.64	1435.21		1436.19	0.001603	7.97	89.51	25.53	0.75
Reach#1	12000	600.00	1429.64	1434.34	1434.06	1435.53	0.002336	8.75	68.57	22.67	0.89
Reach#1	12000	530.00	1429.64	1433.78	1433.77	1435.15	0.003087	9.39	56.44	20.77	1.00
Reach#1	12350	713.00	1430.80	1435.56	1435.48	1437.08	0.002815	9.90	72.00	22.49	0.98
Reach#1	12350	600.00	1430.80	1435.07	1435.07	1436.55	0.003075	9.77	61.39	20.99	1.01
Reach#1	12350	530.00	1430.80	1434.87	1434.80	1436.20	0.002911	9.27	57.19	20.37	0.97
Reach#1	12420	713.00	1431.00	1435.58	1435.58	1437.74	0.004134	11.81	60.39	14.07	1.00
Reach#1	12420	600.00	1431.00	1435.09	1435.09	1437.04	0.004098	11.20	53.59	13.90	1.01
Reach#1	12420	530.00	1431.00	1434.79	1434.78	1436.58	0.004038	10.74	49.36	13.80	1.00
Reach#1	12435	Culvert									

HEC-RAS Plan: powerline River: Powerline Floodw Reach: Reach#1 (Continued)

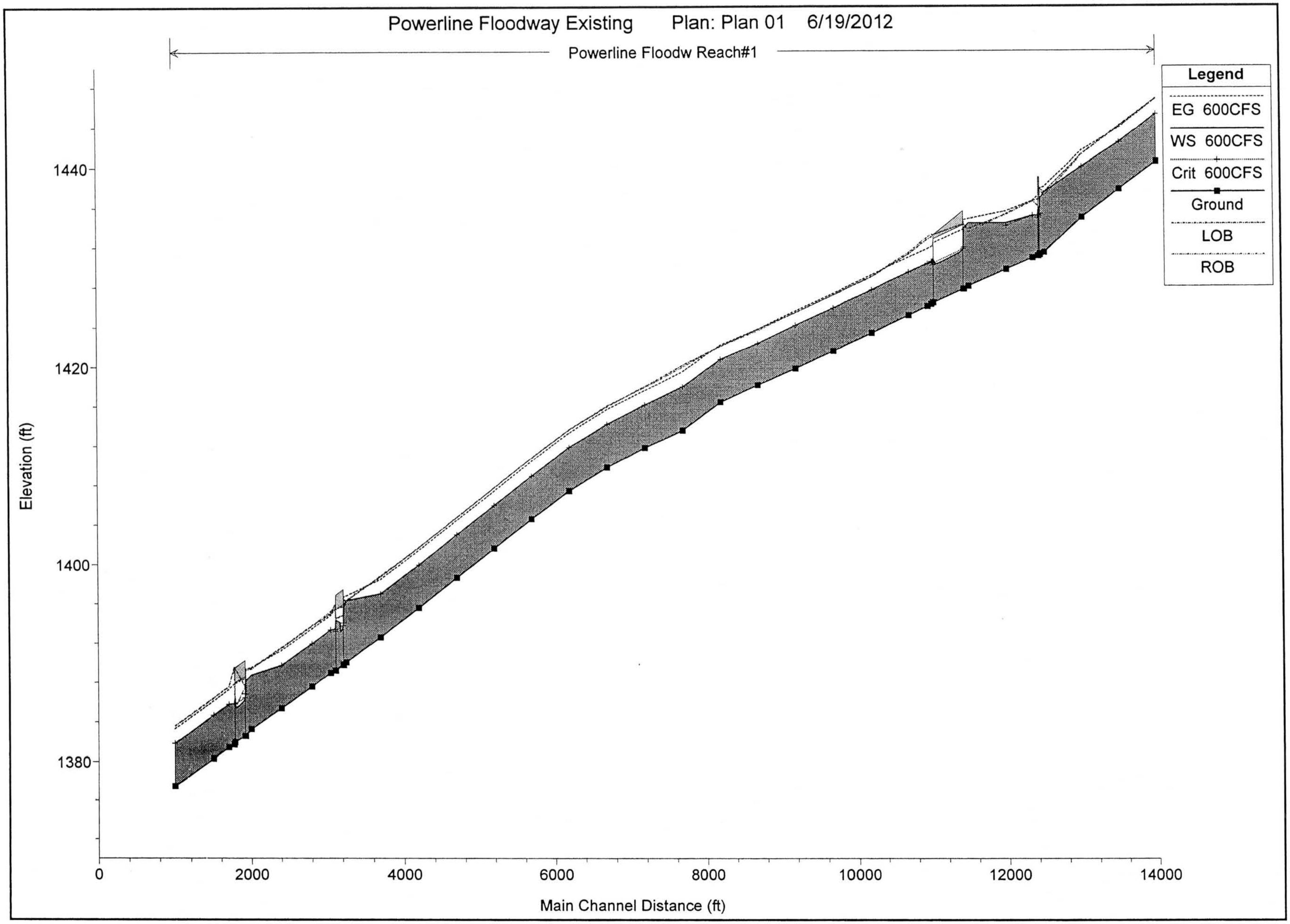
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#1	12448	713.00	1431.11	1437.44	1435.73	1438.61	0.001911	8.69	82.06	15.04	0.66
Reach#1	12448	600.00	1431.11	1436.73	1435.24	1437.80	0.001828	8.31	72.17	13.25	0.63
Reach#1	12448	530.00	1431.11	1436.29	1434.92	1437.28	0.001799	7.99	66.31	13.20	0.63
Reach#1	12500	713.00	1431.35	1438.20		1438.73	0.000634	5.84	122.08	25.39	0.47
Reach#1	12500	600.00	1431.35	1437.37		1437.92	0.000783	5.94	101.00	25.34	0.52
Reach#1	12500	530.00	1431.35	1436.82		1437.39	0.000913	6.07	87.29	24.13	0.56
Reach#1	13000	713.00	1434.89	1440.40	1440.40	1442.11	0.003102	10.51	67.85	19.84	1.00
Reach#1	13000	600.00	1434.89	1439.95	1439.95	1441.54	0.003155	10.12	59.26	18.62	1.00
Reach#1	13000	530.00	1434.89	1439.65	1439.65	1441.16	0.003201	9.86	53.73	17.79	1.00
Reach#1	13500	713.00	1437.67	1442.77	1442.77	1444.35	0.002983	10.07	70.81	22.50	1.00
Reach#1	13500	600.00	1437.67	1442.36	1442.36	1443.82	0.003048	9.71	61.78	21.10	1.00
Reach#1	13500	530.00	1437.67	1442.08	1442.08	1443.47	0.003095	9.46	56.01	20.15	1.00
Reach#1	14000	713.00	1440.43	1445.59	1445.59	1447.21	0.003046	10.20	69.92	22.02	1.01
Reach#1	14000	600.00	1440.43	1445.17	1445.17	1446.68	0.003104	9.83	61.03	20.63	1.01
Reach#1	14000	530.00	1440.43	1444.89	1444.89	1446.32	0.003155	9.59	55.29	19.68	1.01



Powerline Floodway Existing Plan: Plan 01 6/19/2012
Powerline Floodw Reach#1
530 CFS
Legend
EG Capacity
WS Capacity
Crit Capacity
Ground
LOB
ROB
Elevation (ft)
1440
1420
1400
1380
0
2000
4000
6000
8000
10000
12000
14000
Main Channel Distance (ft)



Powerline Floodway Existing Plan: Plan 01 6/19/2012
Powerline Floodw Reach#1
Legend
EG 713CFS
WS 713CFS
Crit 713CFS
Ground
LOB
ROB
Elevation (ft)
1440
1420
1400
1380
0
2000
4000
6000
8000
10000
12000
14000
Main Channel Distance (ft)


Powerline Floodway Existing Plan: Plan 01 6/19/2012
Powerline Floodw Reach#1
Legend
EG 600CFS
WS 600CFS
Crit 600CFS
Ground
LOB
ROB
Elevation (ft)
1440
1420
1400
1380
0
2000
4000
6000
8000
10000
12000
14000
Main Channel Distance (ft)

Proposed Condition with Box Culvert Removed

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX      XX      XXXX
X     X  X        X    X       X   X    X  X    X
X     X  X        X            X   X   X    X   X
XXXXXXX  XXXX     X      XXX   XXXX    XXXXXX    XXXX
X     X  X        X            X X     X    X        X
X     X  X        X    X       X  X    X    X        X
X     X  XXXXXX    XXXX        X   X   X    X   XXXXX
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PROJECT DATA
Project Title: Powerline Floodway Proposed
Project File : ProposedCond.prj
Run Date and Time: 6/19/2012 2:22:47 PM

Project in English units

Project Description:
Powerline Floodway 100-Year HEC-RAS
Hoskin Ryan Consultants, Inc.

****

PLAN DATA

Plan Title: Plan 01
Plan File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedCond.p01

Geometry Title: Powerline Floodway
Geometry File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedCond.g01

Flow Title : Flow 01
Flow File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedCond.f01

Plan Summary Information:

```
Number of:  Cross Sections =  109    Multiple Openings  =    0
            Culverts       =    3    Inline Structures  =    0
            Bridges        =    0    Lateral Structures =    0
```

Computational Information

```
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001
```

Computation Options

```
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow
```

****

FLOW DATA

Flow Title: Flow 01
Flow File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedCond.f01

Flow Data (cfs)

River	Reach	RS	713CFS	600CFS	Capacity
Powerline Floodw	Reach#1	14000	713	600	950

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Powerline Floodw	Reach#1	713CFS	Normal S = 0.0057	Normal S = 0.0057
Powerline Floodw	Reach#1	600CFS	Normal S = 0.0057	Normal S = 0.0057

****

SUMMARY OF MANNING'S N VALUES

River:Powerline Floodw

Reach	River Sta.	n1	n2	n3
Reach#1	14000	.016	.016	.016
Reach#1	13500	.016	.016	.016
Reach#1	13000	.016	.016	.016
Reach#1	12500	.016	.016	.016
Reach#1	12448	.016	.016	.016
Reach#1	12435	Culvert		
Reach#1	12420	.016	.016	.016
Reach#1	12350	.016	.016	.016
Reach#1	12000	.016	.016	.016
Reach#1	11500.1	.016	.016	.016
Reach#1	11500	.016	.016	.016
Reach#1	11497.*	.016	.016	
Reach#1	11494.*	.016	.016	

*Reach#1	* 11491.*	* .016*	.016*	*
*Reach#1	* 11488.*	* .016*	.016*	*
*Reach#1	* 11485.*	* .016*	.016*	*
*Reach#1	* 11482.*	* .016*	.016*	*
*Reach#1	* 11479.*	* .016*	.016*	*
*Reach#1	* 11476.*	* .016*	.016*	*
*Reach#1	* 11473.*	* .016*	.016*	*
*Reach#1	* 11470	* .016*	.016*	.016*
*Reach#1	* 11467.*	* .016*	.016*	*
*Reach#1	* 11464.*	* .016*	.016*	*
*Reach#1	* 11461.*	* .016*	.016*	*
*Reach#1	* 11458.*	* .016*	.016*	*
*Reach#1	* 11455.*	* .016*	.016*	*
*Reach#1	* 11452.*	* .016*	.016*	*
*Reach#1	* 11449.*	* .016*	.016*	*
*Reach#1	* 11446.*	* .016*	.016*	*
*Reach#1	* 11443.*	* .016*	.016*	*
*Reach#1	* 11440	* .016*	.016*	.016*
*Reach#1	* 11438.*	* .016*	.016*	*
*Reach#1	* 11436.*	* .016*	.016*	*
*Reach#1	* 11434.*	* .016*	.016*	*
*Reach#1	* 11432.*	* .016*	.016*	*
*Reach#1	* 11430.*	* .016*	.016*	*
*Reach#1	* 11428.*	* .016*	.016*	*
*Reach#1	* 11426.*	* .016*	.016*	*
*Reach#1	* 11424.*	* .016*	.016*	*
*Reach#1	* 11422.*	* .016*	.016*	*
*Reach#1	* 11420.*	* .016*	.016*	*
*Reach#1	* 11418.*	* .016*	.016*	*
*Reach#1	* 11416.*	* .016*	.016*	*
*Reach#1	* 11414.*	* .016*	.016*	*
*Reach#1	* 11412.*	* .016*	.016*	*
*Reach#1	* 11410.*	* .016*	.016*	*
*Reach#1	* 11408.*	* .016*	.016*	*
*Reach#1	* 11406.*	* .016*	.016*	*
*Reach#1	* 11404.*	* .016*	.016*	*
*Reach#1	* 11402.*	* .016*	.016*	*
*Reach#1	* 11400.*	* .016*	.016*	*
*Reach#1	* 11398.*	* .016*	.016*	*
*Reach#1	* 11396.*	* .016*	.016*	*
*Reach#1	* 11394.*	* .016*	.016*	*
*Reach#1	* 11392.*	* .016*	.016*	*
*Reach#1	* 11390.*	* .016*	.016*	*
*Reach#1	* 11388.*	* .016*	.016*	*
*Reach#1	* 11386.*	* .016*	.016*	*
*Reach#1	* 11384.*	* .016*	.016*	*
*Reach#1	* 11382.*	* .016*	.016*	*
*Reach#1	* 11380.*	* .016*	.016*	*
*Reach#1	* 11378.*	* .016*	.016*	*
*Reach#1	* 11376.*	* .016*	.016*	*
*Reach#1	* 11374.*	* .016*	.016*	*
*Reach#1	* 11372.*	* .016*	.016*	*
*Reach#1	* 11370.*	* .016*	.016*	*
*Reach#1	* 11368.*	* .016*	.016*	*
*Reach#1	* 11366.*	* .016*	.016*	*
*Reach#1	* 11364.*	* .016*	.016*	*
*Reach#1	* 11362.*	* .016*	.016*	*
*Reach#1	* 11360.*	* .016*	.016*	*
*Reach#1	* 11358.*	* .016*	.016*	*
*Reach#1	* 11356.*	* .016*	.016*	*
*Reach#1	* 11354	* .016*	.016*	.016*
*Reach#1	* 11304.*	* .016*	.016*	*
*Reach#1	* 11254.*	* .016*	.016*	*
*Reach#1	* 11204.*	* .016*	.016*	*
*Reach#1	* 11154.*	* .016*	.016*	*
*Reach#1	* 11104.*	* .016*	.016*	*
*Reach#1	* 11054.*	* .016*	.016*	*
*Reach#1	* 11004	* .016*	.016*	.016*
*Reach#1	* 11000	* .016*	.016*	.016*
*Reach#1	* 10950	* .016*	.016*	.016*
*Reach#1	* 10700	* .016*	.016*	.016*
*Reach#1	* 10200	* .016*	.016*	.016*
*Reach#1	* 9700	* .016*	.016*	.016*
*Reach#1	* 9200	* .016*	.016*	.016*
*Reach#1	* 8700	* .016*	.016*	.016*
*Reach#1	* 8200	* .016*	.016*	.016*
*Reach#1	* 7700	* .016*	.016*	.016*
*Reach#1	* 7200	* .016*	.016*	.016*
*Reach#1	* 6700	* .016*	.016*	.016*
*Reach#1	* 6200	* .016*	.016*	.016*
*Reach#1	* 5700	* .016*	.016*	.016*
*Reach#1	* 5200	* .016*	.016*	.016*
*Reach#1	* 4700	* .016*	.016*	.016*
*Reach#1	* 4200	* .016*	.016*	.016*
*Reach#1	* 3700	* .016*	.016*	.016*
*Reach#1	* 3250	* .016*	.016*	.016*
*Reach#1	* 3221	* .016*	.016*	.016*
*Reach#1	* 3164	*Culvert *	*	*
*Reach#1	* 3108	* .016*	.016*	.016*
*Reach#1	* 3050	* .016*	.016*	.016*
*Reach#1	* 2800	* .016*	.016*	.016*
*Reach#1	* 2400	* .016*	.016*	.016*
*Reach#1	* 2000	* .016*	.016*	.016*
*Reach#1	* 1924	* .016*	.016*	.016*
*Reach#1	* 1848	*Culvert *	*	*
*Reach#1	* 1771	* .016*	.016*	.016*
*Reach#1	* 1700	* .016*	.016*	.016*
*Reach#1	* 1500	* .016*	.016*	.016*
*Reach#1	* 1000	* .016*	.016*	.016*

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SUMMARY OF REACH LENGTHS

River: Powerline Floodw

Reach	River Sta.	Left	Channel	Right
Reach#1	14000	500	500	500
Reach#1	13500	500	500	500
Reach#1	13000	507	500	493
Reach#1	12500	52	52	52
Reach#1	12448	28	28	28
Reach#1	12435	Culvert		
Reach#1	12420	70	70	70
Reach#1	12350	350	350	350
Reach#1	12000	500	500	500
Reach#1	11500.1	.1	.1	.1
Reach#1	11500	3	3	3
Reach#1	11497.*	3	3	3
Reach#1	11494.*	3	3	3
Reach#1	11491.*	3	3	3
Reach#1	11488.*	3	3	3
Reach#1	11485.*	3	3	3
Reach#1	11482.*	3	3	3
Reach#1	11479.*	3	3	3
Reach#1	11476.*	3	3	3
Reach#1	11473.*	3	3	3
Reach#1	11470	3	3	3
Reach#1	11467.*	3	3	3
Reach#1	11464.*	3	3	3
Reach#1	11461.*	3	3	3
Reach#1	11458.*	3	3	3
Reach#1	11455.*	3	3	3
Reach#1	11452.*	3	3	3
Reach#1	11449.*	3	3	3
Reach#1	11446.*	3	3	3
Reach#1	11443.*	3	3	3
Reach#1	11440	2	2	2
Reach#1	11438.*	2	2	2
Reach#1	11436.*	2	2	2
Reach#1	11434.*	2	2	2
Reach#1	11432.*	2	2	2
Reach#1	11430.*	2	2	2
Reach#1	11428.*	2	2	2
Reach#1	11426.*	2	2	2
Reach#1	11424.*	2	2	2
Reach#1	11422.*	2	2	2
Reach#1	11420.*	2	2	2
Reach#1	11418.*	2	2	2
Reach#1	11416.*	2	2	2
Reach#1	11414.*	2	2	2
Reach#1	11412.*	2	2	2
Reach#1	11410.*	2	2	2
Reach#1	11408.*	2	2	2
Reach#1	11406.*	2	2	2
Reach#1	11404.*	2	2	2
Reach#1	11402.*	2	2	2
Reach#1	11400.*	2	2	2
Reach#1	11398.*	2	2	2
Reach#1	11396.*	2	2	2
Reach#1	11394.*	2	2	2
Reach#1	11392.*	2	2	2
Reach#1	11390.*	2	2	2
Reach#1	11388.*	2	2	2
Reach#1	11386.*	2	2	2
Reach#1	11384.*	2	2	2
Reach#1	11382.*	2	2	2
Reach#1	11380.*	2	2	2
Reach#1	11378.*	2	2	2
Reach#1	11376.*	2	2	2
Reach#1	11374.*	2	2	2
Reach#1	11372.*	2	2	2
Reach#1	11370.*	2	2	2
Reach#1	11368.*	2	2	2
Reach#1	11366.*	2	2	2
Reach#1	11364.*	2	2	2
Reach#1	11362.*	2	2	2
Reach#1	11360.*	2	2	2
Reach#1	11358.*	2	2	2
Reach#1	11356.*	2	2	2
Reach#1	11354	50	50	50
Reach#1	11304.*	50	50	50
Reach#1	11254.*	50	50	50
Reach#1	11204.*	50	50	50
Reach#1	11154.*	50	50	50
Reach#1	11104.*	50	50	50
Reach#1	11054.*	50	50	50
Reach#1	11004	4	4	4
Reach#1	11000	50	50	50
Reach#1	10950	250	250	250
Reach#1	10700	500	500	500
Reach#1	10200	500	500	500
Reach#1	9700	500	500	500
Reach#1	9200	500	500	500
Reach#1	8700	500	500	500
Reach#1	8200	500	500	500
Reach#1	7700	500	500	500
Reach#1	7200	500	500	500
Reach#1	6700	500	500	500
Reach#1	6200	500	500	500
Reach#1	5700	500	500	500
Reach#1	5200	500	500	500
Reach#1	4700	500	500	500
Reach#1	4200	500	500	500
Reach#1	3700	450	450	450
Reach#1	3250	29	29	29
Reach#1	3221	113	113	113
Reach#1	3164	Culvert		
Reach#1	3108	58	58	58
Reach#1	3050	250	250	250

Reach#1	2800	400	400	400
Reach#1	2400	400	400	400
Reach#1	2000	76	76	76
Reach#1	1924	153	153	153
Reach#1	1848	Culvert		
Reach#1	1771	71	71	71
Reach#1	1700	200	200	200
Reach#1	1500	500	500	500
Reach#1	1000	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Powerline Floodw

Reach	River Sta.	Contr.	Expan.
Reach#1	14000	.1	.3
Reach#1	13500	.1	.3
Reach#1	13000	.1	.3
Reach#1	12500	.1	.3
Reach#1	12448	.1	.3
Reach#1	12435	Culvert	
Reach#1	12420	.1	.3
Reach#1	12350	.1	.3
Reach#1	12000	.1	.3
Reach#1	11500.1	.1	.3
Reach#1	11500	.1	.3
Reach#1	11497.*	.1	.3
Reach#1	11494.*	.1	.3
Reach#1	11491.*	.1	.3
Reach#1	11488.*	.1	.3
Reach#1	11485.*	.1	.3
Reach#1	11482.*	.1	.3
Reach#1	11479.*	.1	.3
Reach#1	11476.*	.1	.3
Reach#1	11473.*	.1	.3
Reach#1	11470	.1	.3
Reach#1	11467.*	.1	.3
Reach#1	11464.*	.1	.3
Reach#1	11461.*	.1	.3
Reach#1	11458.*	.1	.3
Reach#1	11455.*	.1	.3
Reach#1	11452.*	.1	.3
Reach#1	11449.*	.1	.3
Reach#1	11446.*	.1	.3
Reach#1	11443.*	.1	.3
Reach#1	11440	.1	.3
Reach#1	11438.*	.1	.3
Reach#1	11436.*	.1	.3
Reach#1	11434.*	.1	.3
Reach#1	11432.*	.1	.3
Reach#1	11430.*	.1	.3
Reach#1	11428.*	.1	.3
Reach#1	11426.*	.1	.3
Reach#1	11424.*	.1	.3
Reach#1	11422.*	.1	.3
Reach#1	11420.*	.1	.3
Reach#1	11418.*	.1	.3
Reach#1	11416.*	.1	.3
Reach#1	11414.*	.1	.3
Reach#1	11412.*	.1	.3
Reach#1	11410.*	.1	.3
Reach#1	11408.*	.1	.3
Reach#1	11406.*	.1	.3
Reach#1	11404.*	.1	.3
Reach#1	11402.*	.1	.3
Reach#1	11400.*	.1	.3
Reach#1	11398.*	.1	.3
Reach#1	11396.*	.1	.3
Reach#1	11394.*	.1	.3
Reach#1	11392.*	.1	.3
Reach#1	11390.*	.1	.3
Reach#1	11388.*	.1	.3
Reach#1	11386.*	.1	.3
Reach#1	11384.*	.1	.3
Reach#1	11382.*	.1	.3
Reach#1	11380.*	.1	.3
Reach#1	11378.*	.1	.3
Reach#1	11376.*	.1	.3
Reach#1	11374.*	.1	.3
Reach#1	11372.*	.1	.3
Reach#1	11370.*	.1	.3
Reach#1	11368.*	.1	.3
Reach#1	11366.*	.1	.3
Reach#1	11364.*	.1	.3
Reach#1	11362.*	.1	.3
Reach#1	11360.*	.1	.3
Reach#1	11358.*	.1	.3
Reach#1	11356.*	.1	.3
Reach#1	11354	.1	.3
Reach#1	11304.*	.1	.3
Reach#1	11254.*	.1	.3
Reach#1	11204.*	.1	.3
Reach#1	11154.*	.1	.3
Reach#1	11104.*	.1	.3
Reach#1	11054.*	.1	.3
Reach#1	11004	.1	.3
Reach#1	11000	.1	.3
Reach#1	10950	.1	.3
Reach#1	10700	.1	.3
Reach#1	10200	.1	.3
Reach#1	9700	.1	.3
Reach#1	9200	.1	.3

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*Reach#1       *    8700   *        .1*       .3*
*Reach#1       *    8200   *        .1*       .3*
*Reach#1       *    7700   *        .1*       .3*
*Reach#1       *    7200   *        .1*       .3*
*Reach#1       *    6700   *        .1*       .3*
*Reach#1       *    6200   *        .1*       .3*
*Reach#1       *    5700   *        .1*       .3*
*Reach#1       *    5200   *        .1*       .3*
*Reach#1       *    4700   *        .1*       .3*
*Reach#1       *    4200   *        .1*       .3*
*Reach#1       *    3700   *        .1*       .3*
*Reach#1       *    3250   *        .1*       .3*
*Reach#1       *    3221   *        .1*       .3*
*Reach#1       *    3164   *Culvert  *         *
*Reach#1       *    3108   *        .1*       .3*
*Reach#1       *    3050   *        .1*       .3*
*Reach#1       *    2800   *        .1*       .3*
*Reach#1       *    2400   *        .1*       .3*
*Reach#1       *    2000   *        .1*       .3*
*Reach#1       *    1924   *        .1*       .3*
*Reach#1       *    1848   *Culvert  *         *
*Reach#1       *    1771   *        .1*       .3*
*Reach#1       *    1700   *        .1*       .3*
*Reach#1       *    1500   *        .1*       .3*
*Reach#1       *    1000   *        .1*       .3*
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HEC-RAS Plan: powerline River: Powerline Floodw Reach: Reach#1

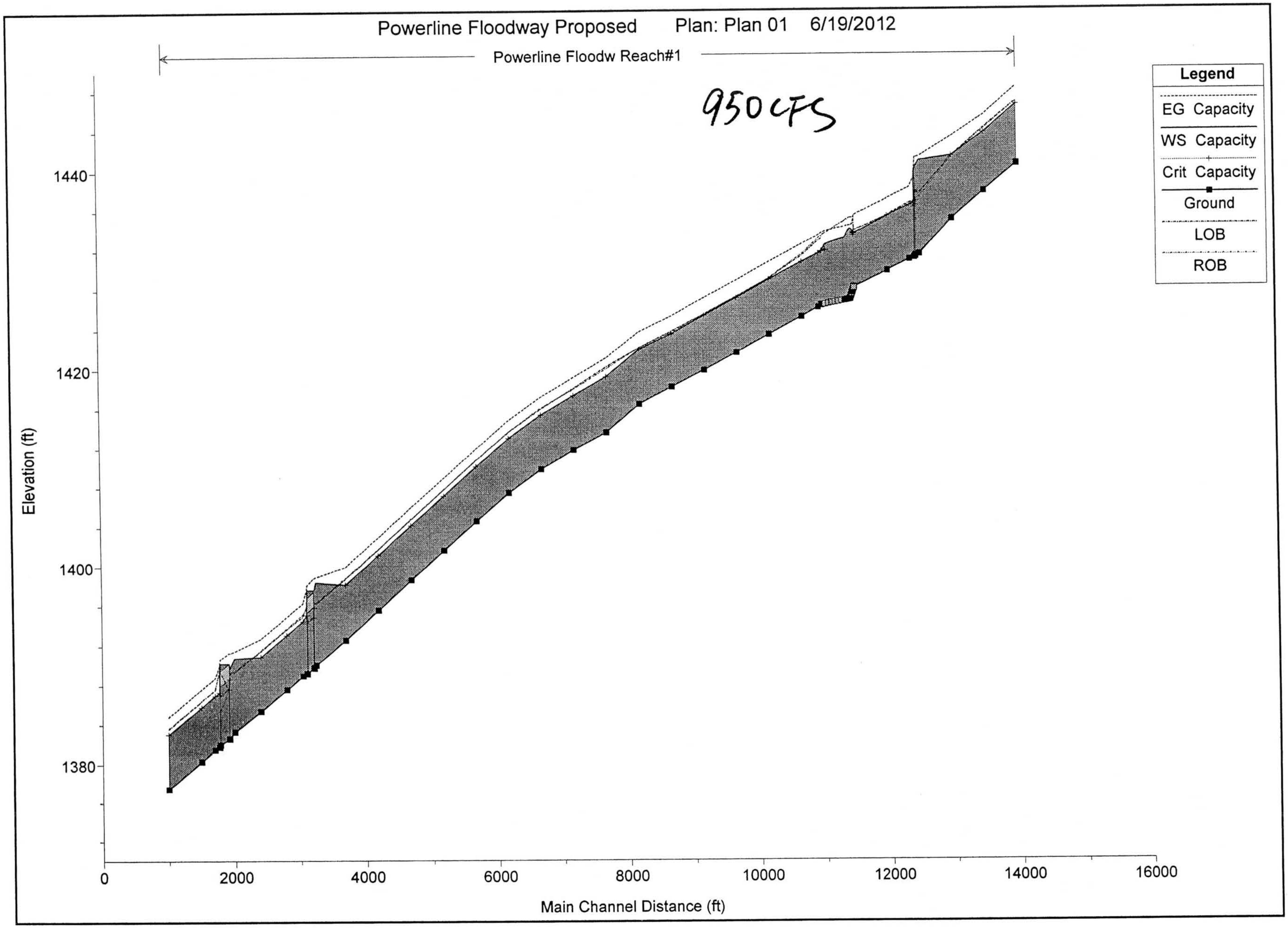
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#1	1000	713.00	1377.46	1382.26	1382.26	1383.84	0.002971	10.08	70.74	22.43	1.00
Reach#1	1000	600.00	1377.46	1381.85	1381.85	1383.32	0.003033	9.71	61.80	21.11	1.00
Reach#1	1000	950.00	1377.46	1383.01	1383.01	1384.80	0.002884	10.74	88.48	24.83	1.00
Reach#1	1500	713.00	1380.31	1385.06	1385.06	1386.65	0.003008	10.10	70.58	22.58	1.01
Reach#1	1500	600.00	1380.31	1384.66	1384.66	1386.13	0.003068	9.73	61.68	21.26	1.01
Reach#1	1500	950.00	1380.31	1385.81	1385.81	1387.61	0.002910	10.75	88.38	25.01	1.01
Reach#1	1700	713.00	1381.45	1386.20	1386.20	1387.79	0.003011	10.11	70.50	22.52	1.01
Reach#1	1700	600.00	1381.45	1385.79	1385.79	1387.26	0.003074	9.74	61.59	21.21	1.01
Reach#1	1700	950.00	1381.45	1386.95	1386.95	1388.75	0.002907	10.75	88.33	24.94	1.01
Reach#1	1771	713.00	1381.73	1386.35	1386.35	1388.56	0.004411	11.93	59.75	13.64	1.00
Reach#1	1771	600.00	1381.73	1385.86	1385.86	1387.84	0.004350	11.29	53.13	13.56	1.01
Reach#1	1771	950.00	1381.73	1387.29	1387.29	1389.94	0.004555	13.08	72.63	13.79	1.00
Reach#1	1848	Culvert									
Reach#1	1924	713.00	1382.59	1388.95	1387.36	1390.15	0.002070	8.80	81.04	16.84	0.71
Reach#1	1924	600.00	1382.59	1388.13	1386.86	1389.33	0.002222	8.79	68.28	14.36	0.71
Reach#1	1924	950.00	1382.59	1389.67	1388.66	1391.27	0.002474	10.12	93.88	17.80	0.78
Reach#1	2000	713.00	1383.27	1389.65		1390.30	0.000883	6.45	110.47	26.94	0.56
Reach#1	2000	600.00	1383.27	1388.75		1389.49	0.001214	6.90	86.93	24.82	0.65
Reach#1	2000	950.00	1383.27	1390.73		1391.45	0.000788	6.81	139.50	26.94	0.53
Reach#1	2400	713.00	1385.38	1390.15	1390.15	1391.72	0.002964	10.05	70.93	22.60	1.00
Reach#1	2400	600.00	1385.38	1389.73	1389.73	1391.20	0.003077	9.74	61.59	21.22	1.01
Reach#1	2400	950.00	1385.38	1390.89	1390.89	1392.68	0.002908	10.75	88.37	24.98	1.01
Reach#1	2800	713.00	1387.56	1392.33	1392.33	1393.90	0.002960	10.05	70.93	22.57	1.00
Reach#1	2800	600.00	1387.56	1391.91	1391.91	1393.38	0.003076	9.75	61.57	21.19	1.01
Reach#1	2800	950.00	1387.56	1393.07	1393.07	1394.86	0.002904	10.75	88.37	24.93	1.01
Reach#1	3050	713.00	1388.95	1393.69	1393.69	1395.28	0.003003	10.12	70.42	22.36	1.01
Reach#1	3050	600.00	1388.95	1393.29	1393.29	1394.75	0.003031	9.71	61.79	21.09	1.00
Reach#1	3050	950.00	1388.95	1394.45	1394.45	1396.24	0.002884	10.74	88.43	24.79	1.00
Reach#1	3108	713.00	1389.19	1393.88	1393.88	1396.18	0.004565	12.18	58.53	12.78	1.00
Reach#1	3108	600.00	1389.19	1393.37	1393.37	1395.43	0.004487	11.53	52.03	12.72	1.00
Reach#1	3108	950.00	1389.19	1395.07	1395.07	1397.60	0.004430	12.77	74.40	14.73	1.00
Reach#1	3164	Culvert									
Reach#1	3221	713.00	1389.74	1396.42	1394.51	1397.48	0.001763	8.25	86.42	17.67	0.66
Reach#1	3221	600.00	1389.74	1395.60	1394.00	1396.65	0.001889	8.23	72.93	15.17	0.66
Reach#1	3221	950.00	1389.74	1397.53	1395.81	1398.77	0.001756	8.97	105.93	17.67	0.65
Reach#1	3250	713.00	1390.01	1397.09		1397.56	0.000550	5.51	129.48	26.87	0.44
Reach#1	3250	600.00	1390.01	1396.25		1396.74	0.000687	5.61	106.88	26.83	0.50
Reach#1	3250	950.00	1390.01	1398.35		1398.87	0.000499	5.82	163.14	26.87	0.42
Reach#1	3700	713.00	1392.54	1397.36	1397.36	1398.93	0.002969	10.07	70.84	22.53	1.00
Reach#1	3700	600.00	1392.54	1396.95	1396.95	1398.41	0.003035	9.70	61.84	21.19	1.00
Reach#1	3700	950.00	1392.54	1398.10	1398.10	1399.89	0.002913	10.76	88.27	24.91	1.01
Reach#1	4200	713.00	1395.52	1400.33	1400.33	1401.89	0.002946	10.02	71.12	22.66	1.00
Reach#1	4200	600.00	1395.52	1399.90	1399.90	1401.37	0.003061	9.72	61.73	21.27	1.01
Reach#1	4200	950.00	1395.52	1401.06	1401.06	1402.85	0.002897	10.73	88.52	25.02	1.01
Reach#1	4700	713.00	1398.57	1403.35	1403.35	1404.93	0.002998	10.09	70.66	22.58	1.01
Reach#1	4700	600.00	1398.57	1402.96	1402.96	1404.41	0.003021	9.67	62.03	21.30	1.00
Reach#1	4700	950.00	1398.57	1404.10	1404.10	1405.89	0.002907	10.74	88.42	25.01	1.01
Reach#1	5200	713.00	1401.56	1406.34	1406.34	1407.90	0.002959	10.05	70.94	22.56	1.00
Reach#1	5200	600.00	1401.56	1405.91	1405.91	1407.38	0.003059	9.72	61.70	21.20	1.00
Reach#1	5200	950.00	1401.56	1407.08	1407.08	1408.86	0.002880	10.72	88.63	24.95	1.00
Reach#1	5700	713.00	1404.53	1409.30	1409.30	1410.90	0.003014	10.13	70.39	22.41	1.01
Reach#1	5700	600.00	1404.53	1408.90	1408.90	1410.37	0.003068	9.75	61.56	21.11	1.01
Reach#1	5700	950.00	1404.53	1410.06	1410.06	1411.86	0.002907	10.76	88.26	24.84	1.01
Reach#1	6200	713.00	1407.38	1412.19	1412.19	1413.78	0.003012	10.13	70.40	22.39	1.01
Reach#1	6200	600.00	1407.38	1411.78	1411.78	1413.26	0.003063	9.74	61.58	21.09	1.00

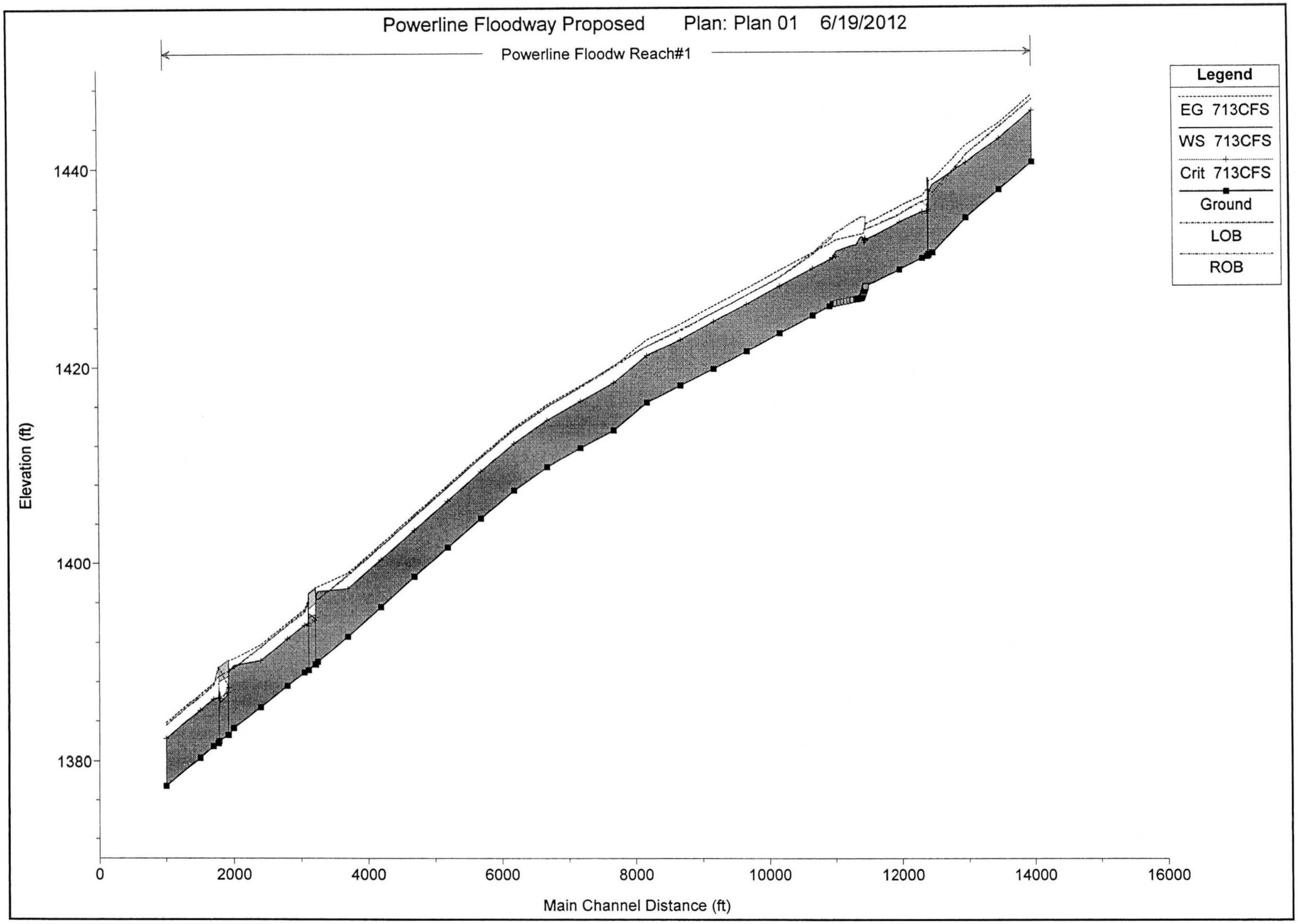
HEC-RAS Plan: powerline River: Powerline Floodw Reach: Reach#1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#1	6200	950.00	1407.38	1412.94	1412.94	1414.74	0.002912	10.77	88.20	24.82	1.01
Reach#1	6700	713.00	1409.73	1414.54	1414.54	1416.13	0.003015	10.13	70.39	22.40	1.01
Reach#1	6700	600.00	1409.73	1414.13	1414.13	1415.61	0.003079	9.76	61.48	21.08	1.01
Reach#1	6700	950.00	1409.73	1415.29	1415.29	1417.10	0.002913	10.77	88.20	24.83	1.01
Reach#1	7200	713.00	1411.70	1416.47	1416.47	1418.06	0.003001	10.12	70.46	22.37	1.00
Reach#1	7200	600.00	1411.70	1416.06	1416.06	1417.53	0.003061	9.74	61.59	21.09	1.00
Reach#1	7200	950.00	1411.70	1417.23	1417.23	1419.02	0.002877	10.74	88.49	24.77	1.00
Reach#1	7700	713.00	1413.49	1418.34	1418.34	1419.98	0.003044	10.28	69.38	21.47	1.01
Reach#1	7700	600.00	1413.49	1417.92	1417.92	1419.44	0.003102	9.89	60.69	20.28	1.01
Reach#1	7700	950.00	1413.49	1419.11	1419.11	1420.97	0.002946	10.95	86.79	23.69	1.01
Reach#1	8200	713.00	1416.33	1421.06	1421.06	1422.65	0.003009	10.10	70.60	22.60	1.01
Reach#1	8200	600.00	1416.33	1420.66	1420.66	1422.13	0.003071	9.72	61.71	21.30	1.01
Reach#1	8200	950.00	1416.33	1421.82	1421.82	1423.60	0.002888	10.72	88.63	25.04	1.00
Reach#1	8700	713.00	1418.05	1422.66	1422.66	1424.22	0.002996	10.02	71.17	23.19	1.01
Reach#1	8700	600.00	1418.05	1422.27	1422.27	1423.71	0.003057	9.63	62.32	21.97	1.01
Reach#1	8700	950.00	1418.05	1423.40	1423.40	1425.16	0.002873	10.66	89.15	25.50	1.00
Reach#1	9200	713.00	1419.73	1424.47	1424.47	1426.04	0.002973	10.06	70.90	22.63	1.00
Reach#1	9200	600.00	1419.73	1424.07	1424.07	1425.52	0.003035	9.69	61.94	21.30	1.00
Reach#1	9200	950.00	1419.73	1425.22	1425.22	1427.00	0.002891	10.72	88.60	25.03	1.00
Reach#1	9700	713.00	1421.47	1426.22	1426.22	1427.79	0.002968	10.05	70.93	22.63	1.00
Reach#1	9700	600.00	1421.47	1425.81	1425.81	1427.27	0.003028	9.68	61.99	21.32	1.00
Reach#1	9700	950.00	1421.47	1426.96	1426.96	1428.75	0.002889	10.72	88.60	25.03	1.00
Reach#1	10200	713.00	1423.30	1428.05	1428.05	1429.63	0.003009	10.10	70.57	22.59	1.01
Reach#1	10200	600.00	1423.30	1427.64	1427.64	1429.11	0.003071	9.73	61.66	21.27	1.01
Reach#1	10200	950.00	1423.30	1428.81	1428.81	1430.59	0.002885	10.71	88.66	25.05	1.00
Reach#1	10700	713.00	1425.06	1429.80	1429.80	1431.40	0.003017	10.15	70.25	22.28	1.01
Reach#1	10700	600.00	1425.06	1429.39	1429.39	1430.88	0.003080	9.77	61.38	20.98	1.01
Reach#1	10700	950.00	1425.06	1430.56	1430.56	1432.37	0.002918	10.80	87.98	24.66	1.01
Reach#1	10950	713.00	1425.97	1430.65	1430.65	1432.26	0.003021	10.18	70.05	22.08	1.01
Reach#1	10950	600.00	1425.97	1430.24	1430.24	1431.73	0.003077	9.79	61.30	20.85	1.01
Reach#1	10950	950.00	1425.97	1431.41	1431.41	1433.23	0.002916	10.83	87.73	24.39	1.01
Reach#1	11000	713.00	1426.18	1430.86	1430.86	1432.47	0.003021	10.18	70.07	22.09	1.01
Reach#1	11000	600.00	1426.18	1430.45	1430.45	1431.94	0.003085	9.80	61.24	20.84	1.01
Reach#1	11000	950.00	1426.18	1431.62	1431.62	1433.44	0.002922	10.84	87.67	24.39	1.01
Reach#1	11004	713.00	1426.22	1430.90	1430.90	1432.50	0.002977	10.13	70.37	22.05	1.00
Reach#1	11004	600.00	1426.22	1430.49	1430.49	1431.97	0.003034	9.75	61.56	20.82	1.00
Reach#1	11004	950.00	1426.22	1431.66	1431.66	1433.47	0.002888	10.80	87.94	24.32	1.00
Reach#1	11354	713.00	1426.66	1432.17		1433.15	0.001548	7.96	89.58	24.53	0.73
Reach#1	11354	600.00	1426.66	1431.72		1432.62	0.001545	7.60	78.91	23.18	0.73
Reach#1	11354	950.00	1426.66	1432.99		1434.13	0.001552	8.58	110.70	26.98	0.75
Reach#1	11440	713.00	1426.79	1432.99		1433.26	0.000291	4.15	171.65	32.42	0.32
Reach#1	11440	600.00	1426.79	1432.49		1432.72	0.000272	3.85	155.68	31.66	0.31
Reach#1	11440	950.00	1426.79	1433.90		1434.24	0.000327	4.71	201.70	33.80	0.34
Reach#1	11470	713.00	1427.40	1432.84		1433.35	0.001007	5.74	124.12	36.62	0.55
Reach#1	11470	600.00	1427.40	1432.32		1432.82	0.001179	5.69	105.36	35.84	0.59
Reach#1	11470	950.00	1427.40	1433.77		1434.32	0.000846	5.98	158.87	38.03	0.52
Reach#1	11500	713.00	1428.00	1432.68	1432.68	1434.28	0.002979	10.14	70.35	37.16	1.00
Reach#1	11500	600.00	1428.00	1432.25	1432.25	1433.75	0.003086	9.81	61.17	35.86	1.01
Reach#1	11500	950.00	1428.00	1433.43	1433.41	1435.25	0.002923	10.85	87.55	39.42	1.01
Reach#1	11500.1	713.00	1428.00	1432.68	1432.68	1434.28	0.002977	10.13	70.37	22.05	1.00
Reach#1	11500.1	600.00	1428.00	1432.37	1432.25	1433.75	0.002784	9.44	63.53	21.10	0.96
Reach#1	11500.1	950.00	1428.00	1433.44	1433.43	1435.25	0.002902	10.82	87.79	24.30	1.00
Reach#1	12000	713.00	1429.64	1434.46	1434.46	1436.01	0.002962	9.99	71.36	23.08	1.00
Reach#1	12000	600.00	1429.64	1434.06	1434.06	1435.50	0.003019	9.62	62.37	21.72	1.00
Reach#1	12000	950.00	1429.64	1435.18	1435.18	1436.95	0.002893	10.68	88.97	25.47	1.01

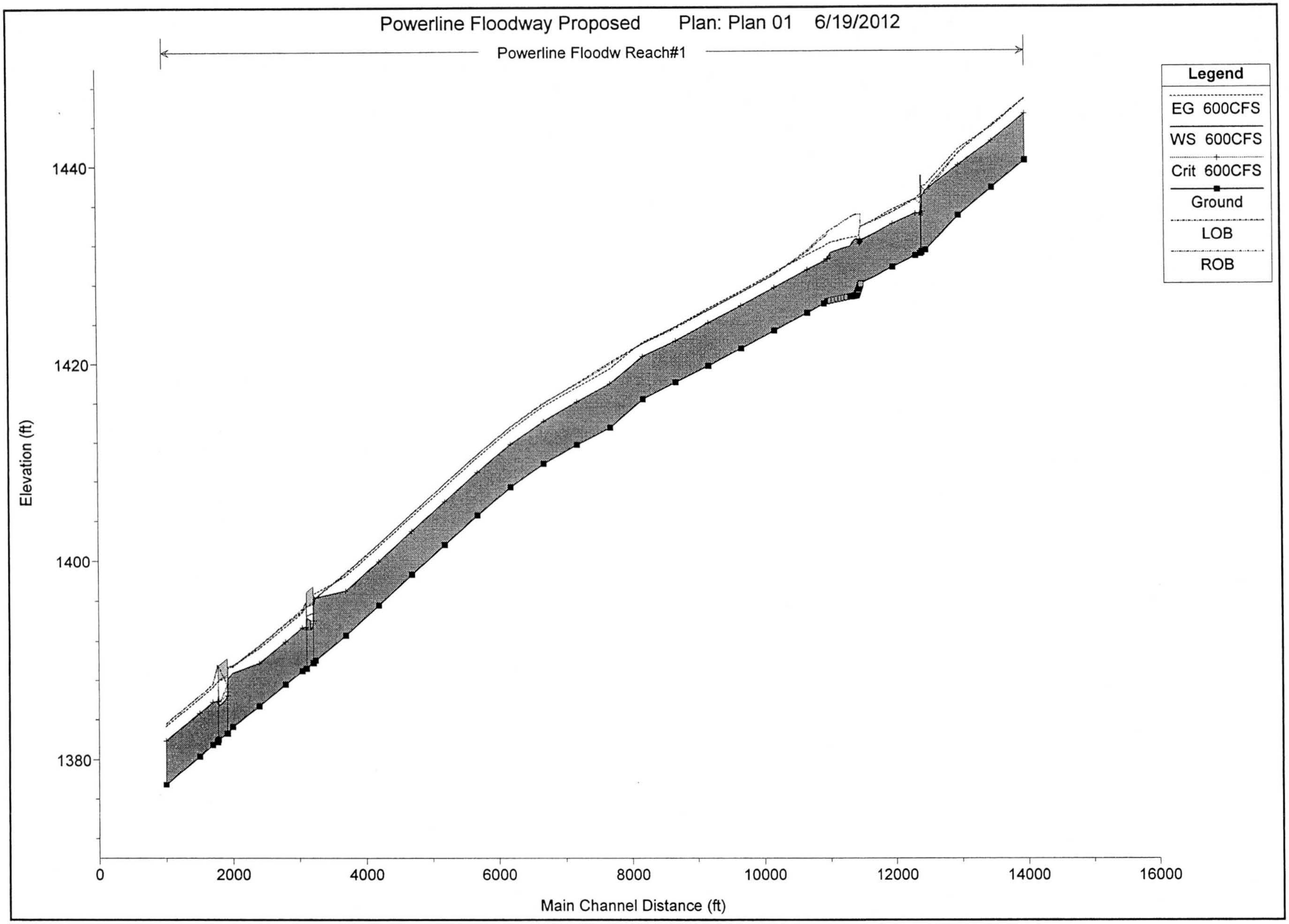
HEC-RAS Plan: powerline River: Powerline Floodw Reach: Reach#1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#1	12350	713.00	1430.80	1435.48	1435.48	1437.08	0.003012	10.15	70.22	22.24	1.01
Reach#1	12350	600.00	1430.80	1435.10	1435.07	1436.55	0.003006	9.69	61.91	21.07	1.00
Reach#1	12350	950.00	1430.80	1436.26	1436.26	1438.05	0.002865	10.74	88.41	24.62	1.00
Reach#1	12420	713.00	1431.00	1435.58	1435.58	1437.74	0.004134	11.81	60.39	14.07	1.00
Reach#1	12420	600.00	1431.00	1435.09	1435.09	1437.04	0.004098	11.20	53.59	13.90	1.01
Reach#1	12420	950.00	1431.00	1436.51	1436.51	1439.09	0.004242	12.91	73.59	14.32	1.00
Reach#1	12435	Culvert									
Reach#1	12448	713.00	1431.11	1437.44	1435.73	1438.61	0.001911	8.69	82.06	15.04	0.66
Reach#1	12448	600.00	1431.11	1436.73	1435.24	1437.80	0.001828	8.31	72.17	13.25	0.63
Reach#1	12448	950.00	1431.11	1440.17	1436.68	1441.05	0.001083	7.57	125.49	15.99	0.48
Reach#1	12500	713.00	1431.35	1438.20		1438.73	0.000634	5.84	122.08	25.39	0.47
Reach#1	12500	600.00	1431.35	1437.37		1437.92	0.000783	5.94	101.00	25.34	0.52
Reach#1	12500	950.00	1431.35	1440.73		1441.13	0.000336	5.10	186.31	25.39	0.33
Reach#1	13000	713.00	1434.89	1440.40	1440.40	1442.11	0.003102	10.51	67.85	19.84	1.00
Reach#1	13000	600.00	1434.89	1439.95	1439.95	1441.54	0.003155	10.12	59.26	18.62	1.00
Reach#1	13000	950.00	1434.89	1441.21	1441.21	1443.15	0.003013	11.20	84.81	21.93	1.00
Reach#1	13500	713.00	1437.67	1442.77	1442.77	1444.35	0.002983	10.07	70.81	22.50	1.00
Reach#1	13500	600.00	1437.67	1442.36	1442.36	1443.82	0.003048	9.71	61.78	21.10	1.00
Reach#1	13500	950.00	1437.67	1443.53	1443.53	1445.31	0.002880	10.71	88.70	24.90	1.00
Reach#1	14000	713.00	1440.43	1445.59	1445.59	1447.21	0.003046	10.20	69.92	22.02	1.01
Reach#1	14000	600.00	1440.43	1445.17	1445.17	1446.68	0.003104	9.83	61.03	20.63	1.01
Reach#1	14000	950.00	1440.43	1446.37	1446.37	1448.18	0.002920	10.79	88.07	24.61	1.00


Powerline Floodway Proposed Plan: Plan 01 6/19/2012
Powerline Floodw Reach#1
950 CFS
Legend
EG Capacity
WS Capacity
Crit Capacity
Ground
LOB
ROB
Elevation (ft)
1440
1420
1400
1380
Main Channel Distance (ft)
0
2000
4000
6000
8000
10000
12000
14000
16000



Powerline Floodway Proposed Plan: Plan 01 6/19/2012
Powerline Floodw Reach#1
Legend
EG 713CFS
WS 713CFS
Crit 713CFS
Ground
LOB
ROB
Elevation (ft)
1440
1420
1400
1380
0
2000
4000
6000
8000
10000
12000
14000
16000
Main Channel Distance (ft)



Powerline Floodway Proposed Plan: Plan 01 6/19/2012
Powerline Floodw Reach#1
Legend
EG 600CFS
WS 600CFS
Crit 600CFS
Ground
LOB
ROB
Elevation (ft)
1440
1420
1400
1380
0
2000
4000
6000
8000
10000
12000
14000
16000
Main Channel Distance (ft)

Proposed Condition with Junction Structure

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX   XXXX       XXXX     XX    XXXX
X     X  X       X    X      X   X   X  X   X
X     X  X       X           X   X  X    X  X
XXXXXXX  XXXX    X      XXX  XXXX   XXXXXX   XXXX
X     X  X       X           X X    X    X      X
X     X  X       X    X      X  X   X    X      X
X     X  XXXXXX   XXXX       X   X  X    X  XXXXX
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PROJECT DATA
Project Title: Powerline Floodway Proposed w/ Junction
Project File : ProposedJunction.prj
Run Date and Time: 6/25/2012 5:59:53 PM

Project in English units

Project Description:
Powerline Floodway 100-Year HEC-RAS
Hoskin Ryan Consultants, Inc.

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PLAN DATA

Plan Title: Plan 01
Plan File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedJunction.p01

Geometry Title: Powerline Floodway
Geometry File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedJunction.g01

Flow Title : Flow 01
Flow File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedJunction.f01

```
Plan Summary Information:
Number of:  Cross Sections =  123   Multiple Openings  =   0
            Culverts       =    3   Inline Structures  =   0
            Bridges        =    0   Lateral Structures =   0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow
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FLOW DATA

Flow Title: Flow 01
Flow File : G:\Projects\11\11-023 Mesa Proving Grounds Infra\01 -MPG Infrastructure\Hydro\HEC-RAS\ProposedJunction.f01

Flow Data (cfs)

River	Reach	RS	520CFS
Powerline Floodw	Reach#1	14000	176
Powerline Floodw	Spillway	66	344
Powerline Floodw	Reach#2	11440	520

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Powerline Floodw	Reach#1	520CFS	Normal S = 0.0057	
Powerline Floodw	Spillway	520CFS	Known WS = 1434.5	
Powerline Floodw	Reach#2	520CFS		Normal S = 0.0057

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SUMMARY OF MANNING'S N VALUES

River:Powerline Floodw

Reach	River Sta.	n1	n2	n3
Reach#1	14000	.016	.016	.016
Reach#1	13500	.016	.016	.016
Reach#1	13000	.016	.016	.016
Reach#1	12500	.016	.016	.016
Reach#1	12448	.016	.016	.016
Reach#1	12435	Culvert		
Reach#1	12420	.016	.016	.016
Reach#1	12350	.016	.016	.016
Reach#1	12000	.016	.016	.016
Reach#1	11500.1	.016	.016	.016

*Reach#1	*	11500	*	.016*	.016*	.016*
*Reach#1	*	11497.*	*	.016*	.016*	*
*Reach#1	*	11494.*	*	.016*	.016*	*
*Reach#1	*	11491.*	*	.016*	.016*	*
*Reach#1	*	11488.*	*	.016*	.016*	*
*Reach#1	*	11485.*	*	.016*	.016*	*
*Reach#1	*	11482.*	*	.016*	.016*	*
*Reach#1	*	11479.*	*	.016*	.016*	*
*Reach#1	*	11476.*	*	.016*	.016*	*
*Reach#1	*	11473.*	*	.016*	.016*	*
*Reach#1	*	11470	*	.016*	.016*	.016*
*Reach#1	*	11467.*	*	.016*	.016*	*
*Reach#1	*	11464.*	*	.016*	.016*	*
*Reach#1	*	11461.*	*	.016*	.016*	*
*Reach#1	*	11458.*	*	.016*	.016*	*
*Reach#1	*	11455.*	*	.016*	.016*	*
*Reach#1	*	11452.*	*	.016*	.016*	*
*Reach#1	*	11449.*	*	.016*	.016*	*
*Reach#1	*	11446.*	*	.016*	.016*	*
*Reach#1	*	11443	*	.016*	.016*	.016*
*Spillway	*	66	*	.016*	.016*	.016*
*Spillway	*	39	*	.016*	.016*	.016*
*Spillway	*	36.*	*	.016*	.016*	*
*Spillway	*	33.*	*	.016*	.016*	*
*Spillway	*	30.*	*	.016*	.016*	*
*Spillway	*	27.*	*	.016*	.016*	*
*Spillway	*	24.*	*	.016*	.016*	*
*Spillway	*	21.*	*	.016*	.016*	*
*Spillway	*	18.*	*	.016*	.016*	*
*Spillway	*	15.*	*	.016*	.016*	*
*Spillway	*	12.*	*	.016*	.016*	*
*Spillway	*	9.00000*	*	.016*	.016*	*
*Spillway	*	5.99999*	*	.016*	.016*	*
*Spillway	*	3	*	.016*	.016*	.016*
*Reach#2	*	11440	*	.016*	.016*	.016*
*Reach#2	*	11438.*	*	.016*	.016*	*
*Reach#2	*	11436.*	*	.016*	.016*	*
*Reach#2	*	11434.*	*	.016*	.016*	*
*Reach#2	*	11432.*	*	.016*	.016*	*
*Reach#2	*	11430.*	*	.016*	.016*	*
*Reach#2	*	11428.*	*	.016*	.016*	*
*Reach#2	*	11426.*	*	.016*	.016*	*
*Reach#2	*	11424.*	*	.016*	.016*	*
*Reach#2	*	11422.*	*	.016*	.016*	*
*Reach#2	*	11420.*	*	.016*	.016*	*
*Reach#2	*	11418.*	*	.016*	.016*	*
*Reach#2	*	11416.*	*	.016*	.016*	*
*Reach#2	*	11414.*	*	.016*	.016*	*
*Reach#2	*	11412.*	*	.016*	.016*	*
*Reach#2	*	11410.*	*	.016*	.016*	*
*Reach#2	*	11408.*	*	.016*	.016*	*
*Reach#2	*	11406.*	*	.016*	.016*	*
*Reach#2	*	11404.*	*	.016*	.016*	*
*Reach#2	*	11402.*	*	.016*	.016*	*
*Reach#2	*	11400.*	*	.016*	.016*	*
*Reach#2	*	11398.*	*	.016*	.016*	*
*Reach#2	*	11396.*	*	.016*	.016*	*
*Reach#2	*	11394.*	*	.016*	.016*	*
*Reach#2	*	11392.*	*	.016*	.016*	*
*Reach#2	*	11390.*	*	.016*	.016*	*
*Reach#2	*	11388.*	*	.016*	.016*	*
*Reach#2	*	11386.*	*	.016*	.016*	*
*Reach#2	*	11384.*	*	.016*	.016*	*
*Reach#2	*	11382.*	*	.016*	.016*	*
*Reach#2	*	11380.*	*	.016*	.016*	*
*Reach#2	*	11378.*	*	.016*	.016*	*
*Reach#2	*	11376.*	*	.016*	.016*	*
*Reach#2	*	11374.*	*	.016*	.016*	*
*Reach#2	*	11372.*	*	.016*	.016*	*
*Reach#2	*	11370.*	*	.016*	.016*	*
*Reach#2	*	11368.*	*	.016*	.016*	*
*Reach#2	*	11366.*	*	.016*	.016*	*
*Reach#2	*	11364.*	*	.016*	.016*	*
*Reach#2	*	11362.*	*	.016*	.016*	*
*Reach#2	*	11360.*	*	.016*	.016*	*
*Reach#2	*	11358.*	*	.016*	.016*	*
*Reach#2	*	11356.*	*	.016*	.016*	*
*Reach#2	*	11354	*	.016*	.016*	.016*
*Reach#2	*	11304.*	*	.016*	.016*	*
*Reach#2	*	11254.*	*	.016*	.016*	*
*Reach#2	*	11204.*	*	.016*	.016*	*
*Reach#2	*	11154.*	*	.016*	.016*	*
*Reach#2	*	11104.*	*	.016*	.016*	*
*Reach#2	*	11054.*	*	.016*	.016*	*
*Reach#2	*	11004	*	.016*	.016*	.016*
*Reach#2	*	11000	*	.016*	.016*	.016*
*Reach#2	*	10950	*	.016*	.016*	.016*
*Reach#2	*	10700	*	.016*	.016*	.016*
*Reach#2	*	10200	*	.016*	.016*	.016*
*Reach#2	*	9700	*	.016*	.016*	.016*
*Reach#2	*	9200	*	.016*	.016*	.016*
*Reach#2	*	8700	*	.016*	.016*	.016*
*Reach#2	*	8200	*	.016*	.016*	.016*
*Reach#2	*	7700	*	.016*	.016*	.016*
*Reach#2	*	7200	*	.016*	.016*	.016*
*Reach#2	*	6700	*	.016*	.016*	.016*
*Reach#2	*	6200	*	.016*	.016*	.016*
*Reach#2	*	5700	*	.016*	.016*	.016*
*Reach#2	*	5200	*	.016*	.016*	.016*
*Reach#2	*	4700	*	.016*	.016*	.016*
*Reach#2	*	4200	*	.016*	.016*	.016*
*Reach#2	*	3700	*	.016*	.016*	.016*
*Reach#2	*	3250	*	.016*	.016*	.016*
*Reach#2	*	3221	*	.016*	.016*	.016*
*Reach#2	*	3164	*Culvert	*	*	*
*Reach#2	*	3108	*	.016*	.016*	.016*

Reach#2	3050	.016	.016	.016
Reach#2	2800	.016	.016	.016
Reach#2	2400	.016	.016	.016
Reach#2	2000	.016	.016	.016
Reach#2	1924	.016	.016	.016
Reach#2	1848	Culvert		
Reach#2	1771	.016	.016	.016
Reach#2	1700	.016	.016	.016
Reach#2	1500	.016	.016	.016
Reach#2	1000	.016	.016	.016

SUMMARY OF REACH LENGTHS

River: Powerline Floodw

Reach	River Sta.	Left	Channel	Right
Reach#1	14000	500	500	500
Reach#1	13500	500	500	500
Reach#1	13000	507	500	493
Reach#1	12500	52	52	52
Reach#1	12448	28	28	28
Reach#1	12435	Culvert		
Reach#1	12420	70	70	70
Reach#1	12350	350	350	350
Reach#1	12000	500	500	500
Reach#1	11500.1	.1	.1	.1
Reach#1	11500	3	3	3
Reach#1	11497.*	3	3	3
Reach#1	11494.*	3	3	3
Reach#1	11491.*	3	3	3
Reach#1	11488.*	3	3	3
Reach#1	11485.*	3	3	3
Reach#1	11482.*	3	3	3
Reach#1	11479.*	3	3	3
Reach#1	11476.*	3	3	3
Reach#1	11473.*	3	3	3
Reach#1	11470	3	3	3
Reach#1	11467.*	3	3	3
Reach#1	11464.*	3	3	3
Reach#1	11461.*	3	3	3
Reach#1	11458.*	3	3	3
Reach#1	11455.*	3	3	3
Reach#1	11452.*	3	3	3
Reach#1	11449.*	3	3	3
Reach#1	11446.*	3	3	3
Reach#1	11443	3	3	3
Spillway	66	27	27	27
Spillway	39	3	3	3
Spillway	36.*	3	3	3
Spillway	33.*	3	3	3
Spillway	30.*	3	3	3
Spillway	27.*	3	3	3
Spillway	24.*	3	3	3
Spillway	21.*	3	3	3
Spillway	18.*	3	3	3
Spillway	15.*	3	3	3
Spillway	12.*	3	3	3
Spillway	9.00000*	3	3	3
Spillway	5.99999*	3	3	3
Spillway	3	3	3	3
Reach#2	11440	2	2	2
Reach#2	11438.*	2	2	2
Reach#2	11436.*	2	2	2
Reach#2	11434.*	2	2	2
Reach#2	11432.*	2	2	2
Reach#2	11430.*	2	2	2
Reach#2	11428.*	2	2	2
Reach#2	11426.*	2	2	2
Reach#2	11424.*	2	2	2
Reach#2	11422.*	2	2	2
Reach#2	11420.*	2	2	2
Reach#2	11418.*	2	2	2
Reach#2	11416.*	2	2	2
Reach#2	11414.*	2	2	2
Reach#2	11412.*	2	2	2
Reach#2	11410.*	2	2	2
Reach#2	11408.*	2	2	2
Reach#2	11406.*	2	2	2
Reach#2	11404.*	2	2	2
Reach#2	11402.*	2	2	2
Reach#2	11400.*	2	2	2
Reach#2	11398.*	2	2	2
Reach#2	11396.*	2	2	2
Reach#2	11394.*	2	2	2
Reach#2	11392.*	2	2	2
Reach#2	11390.*	2	2	2
Reach#2	11388.*	2	2	2
Reach#2	11386.*	2	2	2
Reach#2	11384.*	2	2	2
Reach#2	11382.*	2	2	2
Reach#2	11380.*	2	2	2
Reach#2	11378.*	2	2	2
Reach#2	11376.*	2	2	2
Reach#2	11374.*	2	2	2
Reach#2	11372.*	2	2	2
Reach#2	11370.*	2	2	2
Reach#2	11368.*	2	2	2
Reach#2	11366.*	2	2	2
Reach#2	11364.*	2	2	2
Reach#2	11362.*	2	2	2
Reach#2	11360.*	2	2	2
Reach#2	11358.*	2	2	2

Reach#2	11356.*	2*	2*	2*
Reach#2	11354	50*	50*	50*
Reach#2	11304.*	50*	50*	50*
Reach#2	11254.*	50*	50*	50*
Reach#2	11204.*	50*	50*	50*
Reach#2	11154.*	50*	50*	50*
Reach#2	11104.*	50*	50*	50*
Reach#2	11054.*	50*	50*	50*
Reach#2	11004	4*	4*	4*
Reach#2	11000	50*	50*	50*
Reach#2	10950	250*	250*	250*
Reach#2	10700	500*	500*	500*
Reach#2	10200	500*	500*	500*
Reach#2	9700	500*	500*	500*
Reach#2	9200	500*	500*	500*
Reach#2	8700	500*	500*	500*
Reach#2	8200	500*	500*	500*
Reach#2	7700	500*	500*	500*
Reach#2	7200	500*	500*	500*
Reach#2	6700	500*	500*	500*
Reach#2	6200	500*	500*	500*
Reach#2	5700	500*	500*	500*
Reach#2	5200	500*	500*	500*
Reach#2	4700	500*	500*	500*
Reach#2	4200	500*	500*	500*
Reach#2	3700	450*	450*	450*
Reach#2	3250	29*	29*	29*
Reach#2	3221	113*	113*	113*
Reach#2	3164	Culvert		
Reach#2	3108	58*	58*	58*
Reach#2	3050	250*	250*	250*
Reach#2	2800	400*	400*	400*
Reach#2	2400	400*	400*	400*
Reach#2	2000	76*	76*	76*
Reach#2	1924	153*	153*	153*
Reach#2	1848	Culvert		
Reach#2	1771	71*	71*	71*
Reach#2	1700	200*	200*	200*
Reach#2	1500	500*	500*	500*
Reach#2	1000	0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Powerline Floodw

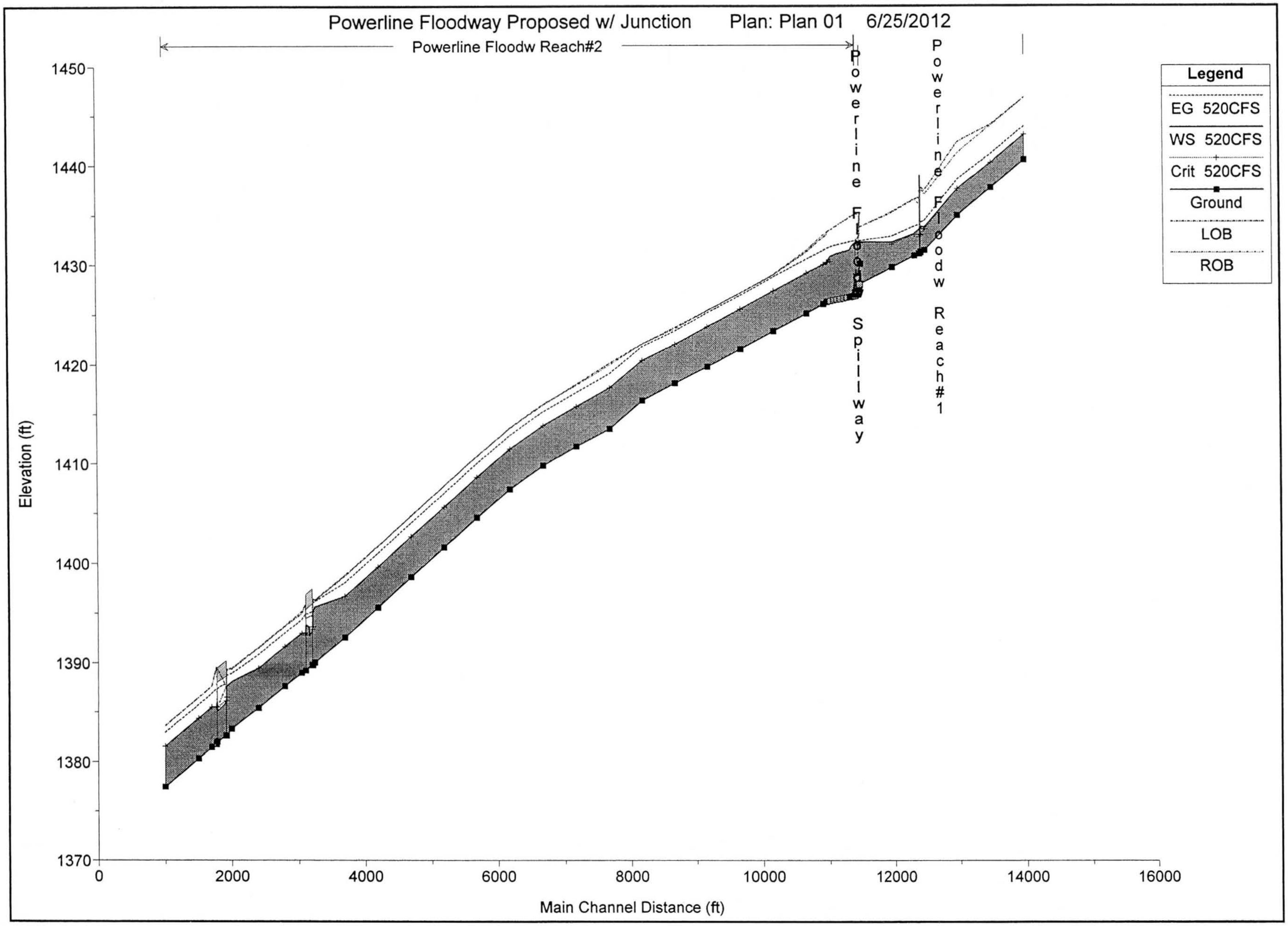
Reach	River Sta.	Contr.	Expan.
Reach#1	14000	.1*	.3*
Reach#1	13500	.1*	.3*
Reach#1	13000	.1*	.3*
Reach#1	12500	.1*	.3*
Reach#1	12448	.1*	.3*
Reach#1	12435	Culvert	
Reach#1	12420	.1*	.3*
Reach#1	12350	.1*	.3*
Reach#1	12000	.1*	.3*
Reach#1	11500.1	.1*	.3*
Reach#1	11500	.1*	.3*
Reach#1	11497.*	.1*	.3*
Reach#1	11494.*	.1*	.3*
Reach#1	11491.*	.1*	.3*
Reach#1	11488.*	.1*	.3*
Reach#1	11485.*	.1*	.3*
Reach#1	11482.*	.1*	.3*
Reach#1	11479.*	.1*	.3*
Reach#1	11476.*	.1*	.3*
Reach#1	11473.*	.1*	.3*
Reach#1	11470	.1*	.3*
Reach#1	11467.*	.1*	.3*
Reach#1	11464.*	.1*	.3*
Reach#1	11461.*	.1*	.3*
Reach#1	11458.*	.1*	.3*
Reach#1	11455.*	.1*	.3*
Reach#1	11452.*	.1*	.3*
Reach#1	11449.*	.1*	.3*
Reach#1	11446.*	.1*	.3*
Reach#1	11443	.1*	.3*
Spillway	66	.1*	.3*
Spillway	39	.1*	.3*
Spillway	36.*	.1*	.3*
Spillway	33.*	.1*	.3*
Spillway	30.*	.1*	.3*
Spillway	27.*	.1*	.3*
Spillway	24.*	.1*	.3*
Spillway	21.*	.1*	.3*
Spillway	18.*	.1*	.3*
Spillway	15.*	.1*	.3*
Spillway	12.*	.1*	.3*
Spillway	9.00000*	.1*	.3*
Spillway	5.99999*	.1*	.3*
Spillway	3	.1*	.3*
Reach#2	11440	.1*	.3*
Reach#2	11438.*	.1*	.3*
Reach#2	11436.*	.1*	.3*
Reach#2	11434.*	.1*	.3*
Reach#2	11432.*	.1*	.3*
Reach#2	11430.*	.1*	.3*
Reach#2	11428.*	.1*	.3*
Reach#2	11426.*	.1*	.3*
Reach#2	11424.*	.1*	.3*
Reach#2	11422.*	.1*	.3*
Reach#2	11420.*	.1*	.3*
Reach#2	11418.*	.1*	.3*

*Reach#2	*	11416.*	*	.1*	.3*
*Reach#2	*	11414.*	*	.1*	.3*
*Reach#2	*	11412.*	*	.1*	.3*
*Reach#2	*	11410.*	*	.1*	.3*
*Reach#2	*	11408.*	*	.1*	.3*
*Reach#2	*	11406.*	*	.1*	.3*
*Reach#2	*	11404.*	*	.1*	.3*
*Reach#2	*	11402.*	*	.1*	.3*
*Reach#2	*	11400.*	*	.1*	.3*
*Reach#2	*	11398.*	*	.1*	.3*
*Reach#2	*	11396.*	*	.1*	.3*
*Reach#2	*	11394.*	*	.1*	.3*
*Reach#2	*	11392.*	*	.1*	.3*
*Reach#2	*	11390.*	*	.1*	.3*
*Reach#2	*	11388.*	*	.1*	.3*
*Reach#2	*	11386.*	*	.1*	.3*
*Reach#2	*	11384.*	*	.1*	.3*
*Reach#2	*	11382.*	*	.1*	.3*
*Reach#2	*	11380.*	*	.1*	.3*
*Reach#2	*	11378.*	*	.1*	.3*
*Reach#2	*	11376.*	*	.1*	.3*
*Reach#2	*	11374.*	*	.1*	.3*
*Reach#2	*	11372.*	*	.1*	.3*
*Reach#2	*	11370.*	*	.1*	.3*
*Reach#2	*	11368.*	*	.1*	.3*
*Reach#2	*	11366.*	*	.1*	.3*
*Reach#2	*	11364.*	*	.1*	.3*
*Reach#2	*	11362.*	*	.1*	.3*
*Reach#2	*	11360.*	*	.1*	.3*
*Reach#2	*	11358.*	*	.1*	.3*
*Reach#2	*	11356.*	*	.1*	.3*
*Reach#2	*	11354	*	.1*	.3*
*Reach#2	*	11304.*	*	.1*	.3*
*Reach#2	*	11254.*	*	.1*	.3*
*Reach#2	*	11204.*	*	.1*	.3*
*Reach#2	*	11154.*	*	.1*	.3*
*Reach#2	*	11104.*	*	.1*	.3*
*Reach#2	*	11054.*	*	.1*	.3*
*Reach#2	*	11004	*	.1*	.3*
*Reach#2	*	11000	*	.1*	.3*
*Reach#2	*	10950	*	.1*	.3*
*Reach#2	*	10700	*	.1*	.3*
*Reach#2	*	10200	*	.1*	.3*
*Reach#2	*	9700	*	.1*	.3*
*Reach#2	*	9200	*	.1*	.3*
*Reach#2	*	8700	*	.1*	.3*
*Reach#2	*	8200	*	.1*	.3*
*Reach#2	*	7700	*	.1*	.3*
*Reach#2	*	7200	*	.1*	.3*
*Reach#2	*	6700	*	.1*	.3*
*Reach#2	*	6200	*	.1*	.3*
*Reach#2	*	5700	*	.1*	.3*
*Reach#2	*	5200	*	.1*	.3*
*Reach#2	*	4700	*	.1*	.3*
*Reach#2	*	4200	*	.1*	.3*
*Reach#2	*	3700	*	.1*	.3*
*Reach#2	*	3250	*	.1*	.3*
*Reach#2	*	3221	*	.1*	.3*
*Reach#2	*	3164	*Culvert	*	*
*Reach#2	*	3108	*	.1*	.3*
*Reach#2	*	3050	*	.1*	.3*
*Reach#2	*	2800	*	.1*	.3*
*Reach#2	*	2400	*	.1*	.3*
*Reach#2	*	2000	*	.1*	.3*
*Reach#2	*	1924	*	.1*	.3*
*Reach#2	*	1848	*Culvert	*	*
*Reach#2	*	1771	*	.1*	.3*
*Reach#2	*	1700	*	.1*	.3*
*Reach#2	*	1500	*	.1*	.3*
*Reach#2	*	1000	*	.1*	.3*

****

HEC-RAS Plan: powerline Profile: 520CFS

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach#2	1000	520.00	1377.46	1381.52	1381.52	1382.91	0.003129	9.46	54.98	20.06	1.01
Reach#2	1500	520.00	1380.31	1384.35	1384.35	1385.72	0.003111	9.42	55.22	20.25	1.00
Reach#2	1700	520.00	1381.45	1385.48	1385.48	1386.86	0.003127	9.44	55.09	20.19	1.01
Reach#2	1771	520.00	1381.73	1385.50	1385.50	1387.30	0.004314	10.79	48.21	13.50	1.01
Reach#2	1848	Culvert									
Reach#2	1924	520.00	1382.59	1387.56	1386.46	1388.71	0.002198	8.57	60.68	12.67	0.69
Reach#2	2000	520.00	1383.27	1388.01		1388.88	0.001683	7.51	69.26	22.37	0.75
Reach#2	2400	520.00	1385.38	1389.43	1389.43	1390.80	0.003082	9.39	55.39	20.25	1.00
Reach#2	2800	520.00	1387.56	1391.61	1391.61	1392.98	0.003070	9.38	55.45	20.23	1.00
Reach#2	3050	520.00	1388.95	1392.96	1392.96	1394.35	0.003116	9.45	55.04	20.05	1.00
Reach#2	3108	520.00	1389.19	1392.99	1392.99	1394.87	0.004427	11.01	47.23	12.68	1.01
Reach#2	3164	Culvert									
Reach#2	3221	520.00	1389.74	1395.03	1393.62	1396.03	0.001877	8.03	64.73	13.38	0.64
Reach#2	3250	520.00	1390.01	1395.59		1396.11	0.000824	5.79	89.83	24.83	0.54
Reach#2	3700	520.00	1392.54	1396.63	1396.63	1398.01	0.003084	9.40	55.31	20.17	1.00
Reach#2	4200	520.00	1395.52	1399.59	1399.59	1400.97	0.003113	9.42	55.21	20.25	1.01
Reach#2	4700	520.00	1398.57	1402.65	1402.65	1404.01	0.003068	9.37	55.50	20.28	1.00
Reach#2	5200	520.00	1401.56	1405.60	1405.60	1406.98	0.003112	9.42	55.18	20.19	1.00
Reach#2	5700	520.00	1404.53	1408.58	1408.58	1409.97	0.003121	9.45	55.05	20.10	1.01
Reach#2	6200	520.00	1407.38	1411.47	1411.47	1412.85	0.003113	9.44	55.08	20.07	1.00
Reach#2	6700	520.00	1409.73	1413.81	1413.81	1415.20	0.003138	9.47	54.93	20.05	1.01
Reach#2	7200	520.00	1411.70	1415.74	1415.74	1417.13	0.003116	9.44	55.09	20.10	1.00
Reach#2	7700	520.00	1413.49	1417.60	1417.60	1419.02	0.003157	9.58	54.30	19.35	1.01
Reach#2	8200	520.00	1416.33	1420.34	1420.34	1421.72	0.003127	9.42	55.18	20.29	1.01
Reach#2	8700	520.00	1418.05	1421.96	1421.96	1423.31	0.003111	9.31	55.83	21.03	1.01
Reach#2	9200	520.00	1419.73	1423.75	1423.75	1425.12	0.003090	9.39	55.37	20.28	1.00
Reach#2	9700	520.00	1421.47	1425.50	1425.50	1426.86	0.003083	9.38	55.42	20.30	1.00
Reach#2	10200	520.00	1423.30	1427.33	1427.33	1428.71	0.003123	9.43	55.15	20.25	1.01
Reach#2	10700	520.00	1425.06	1429.08	1429.08	1430.47	0.003138	9.48	54.87	19.97	1.01
Reach#2	10950	520.00	1425.97	1429.93	1429.93	1431.32	0.003130	9.48	54.85	19.89	1.01
Reach#2	11000	520.00	1426.18	1430.14	1430.14	1431.53	0.003137	9.49	54.81	19.89	1.01
Reach#2	11004	520.00	1426.22	1430.18	1430.18	1431.56	0.003082	9.43	55.11	19.87	1.00
Reach#2	11354	520.00	1426.66	1431.38		1432.21	0.001541	7.32	71.07	22.15	0.72
Reach#2	11440	520.00	1426.80	1432.10		1432.31	0.000259	3.63	143.32	31.07	0.30
Spillway	3	344.00	1426.95	1432.12		1432.42	0.000500	4.40	78.18	15.16	0.34
Spillway	39	344.00	1428.69	1431.78		1432.62	0.002217	7.39	46.54	15.15	0.74
Spillway	66	344.00	1430.00	1432.09	1432.09	1433.14	0.003787	8.23	41.79	20.04	1.00
Reach#1	11443	176.00	1426.85	1432.21	1429.01	1432.31	0.000175	2.53	69.64	17.09	0.22
Reach#1	11470	176.00	1427.40	1432.22		1432.31	0.000170	2.50	70.49	19.54	0.23
Reach#1	11500	176.00	1428.00	1432.20		1432.33	0.000280	2.93	59.97	20.59	0.30
Reach#1	11500.1	176.00	1428.00	1432.20		1432.33	0.000280	2.93	59.97	20.59	0.30
Reach#1	12000	176.00	1429.64	1432.15	1431.94	1432.80	0.002551	6.51	27.05	15.23	0.86
Reach#1	12350	176.00	1430.80	1433.06	1432.96	1433.81	0.003054	6.94	25.35	14.82	0.94
Reach#1	12420	176.00	1431.00	1433.52		1433.98	0.001556	5.48	32.10	13.36	0.62
Reach#1	12435	Culvert									
Reach#1	12448	176.00	1431.11	1433.79	1432.97	1434.22	0.001363	5.22	33.71	12.94	0.57
Reach#1	12500	176.00	1431.35	1433.71	1433.53	1434.39	0.002674	6.63	26.53	14.97	0.88
Reach#1	13000	176.00	1434.89	1437.56	1437.56	1438.51	0.003688	7.81	22.55	12.12	1.01
Reach#1	13500	176.00	1437.67	1440.15	1440.15	1441.03	0.003598	7.50	23.48	13.65	1.01
Reach#1	14000	176.00	1440.43	1442.95	1442.95	1443.84	0.003602	7.55	23.32	13.37	1.01



Powerline Floodway Proposed w/ Junction Plan: Plan 01 6/25/2012
Powerline Floodw Reach#2
Powerline Floodw Spillway
Powerline Floodw Reach#1
Legend
EG 520CFS
WS 520CFS
Crit 520CFS
Ground
LOB
ROB
Elevation (ft)
1450
1440
1430
1420
1410
1400
1390
1380
1370
0
2000
4000
6000
8000
10000
12000
14000
16000
Main Channel Distance (ft)

Appendix D

Excerpts from the Final Drainage Report for EASTMARK Master Planned Community Phase 1 Infrastructure Improvements

FINAL DRAINAGE REPORT
FOR
EASTMARK
MASTER PLANNED COMMUNITY
PHASE 1 INFRASTRUCTURE IMPROVEMENTS
Mesa, Arizona

Prepared:
January 31, 2012
February 27, 2012
March 29, 2012
June 25, 2012

Prepared for:

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Scottsdale, Arizona 85258

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HRC 11-023-01

FINAL DRAINAGE REPORT
FOR
EASTMARK MASTER PLANNED COMMUNITY
PHASE 1INFRASTRUCTURE IMPROVEMENTS

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Appendix H	Excerpts From the *Master Drainage Report for Mesa Proving Grounds*, by Wood/Patel (Ref. 1)
Appendix I	Excerpts From the *Master Drainage Report for Development Unit 7 at Mesa Proving Grounds,* by Wood/Patel (Ref. 2)
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EXPIRES 3/31/2012

1.0 Introduction

Hoskin-Ryan Consultants, Inc. (HRC) has been contracted by DMB Mesa Proving Grounds, LLC. to provide final engineering for the first phase of the infrastructure for the EASTMARK Master Planned Community which was named Mesa Proving Grounds previously. The proposed improvements include infrastructure roads that provide access to Dwelling Unit 7 (DU-7). Infrastructure roads include Ray Road, Signal Butte Road, Eastmark Parkway, Kinnet Parkway, and Everton Terrace.

The purpose of this report is to document the on-site and offsite drainage conditions that affect the site, and to demonstrate that the design is in accordance with drainage design criteria established by the City of Mesa.

2.0 Location

The first phase of development is located north of Ray Road and south of Warner Road, between Ellsworth Road and Signal Butte Road. Eastmark Parkway and Kinnet Parkway are paved north/south district streets, and Everton Terrace is a paved north/south local street. All three streets can be accessed from Ray Road (Figure 1).

3.0 Site Description and Proposed Development

3.1 Site Description

Eastmark is a mixed-use development consisting of single-family residential, multi-family residential, commercial mixed use, resort, golf, and open space. The first phase of development, DU-7, encompasses approximately 582 acres.

This drainage report accompanies the design of Kinnet Parkway and Eastmark Parkway, Everton Terrace, Ray Road and Signal Butte Road. An existing channel west of Signal Butte Road conveys offsite flow south to the existing Powerline Floodway Channel (PFC), located just south of the Ray Road alignment. The PFC, which provides an outfall for the upstream Powerline Flood Retarding Structure (PFRS), follows the alignment of Ray Road from Signal Butte Road to Ellsworth Road. The PFRS is located approximately three miles east of the site.

The watershed areas east of Signal Butte Road and north of the PFC have been developed primarily into single family home subdivisions. Offsite drainage reaching the existing Signal Butte Channel is limited to an existing channel and culvert which crosses Signal Butte Road approximately 4680 feet north of Ray Road.

3.2 Proposed Development

The first phase of this project consists of the DU-7 development, the arterial streets of Ray Road and Signal Butte Road, and the district streets of Eastmark Parkway and Kinnet Parkway. This report addresses the drainage analysis and design of these infrastructure streets and their associated storm drainage systems, the drainage channel along the west side of Signal Butte Road, the retention basins for street runoff, and basin bleed pipes for the adjacent DU-7 subdivision parcels. Design and analysis of the DU-7 subdivisions and drainage systems are addressed by others.

3.3 Development Standards

The infrastructure will be developed in accordance with the current City of Mesa standards and the applicable standards of the Flood Control District of Maricopa County except for Everton Terrace for which a non-standard cross-section was selected. Storm drainage standards are addressed in the *City of Mesa, Engineering and Design Standards Manual,* 2009 (Ref.5), *Drainage Policies and Standards for Maricopa County, Arizona,* 2007 (Ref. 6), *Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology,* 2011 (Ref. 7) and *Drainage Design Manual for Maricopa County, Arizona, Volume 2 Hydraulics, 1996* (Ref. 8).

4.0 FEMA Floodplain Classification and 404 Wash

The Flood Insurance Rate Map (FIRM) for Maricopa County Arizona, and Incorporated Areas, Map Panel Numbers 04013C2685H and 04013C2705F (Ref. 4) cover the project site (Figure 2A). The site lies within Zone "D" which is defined as follows:

Zone "D" – *Areas in which flood hazards are undetermined.*

A jurisdictional delineation of 404 washes across the site was completed by the U.S. Army Corps of Engineers (Corps). The PFC and a small wash are designated as Jurisdictional (Figure 2B).

The small wash will be converted into a detention/sedimentation basin with the infrastructure improvement. The proposed disturbances to the Jurisdictional areas are required to be permitted with the Corps.

5.0 Offsite Drainage

5.1 Existing Conditions

The *Master Drainage Report for Mesa Proving Grounds* (Ref. 1) and the *Master Drainage Report for Development Unit 7 at Mesa Proving Grounds* (Ref. 2) each provide guidance to the offsite drainage impacts and the proposed onsite drainage systems. These reports include hydrology models for pre, interim, and post- development conditions.

For interim and full build-out conditions, an offsite flow of 441 cfs (Ref. 2) crosses Signal Butte Road, south of Warner Road, through an existing double-barrel, 10-feet x 3-feet box culvert. An existing ditch west of Signal Butte Road conveys the flow south to the existing PFC. Although the Flood Control District of Maricopa County has issued a report that quantifies a 100-year flow of less than 441 cfs at this location, it was advised that the flow of 441 cfs is to be used for design.

5.2 Signal Butte Channel, Detention/Sediment Basin, and Outlet Structure

In the interim and future conditions this offsite flow will be conveyed south to the PFC in a new channel located on the west side of Signal Butte Road (Figure 4). This unlined trapezoidal channel will only convey offsite drainage, with the exception of one area located at the north end of this design phase.

At Ray Road, the flow within the Signal Butte Channel will be conveyed through a proposed triple barrel, 8-feet x 4-feet box culvert and then outlet into a detention/sedimentation basin. The purpose of the detention/sediment basin is to attenuate flow prior to its release into the PFC and collect sediment.

A concrete broad-crest weir with a low-flow orifice is designed to release flow from the detention/sediment basin into a concrete spillway. The concrete spillway ties into the PFC at a 10 degree angle to minimize the impact to the supercritical flow in the channel. On the PFC there is an existing 400 feet long 20-feet by 6.4-feet box culvert that will be removed and replaced by a trapezoidal concrete channel that will match the existing sections upstream and downstream.

A HEC-RAS model was created to analyze the hydraulic performance of the proposed Signal Butte Channel. For the north 1800-feet of the channel, a Manning's roughness of 0.035 was selected for the main channel, given that this portion of channel will be a straight earthen channel. A Manning's roughness of 0.045 was selected for the south 2700-feet of the channel, based on proposed landscape features of boulders, retaining walls and trails.

The downstream boundary condition for the HEC-RAS model was obtained from the HEC-1 model, which indicates that a high water surface elevation of 1434.50 feet will occur in the detention/sediment basin during the 100-year 24-hour storm event. The HEC-RAS output is provided in Appendix F.

A scour depth of 2.57 feet was estimated using SSA 5-96 Level I scour analysis. The retaining walls along Signal Butte Channel will be provided with a minimum cut-off wall of 3 feet. The scour calculations are provided in Appendix F.

5.3 Post-Development

An interim post-development condition HEC-1 model provided in the DU-7 report, presents the development condition after DU-7 is constructed with residential, commercial and open space land uses (Ref. 3). The retention volume for DU-7 was calculated using the 100-year, 2-hour precipitation of 2.2 inches, which is based on NOAA Atlas 14 point precipitation frequency estimates (Ref. 9).

The impact of the proposed design on the PFC was analyzed using a post-development condition HEC-1 model (Appendix G) that is based on the interim condition HEC-1 model from Ref. 2 (Appendix I). Changes that were made to the model include modifications to the side drainage channel and the detention/sediment basin.

A rating curve was established by analyzing the capacity of the weir and the low flow orifice. The 60-feet long weir is set at an elevation of 1433.0 feet (NACD 88), 2 feet below the top of the detention/sediment basin. The invert of the 8-inch low-flow orifice is 1431.80 feet. The detention/sediment basin outlet structure calculations can be found in Appendix G.

The model results indicate that flow from the Signal Butte Channel will be released into the PFC after the peak flow has passed. A hydrograph simulation (Figure 5) represents the effect of the basin on the PFC at various times. According to Figure 5, the peak in the PFC is 713 cfs at 12:25 pm; however, it passes through the box culvert at that time without any contribution from the proposed Signal Butte Channel and the detention/sediment basin. Therefore, the proposed design will not increase the peak discharge in the PFC at Signal Butte Road. The HEC-1 model output is included in Appendix G.

With the removal of the existing box culvert and construction of a 500-feet concrete channel, the capacity of the PFC has been increased from 530 cfs to 950 cfs. The capacity analysis can be found in the HEC-RAS models.

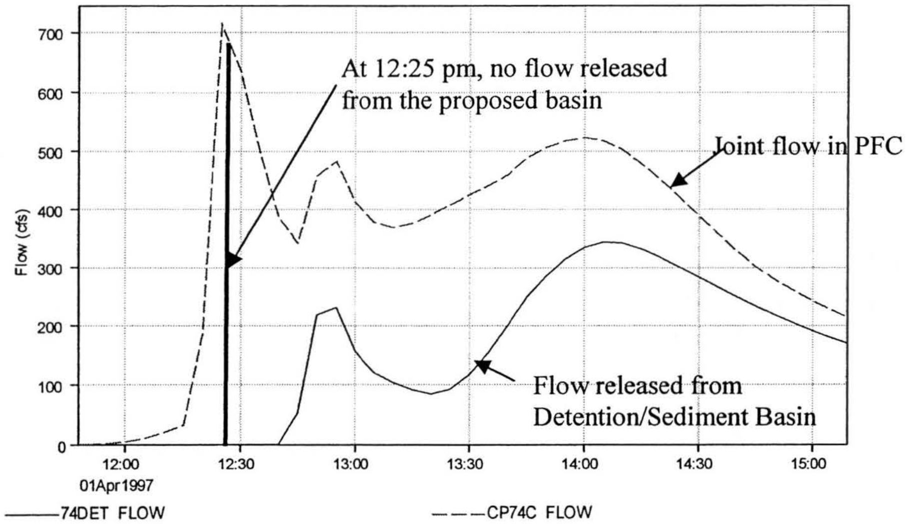

Figure 5. Hydrograph Released from Detention/Sediment Basin (74DET) and Combined Hydrograph at the Powerline Floodway Channel

According to the existing condition HEC-1 model provided in the *Master Drainage Report for Mesa Proving Grounds* (Ref. 1), the PFC collects excess runoff from EASTMARK and reaches a 100-year peak flow of 661 cfs at Ellsworth Road (CP75). The full build-out condition HEC-1 indicates that upon development of the entire EASTMARK the 100-year peak flow of the PFC at Ellsworth Road will reduce from 661 cfs to 616 cfs.

The HEC-1 model results (Appendix G) indicate that the development of Unit DU-7 and Phase 1 infrastructure (the interim condition) will reduce the 100-year peak flow of the PFC at Ellsworth Road from 661 cfs to 638 cfs, which will be further reduced to 616 cfs with future development. Therefore, the development of the Phase 1 infrastructure will not increase the peak discharge of the PFC at both Signal Butte Road and Ellsworth Road.

6.0 On-Site Drainage

6.1 On-Site Hydrology

Signal Butte Road, Ray Road, Eastmark Parkway, Kinnet Parkway, and Everton Terrace are designed to convey runoff to one of several retention basins. A storm drainage system within each street collects the pavement runoff and provides an outfall for parcel bleed-off. Peak flows are calculated based on the Rational Method as outlined in the *Drainage Design Manual for Maricopa County, Volume I - Hydrology* (Ref. 7) and *Mesa Engineering and Design Standards Manual* (Ref. 5). On-site drainage sub-basins are presented on Figure 3.

The Rational Method was used for the computation of peak discharges as follows:

$$Q = C\, i\, A$$

where:

Q = computed runoff in cfs
C = runoff coefficient
i = rainfall intensity (inches)
A = sub-basin area (acres)

Runoff coefficients ('C') are shown in Table 1 and are selected based on the guidelines provided in Ref. 5. Refer to Appendix A for the peak flow calculations.

Table 1: Runoff Coefficients

Land Use	Runoff Coefficients C
Turf Landscaping	0.15
Desert Landscaping	0.50
Asphalt Pavement	0.85
Concrete Surface	0.95

Weighted runoff coefficients were calculated for Ray Road, Signal Butte Road, Eastmark Parkway, Kinnet Parkway and Everton Terrace based on their typical cross-sections. Using desert landscaping within the median and other open space areas, weighted runoff coefficients were developed for each street (Appendix B).

The rainfall intensity consists of the mean partial duration time series point precipitation frequency obtained from the NOAA Atlas 14, Volume 1, Version 5.0 (Ref. 9). The rainfall intensity (i) for a drainage area is dependent of the time of concentration (T_c), with a minimum T_c of 5 minutes. The T_c is calculated by using the following equation from the *Drainage Design Manual for Maricopa County, Volume I - Hydrology* (Ref. 7) and *Mesa Engineering and Design Standards Manual* (Ref. 5):

$$T_C=11.4*L^{0.5} * K_b^{0.52} * S^{-0.31} * i^{-0.38}$$

where:

T_C = time of concentration in hours
L = length of the longest flow path in miles
Kb = watershed resistance coefficient, 0.040 for street
S = watercourse slope in feet/mile
i = rainfall intensity in inches/hour

6.2 Pavement Drainage

In accordance with City of Mesa criteria, Ray Road, Signal Butte Road, Eastmark Parkway and Kinnet Parkway are designed to flood no more than one lane of traffic per half street, and to contain the 100-year event runoff within the right-of-way. Where pavement runoff exceeds this criteria, the excess flow is captured by catch basins and conveyed within a storm drainage system. The roadside swales of Everton Terrance are designed to collect the 100-year storm runoff from street and convey it to the storm drain system. The outfall for the Everton Terrace storm drainage system is the Ray Road storm drainage system. The outfall for the Ray Road storm drainage system is one of several retention basins, which then leads into an existing storm drain system within Ellsworth Road. Retention Basin A is the outfall for the Signal Butte Road storm drain. Three temporary retention basins collects flow from Eastmark Parkwaym, Kinnet Parkway and Everton Terrace which will be extended north in the future. A maximum flow of 100 cfs is allowed within the street, at a maximum velocity of 10 fps, and a maximum depth of 12 inches (Ref. 6).

General street flow directions and storm drain systems are shown on Figure 3. Refer to Appendix A for the street capacity calculations, Appendix C for the catch basin calculations and Appendix D for the storm drain calculations. Table 2 indicates the 100-year flow generated from the street surface is completely contained within each street or within the roadside swale.

Table 2: Street Capacities and 100-Year Peak Flows

Street	Minimum Slope	Minimum Capacity within ROW (cfs)	100-Year Peak Flow (cfs)
Ray	0.31%	111	63
Signal Butte	0.38%	120	16
Eastmark Parkway	0.58%	23	14
Kinnet Parkway	0.60%	23	12
Everton Terrace *	0.25%	6	3

* Everton Terrace runoff is collected by roadside swale. The minimum capacity of swale is 6 cfs. And 100-year peak discharge for the swale is no more than 3 cfs.

Bike lanes are proposed for Ray Road, Signal Butte Road, Eastmark Parkway and Kinnet Parkway. The total width for the bike lane and right drive lane varies from 15 feet to 17 feet. The summary table in Appendix C indicates that during a 10-year storm event, the maximum flow spread measured from the gutter line will be less than 15 feet, except near Catch Basins D11, F1, F2 and G1 (Figure 3). The flow spread at D11, F1, F2 and G1 will be less than 16 feet and the total width of the bike lane and right drive lane is 17 feet. Therefore, no more than one drive lane will be flooded during a 10-year event.

Storm Drain System A collects the half street surface flow from Signal Butte Road and discharges it into Retention Basin A (Figure 3). Storm Drain Systems B, C, D and E collect street runoff from Ray Road and discharge it into Retention Basins B, C, D and E, respectively. Storm Drain System J connects Retention Basin E to the existing 60-inch storm drain system along Ellsworth Road. Storm Drain System I collects runoff from Kinnet Parkway. System I will be extended north in the future with the road extension. System K collects runoff from Everton Terrace and discharges to System C at Ray Road.

The storm drain systems hydraulic performance was analyzed using StormCAD. The Manning's equation was selected to calculate the friction loss along the storm drain pipes using a Manning's roughness of 0.013 for concrete pipes. The head loss coefficient that was used for a straight manhole is 0.05. The junction losses for manholes with lateral connections were calculated using Equation 4.9b in the hydraulic manual (Ref. 8). The tail water depth in retention basins were assumed to be two feet. The tail water depth for System K was assumed to be three feet in the manhole where System K tying into System C.

Except for System K along Everton Terrace, all storm drain systems were sized to ensure that the 10-year hydraulic grade line will always be more than one foot below catch basin gutter line. The StormCAD results indicate that the 10-year hydraulic grade line is mostly contained within the pipe. System K along Everton Terrace was designed to convey the 100-year storm. Type F catch basins were used to collect runoff from roadside swale into System K (Appendix C). The StormCAD results indicate the 100-year hydraulic grade line is controlled below ground. The StormCAD outputs are provided in Appendix D.

Storm Drain System J connects the Ray Road storm drain into the existing 60-inch storm drain at Ellsworth Road which outlets to the PFC. Per the *Master Drainage Report for Mesa Proving Grounds* (Ref. 1), the existing 60-inch storm drain along Ellsworth Road collects runoff from approximately one-half mile south of Elliot Road. The full build-out model (Ref. 1) indicates that the 100-year, 24-hour peak flow of 178 cfs (flow in excess of the retention basin capacity) will be collected at Ellsworth Road and Ray Road from EASTMARK proposed development. It is estimated that the majority of this flow will be collected by this existing 60-inch pipe and conveyed to the PFC.

7.0 Retention Requirements

7.1 Retention Basin Volume

In accordance with the Ref. 5, retention basins will retain the 100-year, 2-hour storm event. The storm water volume to be retained on-site is computed as follows:

$$V = C\,(P/12)\,A$$

where: V = Calculated Volume in acre-feet
C= Runoff Coefficient
P = 100-yr, 2-hr rainfall depth (inches)
A = Drainage area (acres)

For this site, the 100-year 2-hour rainfall of 2.2 inches was used. The runoff coefficients used for this site are selected from Table 1. In addition, calculations for the weighted runoff coefficients ('C' values) used for the retention calculations are included in Appendix B.

Street runoff will be collected by storm drain systems and conveyed to retention basins (Figure 3). Retention basin calculations are included in Appendix E, and are summarized in Table 3. The results presented in Table 3 indicate that there is sufficient retention volume provided for the Site. The retention basins with their outfall locations are shown on Figure 3.

Table 3: Retention Summary

Sub-Basin I.D.	Contributing Sub-Basins	Contributing Drainage Area (AC)	100-year, 2-hr Volume Required (AF)	Volume Provided (AF)	Excess Volume (AF)
Basin A	A1, A2, A3	6.96	0.97	1.01	0.04
Basin B	B1, B2	5.46	0.72	1.37	0.64
Basin C	C1, C2, C3	6.29	0.86	0.64	-0.22*
Basin D	D1, D2	19.94	2.78	3.85	1.07
Basin E	E1, E2	5.77	0.80	0.96	0.16
Basin F	F	2.92	0.40	0.56	0.16
Basin G	G1, G2	4.94	0.55	0.64	0.10
Basin I	I1, I2	4.17	0.53	0.56	0.03
Basin K	K1, K2	5.30	0.70	0.03	-0.66*
Basin L	L	1.32	0.18	0.21	0.03

* Excess flow from Basin C and Basin K will be retained by downstream Basin D and E.

The 22-ft tract on the south side of Ray Road will retain the runoff by itself with depressions in series separated by berms.

7.2 Draining Retention Basins

All retention basins must drain within 36-hours, either by infiltration or by storm drain bleed-off. Drywells will be provided for Retention Basins A and B (Figure 3) because a storm drain bleed-off is not practical. A drywell with a disposal rate of 0.1 cfs can drain 0.30 acre-feet water within 36 hours. Using this initial rate, four (4) drywells are required for Retention Basin A and five (5) drywells are required for Retention Basin B. The first installed drywell in each retention basin will be tested for actual percolation rates. Calculations with the revised rates may change the number of required drywells. Retention Basins I, K and L are one-foot deep and will drain by infiltration only; therefore, no drywell or bleed-off system is required.

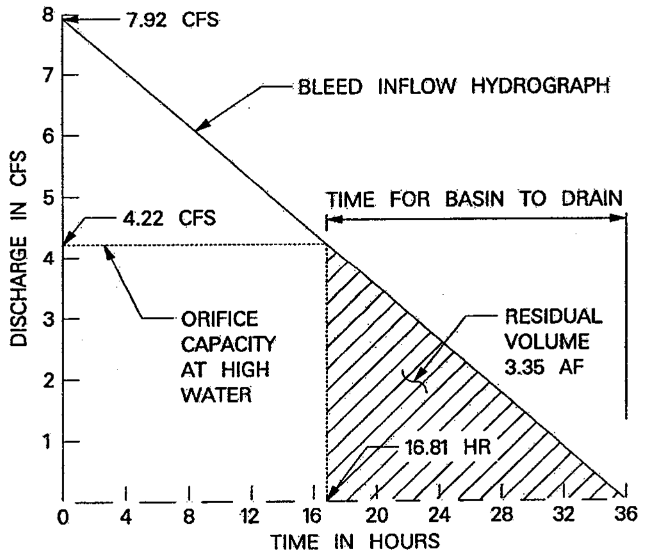

Figure 6. Bleed Off Calculations for Retention Basin C

An orifice plate will be used to control the bleed-off rate for Retention Basins C, D and E. Retention basins in the DU-7 development will bleed retained runoff into the Ray Road storm drain and then into Retention Basins C, D and E after a storm event. The orifices in these retention basins were designed to drain the runoff retained by themselves and the bleed-off flow from DU-7 within 36 hours. Basin C is used here as an example to illustrate the concept of orifice sizing.

Retention Basin C receives a bleed-off volume of 11.78 acre-feet from DU-7 (Ref. 3). The bleed-off flow decreases with time; therefore, to show graphically and to simplify the analysis, the bleed-off inflow hydrograph is assumed to be a straight line. The graph above

(Figure 6) illustrates that the initial bleed-off discharge received by Retention Basin C is 7.92 cfs and decreases to zero cfs within 36 hours.

A 10-inch orifice is proposed for the bleed-off of Retention Basin C. It has a maximum capacity of 4.22 cfs with a maximum water depth of 3-foot in the basin. Within 16.81 hours after a storm event (Figure 6), the bleed-off inflow is more than 4.22 cfs. A Type F catch basin is used with a designed grate elevation 3-foot above basin bottom. This catch basin functions as an emergency spillway and collects the excess bleed-off inflow.

Retention Basin C is full during the entire period of 16.81 hours. The bleed-off inflow falls below 4.22 cfs after 16.81 hours, and the water surface in the basin starts to draw down. Within the remaining 19.19 hours (36 - 16.81), the orifice needs to completely drain the residual bleed-off inflow of 3.35 acre-feet and its retained volume of 0.72 acre-feet. The average orifice flow is required to be no less than 2.56 cfs. With an average water depth of 1.5 feet in Retention Basin C, the average orifice flow is calculated to be 3.22 cfs. Therefore, Retention Basin C will be drained within 36 hours.

Similar calculations were conducted to size orifices for Retention Basins D and E to ensure they are drained within 36 hours. Calculations for retention basin drain time (Basin C, D and E) are provided in Appendix E. Basin F does not receive bleed-off flow from upstream basins. An orifice of 4-inch with an average discharge of 0.45 cfs is proposed to drain the basin of 0.56 acre within 36 hours.

8.0 Conclusions

1. All drainage design is in accordance with the approved *Master Drainage Report for Mesa Proving Grounds* and the *Master Drainage Report for Development Unit 7 at Mesa Proving Grounds,* prepared by Wood Patel (Ref. 1 and Ref. 2).

2. Offsite flow will be collected and routed around DU-7, by a drainage channel along the west side of Signal Butte Road. The offsite flow will be released into the Powerline Floodway Channel in a manner similar to the current condition without an increase in flow.

3. Ray Road, Signal Butte Road, Eastmark Parkway, Kinnet Parkway, and Everton Terrace are designed to contain the 10-year event runoff within the street and flood only one lane of traffic per half street, and the 100-year event runoff within the right-of-way. A maximum flow of 100 cfs is allowed within the street, at a maximum velocity of 10 fps, and a maximum depth of 12 inches.

5. Retention is provided for the 100-year, 2-hour rainfall event.

6. Retention basins will be drained within 36-hours by ground infiltration and bleed-off storm drains. Where bleed-off storm drains are impractical, and infiltration time exceeds the allowable 36 hours, drywells will be used.

9.0 References

1. Wood, Patel and Associates, Inc., *Master Drainage Report for Mesa Proving Grounds,* dated December 20, 2011.
2. Wood, Patel and Associates, Inc., *Master Drainage Report for Development Unit 7 at Mesa Proving Grounds,* dated September 29, 2011.
3. Entellus, Preliminary Drainage Report for Mesa Proving Grounds DU7 South, November, 2011.
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Appendix F

Comment Responses

* The full build-out model in MDR (Wood&Patel, 2011) indicates that a 100-year peak flow of 178 cfs will be collected from the full build-out of MPG. It is estimated that the most of the flow will be collected by the existing 60-inch storm drain aling Ellsworth Road and conveyed to the PFC.

* * System J and System F cross each other and do not interconnect.

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LEGEND

- SUB-BASIN BOUNDARY
- (A) SUB-BASIN IDENTIFICATION
- RETENTION BASIN
- (A) RETENTION BASIN ID
- CATCH BASIN
- STORM DRAIN
- CULVERT

EASTMARK
ON-SITE DRAINAGE MAP

FIGURE 3