APPENDIX G

PRELIMINARY DRAINAGE REPORT
FORRESTER CREEK DEVELOPMENT
Chang Consultants, November 4, 2008

PRELIMINARY STORM WATER MITIGATION PLAN
Burkett & Wong Engineers, March 3, 2009

PRELIMINARY DRAINAGE REPORT
FORRESTER CREEK DEVELOPMENT

Chang Consultants, November 4, 2008

PRELIMINARY DRAINAGE REPORT

FOR

FORESTER CREEK DEVELOPMENT

November 4, 2008

Wayne W. Chang, MS, PE

ChangConsultants

Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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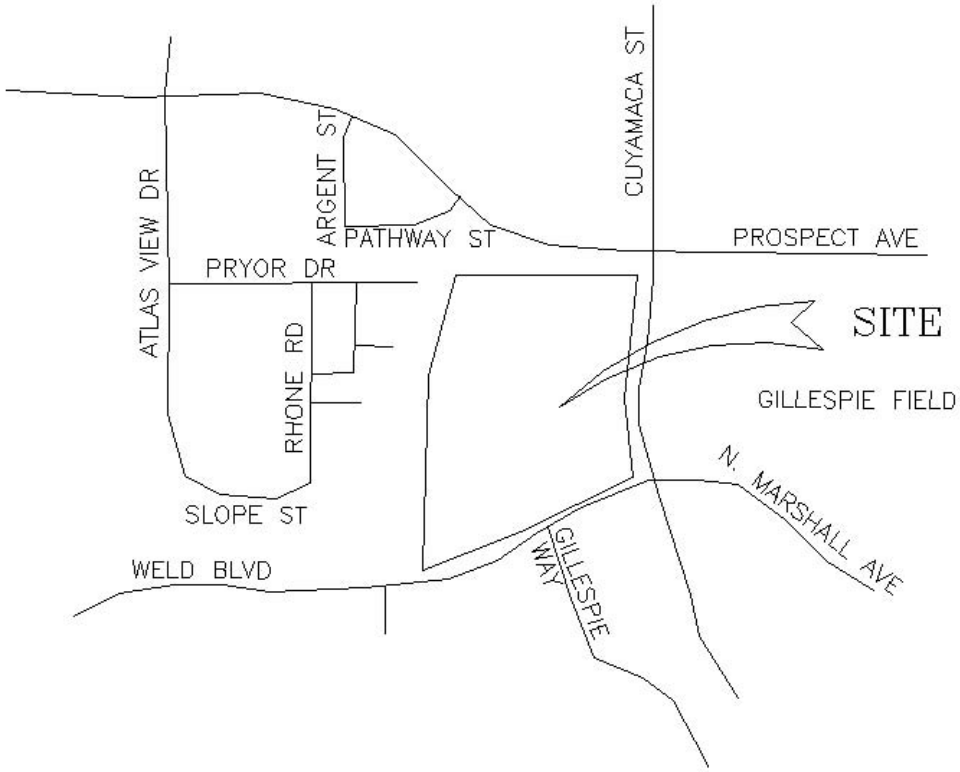
APPENDICES

INTRODUCTION

The Forester Creek project is a proposed industrial development located immediately northwest of the intersection of Weld Boulevard and Cuyamaca Street in the city of El Cajon, California (see Vicinity Map). Burkett & Wong is the civil engineering firm preparing the engineering drawings for the current entitlement process.



VICINITY MAP
NO SCALE

The site is presently undeveloped except for the remains of an abandoned building (see Figure 1). Surface runoff from the site generally flows in an easterly to northeasterly direction towards Forester Creek, which is a concrete-lined trapezoidal channel along the easterly portion of the site. The proposed development will maintain the on-site flows towards the Forester Creek channel. This report contains preliminary hydrologic and hydraulic analyses for the pre-(existing) and post-development (proposed) conditions. This report also contains preliminary detention analyses to estimate the detention volume needed to attenuate the proposed condition 100-year runoff to existing levels. Finally, this report contains hydraulic analyses for a proposed storm drain that will convey off-site runoff around the site.

Figure 1. Looking East towards Cuyamaca Street (Weld Boulevard is on the right)

HYDROLOGIC ANALYSES

Rational method analyses were performed in accordance with the city of El Cajon's hydrology criteria. The analyses determined the existing and proposed condition 100-year flow rates at the site. Advanced Engineering Software's (AES) Rational Method program was used for the analyses.

The following summarizes the input parameters (see Appendix A for backup). The 100-year intensity-duration curve from the city of El Cajon's 1987, *Department of Public Works Improvement Standards,* was entered into the model. The drainage basins, flow paths, and elevations were based on the topographic mapping for existing conditions and Burkett & Wong's grading plan for proposed conditions.

The existing condition runoff coefficient was based on Figure 3.4-0 from the *Improvement Standards*. Figure 3.4-0 provides the runoff coefficient based on the soil infiltration, topographic relief, vegetal cover, and surface storage. The hydrologic soil group at the site is entirely "C" according to the *Soil Survey* for San Diego County, which represents a soil with high runoff

potential and low infiltration. The ground relief was estimated from the topographic mapping and a site visit. The vegetal cover and surface storage were determined from the site visit. Based on this, the existing condition on-site runoff coefficient is 0.55. The proposed condition runoff coefficient for an industrial site is 0.85 according to the *Improvement Standards.*

The existing and proposed condition rational method analyses results and work maps are included in Appendix A. An existing residential subdivision just west of the site outlets runoff onto the site from a storm drain pipe and drainage ditches. The plans and hydrology study for the subdivision (Los Castillos, Drawing No. 2003-176) were obtained from the city of Santee. The study shows that the subdivision contributes a 100-year flow rate of 17.5 cubic feet per second (cfs) onto the Forester Creek site at Rational Method Node 10. Therefore, this was entered as user-specified data at Node 10 in the existing and proposed condition analyses. The overall existing condition drainage area was set equal to the overall proposed condition drainage area to allow a comparison of the results. The results indicate that the total existing and proposed condition flow rates from the site and its tributary areas are 55 and 80 cfs, respectively.

Detention analyses were performed to assess the storage proposed on the preliminary plan, which involves an underground detention basin serving the site. The County of San Diego's hydrograph synthesis procedure was used to create a hydrograph from the proposed condition rational method results. The hydrograph was entered into HEC-1. Next a stage-storage and stage-discharge relationship must be entered into HEC-1. The stage-storage relationship was established based on the basin footprint shown on the plan, assuming vertical basin walls, and no loss in storage volume due to interior support walls. A stage-discharge relationship was established by assuming a 30-inch reinforced concrete pipe from the basin to the adjacent Forrester Creek channel. WSPGW was used to determine the stage-discharge in the 30-inch RCP based on both a free outflow and a 100-year water surface elevation in Forrester Creek of 349 feet.

The HEC-1 input data and results are included in Appendix B. For the pipe outflow based on the 349 feet elevation, the proposed condition flow is reduced to 42 cfs and the ponded water surface elevation in the basin is 351.3 feet. For the free pipe outflow, the flow is reduced to 40 cfs and the ponded water surface elevation in the basin is 349.5 feet. In both cases, the flow is below the existing condition rate of 55 cfs, so the detention is adequate. Furthermore, the ponded water surface elevation does not reach the basin ceiling, which is shown as 352 feet on the plans.

HYDRAULIC ANALYSES

There are two existing storm drains (a double 24-inch RCP and a 42-inch RCP per city of El Cajon Drawing No. 4432) that outlet onto the site from Weld Boulevard. The project proposes to collect the runoff from these outlets in a proposed storm drain. The storm drain will be aligned along the site perimeter and ultimately outlet into the Forester Creek channel. The as-built plans show a 100-year flow rate of 30.3 cfs from the double 24-inch RCPs, but do not provide a flow rate for the 42-inch RCP. A normal depth analysis was performed for the 42-inch RCP, which shows a capacity of 112.5 cfs (see analysis following this report text). Therefore, the total runoff

was estimated to be 143 cfs (30.3 cfs + 112.5 cfs). An additional normal depth analysis was performed that indicated that this flow rate can be conveyed in a 48-inch RCP.

CONCLUSION

Hydrologic, hydraulic, and detention analyses have been performed to determine the existing and proposed condition 100-year flow rates at the site. The results were performed for entitlement purposes and are, therefore, at a preliminary level. More detailed analyses will be performed during final engineering.

Worksheet for 42" RCP Storm Drain

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01250	ft/ft
Normal Depth	3.50	ft
Diameter	3.50	ft
Discharge	112.48	ft^3/s

Results

Discharge	112.48	ft^3/s
Normal Depth	3.50	ft
Flow Area	9.62	ft^2
Wetted Perimeter	11.00	ft
Top Width	0.00	ft
Critical Depth	3.19	ft
Percent Full	100.0	%
Critical Slope	0.01090	ft/ft
Velocity	11.69	ft/s
Velocity Head	2.12	ft
Specific Energy	5.62	ft
Froude Number	0.00	
Maximum Discharge	120.99	ft^3/s
Discharge Full	112.48	ft^3/s
Slope Full	0.01250	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for 42" RCP Storm Drain

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.50	ft
Critical Depth	3.19	ft
Channel Slope	0.01250	ft/ft
Critical Slope	0.01090	ft/ft

Worksheet for New Storm Drain

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.01800	ft/ft
Normal Depth	3.58	ft
Diameter	3.58	ft
Discharge	143.00	ft^3/s

Results

Diameter	3.58	ft
Normal Depth	3.58	ft
Flow Area	10.05	ft^2
Wetted Perimeter	11.24	ft
Top Width	0.00	ft
Critical Depth	3.41	ft
Percent Full	100.0	%
Critical Slope	0.01561	ft/ft
Velocity	14.23	ft/s
Velocity Head	3.15	ft
Specific Energy	6.73	ft
Froude Number	0.00	
Maximum Discharge	153.80	ft^3/s
Discharge Full	142.98	ft^3/s
Slope Full	0.01801	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for New Storm Drain

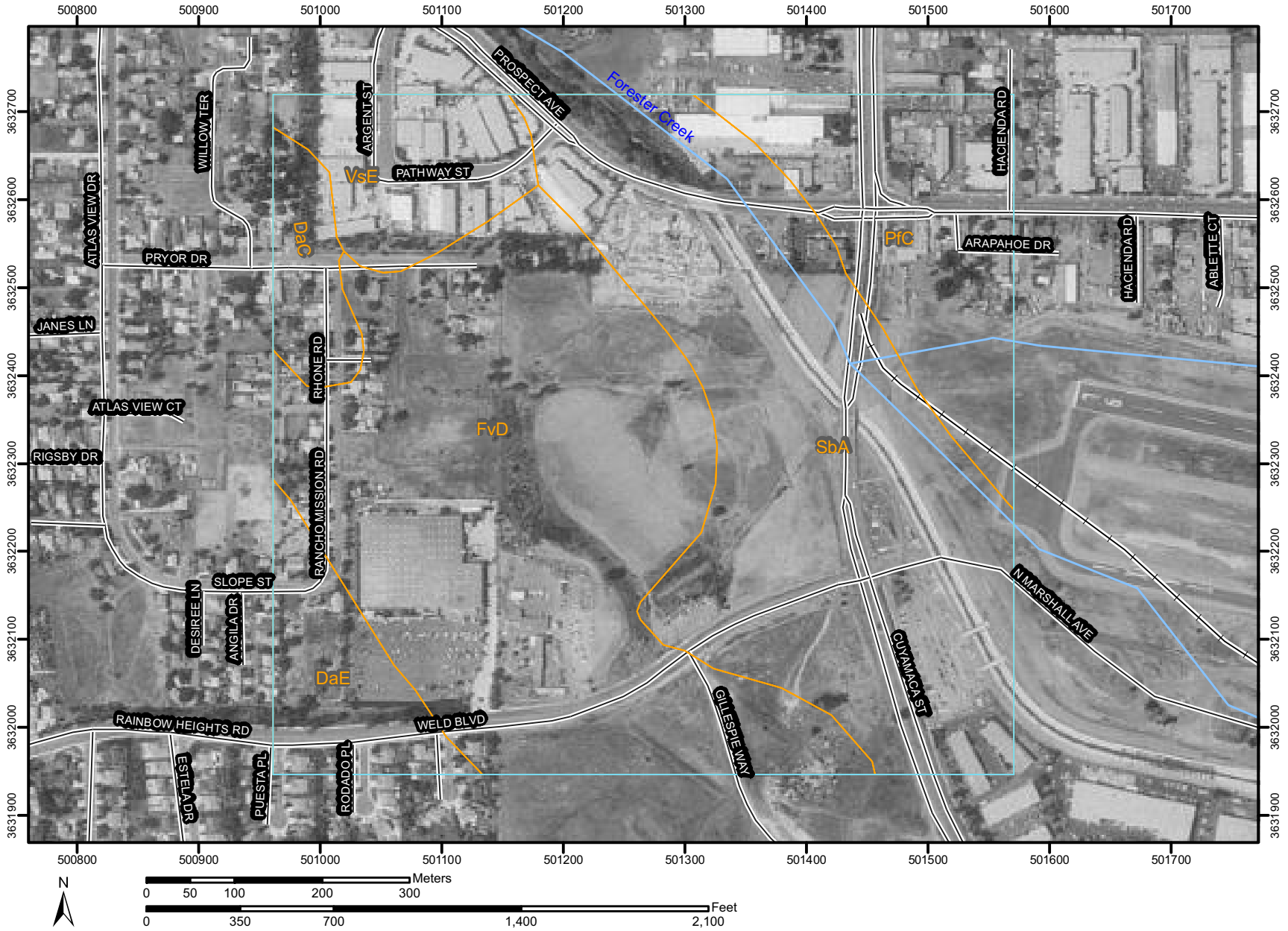
GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.58	ft
Critical Depth	3.41	ft
Channel Slope	0.01800	ft/ft
Critical Slope	0.01561	ft/ft

APPENDIX A

100-Year Rational Method Analyses

SITE IS IN SOIL GROUP C (FvD & SbA)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

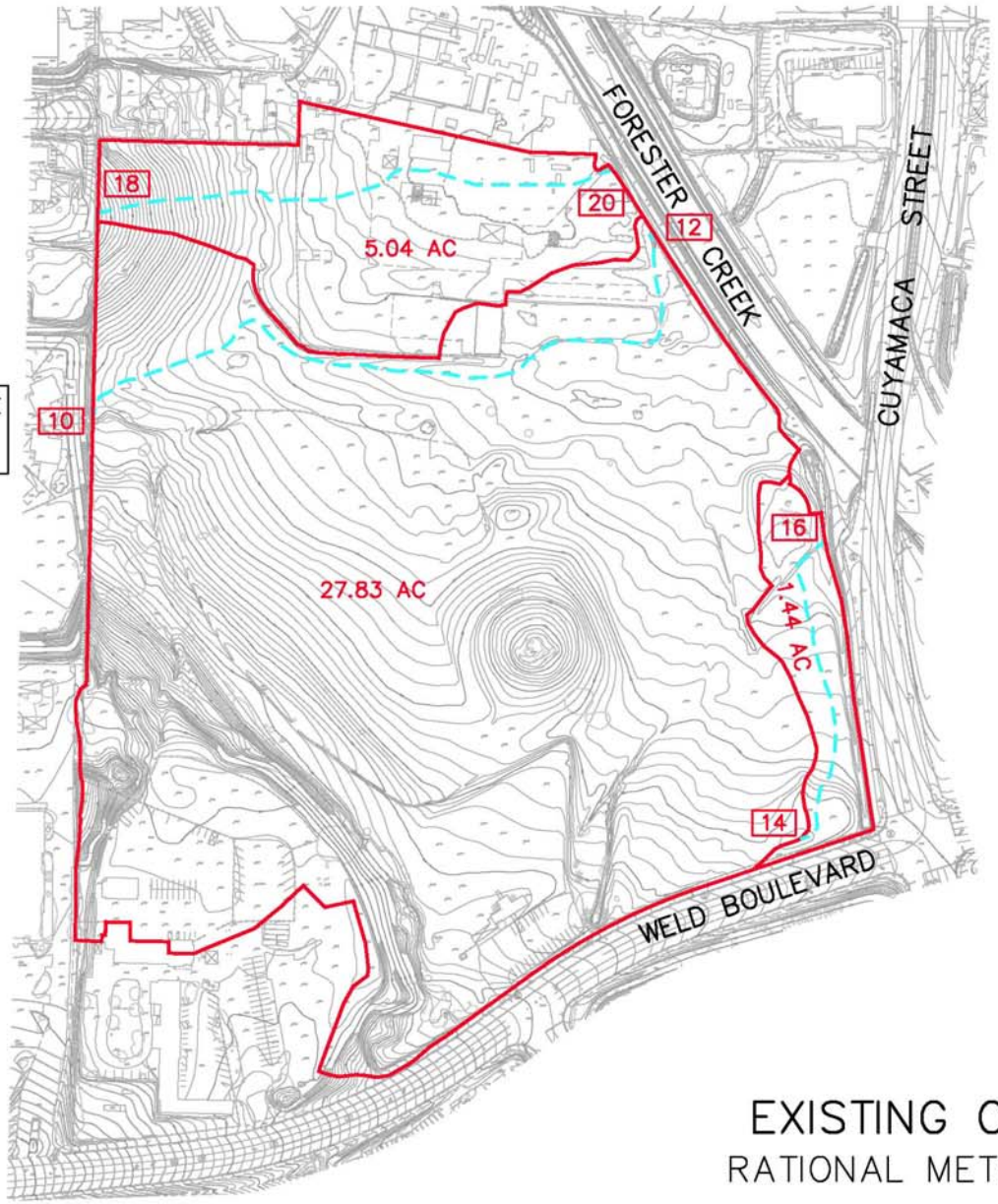
Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 6, Dec 17, 2007

Date(s) aerial images were photographed: 5/31/1994

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
DaC	Diablo clay, 2 to 9 percent slopes	5.2	3.2%
DaE	Diablo clay, 15 to 30 percent slopes	9.4	5.9%
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes	61.5	38.1%
PfC	Placentia sandy loam, thick surface, 2 to 9 percent slo pes	19.9	12.3%
SbA	Salinas clay loam, 0 to 2 percent slopes	54.8	34.0%
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	10.5	6.5%
Totals for Area of Interest (AOI)		161.3	100.0%



Q100=17.5 CFS AT NODE 10 FROM LOS CASTILLOS SUBDIVISION

1" = 200'

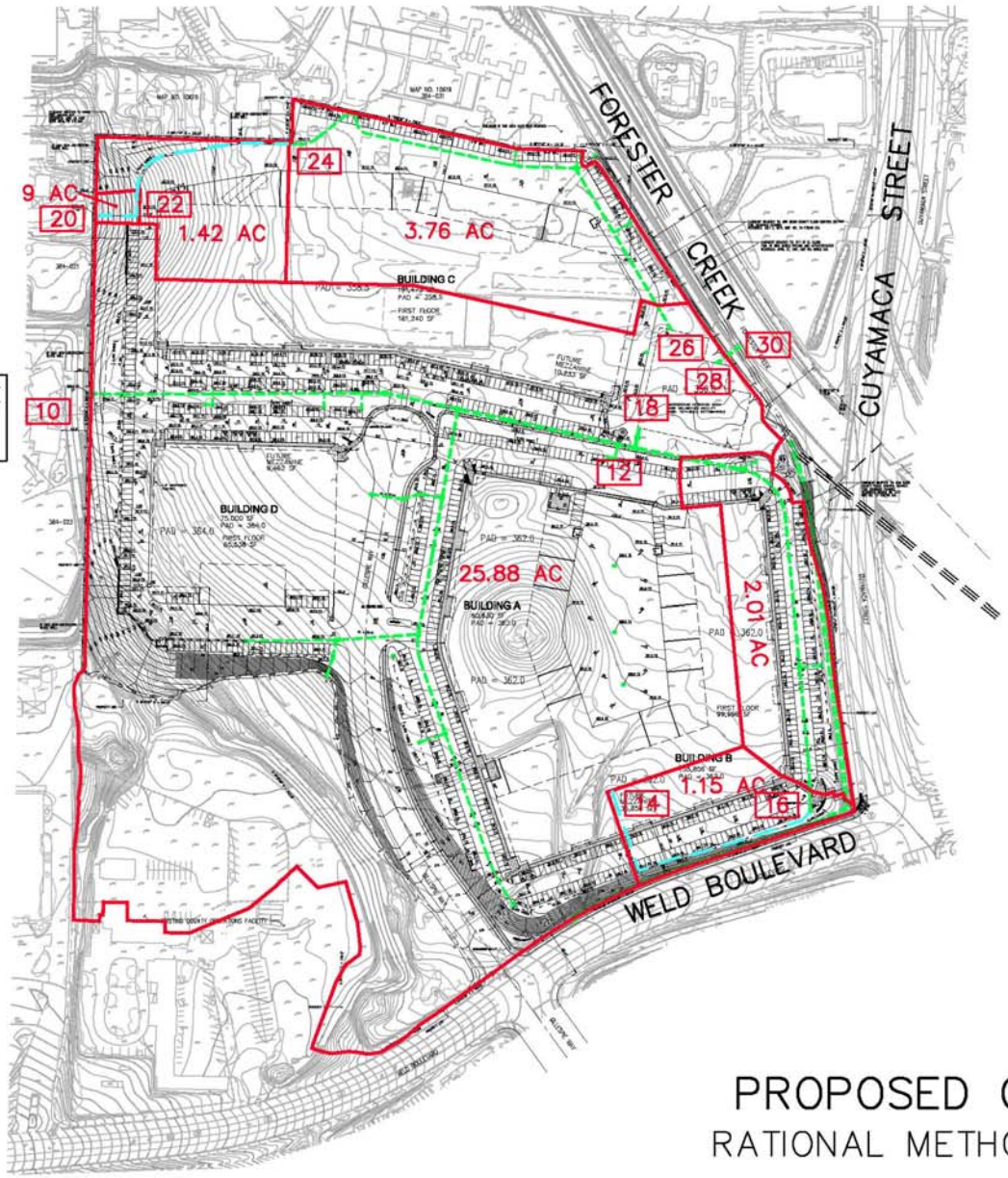
0 200

LEGEND:

- DRAINAGE BASIN BOUNDARY
- FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER

EXISTING CONDITION

RATIONAL METHOD WORK MAP



1" = 200'

0 200

Q100=17.5 CFS AT NODE 10 FROM LOS CASTILLOS SUBDIVISION

LEGEND:

- DRAINAGE BASIN BOUNDARY
- FLOW PATH
- PROPOSED STORM DRAIN
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER

PROPOSED CONDITION

RATIONAL METHOD WORK MAP

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              Ver. 2.0 Release Date: 06/01/2005  License ID 1526

                              Analysis prepared by:
```

************************** DESCRIPTION OF STUDY **************************

*** Forester Creek Project ***
*** City of El Cajon Hydrology ***
*** Existing Condition 100-Year Analysis ***

****

```
  FILE NAME: EXIST.DAT
  TIME/DATE OF STUDY: 19:11 11/04/2008
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  3.700
   2)   6.000;  3.400
   3)   7.000;  3.200
   4)   8.000;  3.000
   5)   9.000;  2.800
   6)  10.000;  2.700
   7)  15.000;  2.200
   8)  20.000;  2.000
   9)  30.000;  1.600
  SPECIFIED CONSTANT RUNOFF COEFFICIENT = 0.550
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  15.70   RAIN INTENSITY(INCH/HOUR) =  2.17
  TOTAL AREA(ACRES) =     6.95   TOTAL RUNOFF(CFS) =     17.45

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     12.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    367.00  DOWNSTREAM(FEET) =    344.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1217.00   CHANNEL SLOPE =  0.0182
  CHANNEL BASE(FEET) =    5.00   "Z" FACTOR =   3.000
  MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.970
  *USER SPECIFIED(GLOBAL):
  GRASS FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      32.71
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.02
  AVERAGE FLOW DEPTH(FEET) =   1.01   TRAVEL TIME(MIN.) =   5.04
  Tc(MIN.) =  20.74
  SUBAREA AREA(ACRES) =    27.83       SUBAREA RUNOFF(CFS) =   30.16
  TOTAL AREA(ACRES) =       34.8         PEAK FLOW RATE(CFS) =      47.61

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  1.23   FLOW VELOCITY(FEET/SEC.) =   4.45
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE     12.00 =    1217.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  20.74
  RAINFALL INTENSITY(INCH/HR) =   1.97
  TOTAL STREAM AREA(ACRES) =    34.78
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     47.61

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     16.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(GLOBAL):
  GRASS FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MIN. ADDED =  13.86(MIN.)
```

```
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   540.00
  UPSTREAM ELEVATION(FEET) =    366.80
  DOWNSTREAM ELEVATION(FEET) =    351.00
  ELEVATION DIFFERENCE(FEET) =     15.80
  NATURAL WATERSHED TIME OF CONCENTRATION =  13.86
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.314
  SUBAREA RUNOFF(CFS) =      1.83
  TOTAL AREA(ACRES) =      1.44   TOTAL RUNOFF(CFS) =      1.83

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     16.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  13.86
  RAINFALL INTENSITY(INCH/HR) =   2.31
  TOTAL STREAM AREA(ACRES) =     1.44
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.83

****************************************************************************
  FLOW PROCESS FROM NODE     18.00 TO NODE     20.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(GLOBAL):
  GRASS FAIR COVER RUNOFF COEFFICIENT = .5500
  S.C.S. CURVE NUMBER (AMC II) =   0
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MIN. ADDED =  14.44(MIN.)
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   873.00
  UPSTREAM ELEVATION(FEET) =    389.00
  DOWNSTREAM ELEVATION(FEET) =    342.50
  ELEVATION DIFFERENCE(FEET) =     46.50
  NATURAL WATERSHED TIME OF CONCENTRATION =  14.44
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.256
  SUBAREA RUNOFF(CFS) =      6.25
  TOTAL AREA(ACRES) =      5.04   TOTAL RUNOFF(CFS) =      6.25

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     20.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =  14.44
  RAINFALL INTENSITY(INCH/HR) =   2.26
  TOTAL STREAM AREA(ACRES) =     5.04
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.25

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       47.61    20.74        1.970         34.78
```

```
    2        1.83    13.86        2.314          1.44
    3        6.25    14.44        2.256          5.04

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       48.48    13.86       2.314
      2       49.62    14.44       2.256
      3       54.63    20.74       1.970

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      54.63   Tc(MIN.) =   20.74
  TOTAL AREA(ACRES) =       41.3
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE     20.00 =    1217.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       41.3  TC(MIN.) =     20.74
  PEAK FLOW RATE(CFS)   =      54.63
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
 ************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              Ver. 2.0 Release Date: 06/01/2005  License ID 1526

                              Analysis prepared by:
```

********** **DESCRIPTION OF STUDY** **********

*** Forester Creek Project ***
*** City of El Cajon Hydrology ***
*** Proposed Condition 100-Year Analysis ***

****

```
  FILE NAME: PROP.DAT
  TIME/DATE OF STUDY: 19:09 11/04/2008
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  3.700
   2)   6.000;  3.400
   3)   7.000;  3.200
   4)   8.000;  3.000
   5)   9.000;  2.800
   6)  10.000;  2.700
   7)  15.000;  2.200
   8)  20.000;  2.000
   9)  30.000;  1.600
  SPECIFIED CONSTANT RUNOFF COEFFICIENT = 0.850
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =   7
----------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  15.70   RAIN INTENSITY(INCH/HOUR) =  2.17
  TOTAL AREA(ACRES) =     6.95   TOTAL RUNOFF(CFS) =     17.45

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   366.00  DOWNSTREAM(FEET) =   348.20
  FLOW LENGTH(FEET) =   921.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.95
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      17.45
  PIPE TRAVEL TIME(MIN.) =   1.54    Tc(MIN.) =  17.24
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE     12.00 =     921.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     12.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.110
  *USER SPECIFIED(GLOBAL):
  INDUSTRIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =   25.88   SUBAREA RUNOFF(CFS) =   46.42
  TOTAL AREA(ACRES) =       32.8   TOTAL RUNOFF(CFS) =      63.87
  TC(MIN.) =  17.24

****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  17.24
  RAINFALL INTENSITY(INCH/HR) =   2.11
  TOTAL STREAM AREA(ACRES) =    32.83
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     63.87

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     16.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(GLOBAL):
  INDUSTRIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
```

```
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   445.00
  UPSTREAM ELEVATION(FEET) =    363.00
  DOWNSTREAM ELEVATION(FEET) =    358.20
  ELEVATION DIFFERENCE(FEET) =      4.80
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    9.256
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.774
  SUBAREA RUNOFF(CFS) =      2.71
  TOTAL AREA(ACRES) =      1.15   TOTAL RUNOFF(CFS) =      2.71

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     12.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   353.20  DOWNSTREAM(FEET) =   348.20
  FLOW LENGTH(FEET) =   789.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.14
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.71
  PIPE TRAVEL TIME(MIN.) =   3.17    Tc(MIN.) =  12.43
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     12.00 =    1234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     12.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.457
  *USER SPECIFIED(GLOBAL):
  INDUSTRIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =    2.01   SUBAREA RUNOFF(CFS) =    4.20
  TOTAL AREA(ACRES) =        3.2   TOTAL RUNOFF(CFS) =       6.91
  TC(MIN.) =  12.43

****************************************************************************
  FLOW PROCESS FROM NODE     16.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.43
  RAINFALL INTENSITY(INCH/HR) =   2.46
  TOTAL STREAM AREA(ACRES) =     3.16
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.91

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       63.87    17.24        2.110         32.83
      2        6.91    12.43        2.457          3.16
```

```
  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       61.77    12.43       2.457
      2       69.81    17.24       2.110

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      69.81   Tc(MIN.) =   17.24
  TOTAL AREA(ACRES) =       36.0
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     12.00 =    1234.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     18.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   348.20  DOWNSTREAM(FEET) =   346.00
  FLOW LENGTH(FEET) =    34.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  21.88
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      69.81
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =  17.27
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     18.00 =    1268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     18.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  17.27
  RAINFALL INTENSITY(INCH/HR) =   2.11
  TOTAL STREAM AREA(ACRES) =    35.99
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     69.81

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     22.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(GLOBAL):
  INDUSTRIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
  S.C.S. CURVE NUMBER (AMC II) =   0
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MIN. ADDED =  10.30(MIN.)
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    73.00
  UPSTREAM ELEVATION(FEET) =    389.00
  DOWNSTREAM ELEVATION(FEET) =    358.00
  ELEVATION DIFFERENCE(FEET) =     31.00
  NATURAL WATERSHED TIME OF CONCENTRATION =  10.30
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.670
SUBAREA RUNOFF(CFS) =      0.20
TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.20

****************************************************************************
FLOW PROCESS FROM NODE     22.00 TO NODE     24.00 IS CODE =  51
----------------------------------------------------------------------------
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    358.00  DOWNSTREAM(FEET) =    355.00
CHANNEL LENGTH THRU SUBAREA(FEET) =   290.00   CHANNEL SLOPE =  0.0103
CHANNEL BASE(FEET) =    0.20   "Z" FACTOR =   3.000
MANNING'S FACTOR = 0.040   MAXIMUM DEPTH(FEET) =   1.00
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.368
*USER SPECIFIED(GLOBAL):
INDUSTRIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
S.C.S. CURVE NUMBER (AMC II) =   0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.64
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.60
AVERAGE FLOW DEPTH(FEET) =   0.55   TRAVEL TIME(MIN.) =   3.02
Tc(MIN.) =  13.32
SUBAREA AREA(ACRES) =     1.42       SUBAREA RUNOFF(CFS) =    2.86
TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       3.06

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.70   FLOW VELOCITY(FEET/SEC.) =   1.88
LONGEST FLOWPATH FROM NODE     20.00 TO NODE     24.00 =     363.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     24.00 TO NODE     26.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   350.00  DOWNSTREAM(FEET) =   346.00
FLOW LENGTH(FEET) =   838.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.86
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       3.06
PIPE TRAVEL TIME(MIN.) =   3.62    Tc(MIN.) =  16.94
LONGEST FLOWPATH FROM NODE     20.00 TO NODE     26.00 =    1201.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     24.00 TO NODE     26.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.122
*USER SPECIFIED(GLOBAL):
INDUSTRIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =    3.76   SUBAREA RUNOFF(CFS) =    6.78
TOTAL AREA(ACRES) =        5.3   TOTAL RUNOFF(CFS) =       9.85
TC(MIN.) =  16.94
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     24.00 TO NODE     26.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  16.94
  RAINFALL INTENSITY(INCH/HR) =   2.12
  TOTAL STREAM AREA(ACRES) =     5.27
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.85

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
      1       69.81    17.27        2.109         35.99
      2        9.85    16.94        2.122          5.27

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1       79.22    16.94       2.122
      2       79.59    17.27       2.109

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      79.59   Tc(MIN.) =   17.27
  TOTAL AREA(ACRES) =       41.3
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     26.00 =    1268.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     28.00 TO NODE     30.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   346.00  DOWNSTREAM(FEET) =   345.00
  FLOW LENGTH(FEET) =    46.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  25.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.16
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      79.59
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =  17.32
  LONGEST FLOWPATH FROM NODE     14.00 TO NODE     30.00 =    1314.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       41.3  TC(MIN.) =     17.32
  PEAK FLOW RATE(CFS)   =      79.59
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX B

Detention Analyses

STAGE-STORAGE RELATIONSHIP

==========
JOB TITLE
==========

Project Date: 8/25/2008
Project Engineer:
Project Title: Watershed
Project Comments:

S/N:
PondPack Ver: Compute Time: Date:

Table of Contents

S/N:
PondPack Ver: Compute Time: Date:

Name.... PRELIM BASIN

File.... C:\Documents and Settings\Wayne W. Chang\Desktop\BASIN.PPW

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
345.20	-----	.0000	.0000	.000	.000
346.00	-----	.5614	.5614	.150	.150
348.00	-----	.5614	1.6843	1.123	1.273
350.00	-----	.5614	1.6843	1.123	2.395
352.00	-----	.5614	1.6843	1.123	3.518
353.00	-----	.5614	1.6843	.561	4.080

POND VOLUME EQUATIONS

* Incremental volume computed by the Conic Method for Reservoir Volumes.

Volume = (1/3) * (EL2-EL1) * (Area1 + Area2 + sq.rt.(Area1*Area2))

where: EL1, EL2 = Lower and upper elevations of the increment
Area1,Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

S/N:
PondPack Ver: Compute Time: Date:

STAGE-DISCHARGE (FREE OUTFLOW)

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:45:50

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet is free outflow

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	344.500	.403	344.903	2.80	5.46	.46	345.37	.00	.55	1.84	2.500	.000	.00	1 .0
10.917	.0150					.0145	.16	.40	1.82	.40	.013	.00	.00	PIPE
1010.917	344.664	.405	345.069	2.80	5.42	.46	345.52	.00	.55	1.84	2.500	.000	.00	1 .0
17.843	.0150					.0134	.24	.41	1.80	.40	.013	.00	.00	PIPE
1028.760	344.931	.418	345.349	2.80	5.17	.41	345.76	.00	.55	1.87	2.500	.000	.00	1 .0
6.896	.0150					.0117	.08	.42	1.69	.40	.013	.00	.00	PIPE
1035.655	345.034	.433	345.468	2.80	4.93	.38	345.84	.00	.55	1.89	2.500	.000	.00	1 .0
4.250	.0150					.0102	.04	.43	1.58	.40	.013	.00	.00	PIPE
1039.905	345.098	.447	345.545	2.80	4.70	.34	345.89	.00	.55	1.92	2.500	.000	.00	1 .0
2.661	.0150					.0089	.02	.45	1.48	.40	.013	.00	.00	PIPE
1042.566	345.138	.462	345.600	2.80	4.48	.31	345.91	.00	.55	1.94	2.500	.000	.00	1 .0
1.712	.0150					.0078	.01	.46	1.39	.40	.013	.00	.00	PIPE
1044.278	345.164	.478	345.642	2.80	4.27	.28	345.92	.00	.55	1.97	2.500	.000	.00	1 .0
1.191	.0150					.0068	.01	.48	1.30	.40	.013	.00	.00	PIPE
1045.469	345.182	.494	345.676	2.80	4.07	.26	345.93	.00	.55	1.99	2.500	.000	.00	1 .0
.708	.0150					.0060	.00	.49	1.22	.40	.013	.00	.00	PIPE
1046.176	345.192	.511	345.703	2.80	3.88	.23	345.94	.00	.55	2.02	2.500	.000	.00	1 .0
.436	.0150					.0052	.00	.51	1.14	.40	.013	.00	.00	PIPE

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:45:50

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet is free outflow

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1046.612	345.199	.528	345.727	2.80	3.70	.21	345.94	.00	.55	2.04	2.500	.000	.00	1 .0
.088	.0150					.0045	.00	.53	1.07	.40	.013	.00	.00	PIPE
1046.700	345.200	.548	345.748	2.80	3.52	.19	345.94	.00	.55	2.07	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	.804	346.004	2.80	.87	.01	346.02	.00	.25	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:45:50

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet is free outflow

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	344.500	1.363	345.863	26.00	9.50	1.40	347.26	.00	1.74	2.49	2.500	.000	.00	1 .0
19.725	.0150					.0114	.22	1.36	1.60	1.28	.013	.00	.00	PIPE
1019.725	344.796	1.415	346.211	26.00	9.07	1.28	347.49	.00	1.74	2.48	2.500	.000	.00	1 .0
11.914	.0150					.0100	.12	1.42	1.49	1.28	.013	.00	.00	PIPE
1031.639	344.974	1.472	346.446	26.00	8.64	1.16	347.61	.00	1.74	2.46	2.500	.000	.00	1 .0
7.439	.0150					.0089	.07	1.47	1.38	1.28	.013	.00	.00	PIPE
1039.078	345.086	1.532	346.618	26.00	8.24	1.05	347.67	.00	1.74	2.44	2.500	.000	.00	1 .0
4.474	.0150					.0079	.04	1.53	1.28	1.28	.013	.00	.00	PIPE
1043.552	345.153	1.596	346.749	26.00	7.86	.96	347.71	.00	1.74	2.40	2.500	.000	.00	1 .0
2.393	.0150					.0070	.02	1.60	1.18	1.28	.013	.00	.00	PIPE
1045.945	345.189	1.664	346.853	26.00	7.49	.87	347.72	.00	1.74	2.36	2.500	.000	.00	1 .0
.755	.0150					.0062	.00	1.66	1.09	1.28	.013	.00	.00	PIPE
1046.700	345.200	1.738	346.938	26.00	7.14	.79	347.73	.00	1.74	2.30	2.500	.000	.00	1 .0
WALL ENTRANCE														
1046.700	345.200	2.830	348.030	26.00	2.30	.08	348.11	.00	1.09	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:45:50

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet is free outflow

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	1.941	346.441	45.00	11.00	1.88	348.32	.00	2.23	2.08	2.500	.000	.00	1 .0
21.442	.0150					.0130	.28	1.94	1.38	1.85	.013	.00	.00	PIPE
1021.442	344.821	1.992	346.814	45.00	10.73	1.79	348.60	.00	2.23	2.01	2.500	.000	.00	1 .0
19.699	.0150					.0121	.24	1.99	1.31	1.85	.013	.00	.00	PIPE
1041.141	345.117	2.098	347.215	45.00	10.23	1.62	348.84	.00	2.23	1.84	2.500	.000	.00	1 .0
5.559	.0150					.0111	.06	2.10	1.16	1.85	.013	.00	.00	PIPE
1046.700	345.200	2.225	347.425	45.00	9.75	1.48	348.90	.00	2.23	1.56	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	4.840	350.040	45.00	2.32	.08	350.12	.00	1.58	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:45:50

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet is free outflow

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	2.416	346.916	64.00	13.17	2.70	349.61	.00	2.42	.90	2.500	.000	.00	1 .0
3.957	.0150					.0222	.09	2.42	1.00	2.50	.013	.00	.00	PIPE
1003.957	344.559	2.500	347.059	64.00	13.04	2.64	349.70	.00	2.42	.00	2.500	.000	.00	1 .0
42.743	.0150					.0237	1.01	2.50	.00	2.50	.013	.00	.00	PIPE
1046.700	345.200	2.900	348.100	64.00	13.04	2.64	350.74	.00	2.42	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	6.728	351.928	64.00	2.38	.09	352.02	.00	2.00	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:45:50

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet is free outflow

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	2.440	346.940	70.00	14.35	3.20	350.14	.00	2.44	.76	2.500	.000	.00	1 .0
1.708	.0150					.0267	.05	2.44	1.00	2.50	.013	.00	.00	PIPE
1001.708	344.526	2.500	347.026	70.00	14.26	3.16	350.18	.00	2.44	.00	2.500	.000	.00	1 .0
44.992	.0150					.0283	1.28	2.50	.00	2.50	.013	.00	.00	PIPE
1046.700	345.200	3.136	348.336	70.00	14.26	3.16	351.49	.00	2.44	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	7.755	352.955	70.00	2.26	.08	353.03	.00	2.12	4.00	7.800	4.000	.00	0 .0

STAGE-DISCHARGE (DOWNSTREAM TAILWATER = 349')

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:24:12

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet wsel = 349' from previous FIRM

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	4.500	349.000	1.00	.20	.00	349.00	.00	.32	.00	2.500	.000	.00	1 .0
46.700	.0150					.0000	.00	4.50	.00	.24	.013	.00	.00	PIPE
WALL	ENTRANCE													
1046.700	345.200	3.801	349.001	1.00	.07	.00	349.00	.00	.12	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:24:12

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet wsel = 349' from previous FIRM

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	4.500	349.000	29.00	5.91	.54	349.54	.00	1.84	.00	2.500	.000	.00	1 .0
46.700	.0150					.0050	.23	4.50	.00	1.36	.013	.00	.00	PIPE
1046.700	345.200	4.033	349.233	29.00	5.91	.54	349.78	.00	1.84	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	4.794	349.994	29.00	1.51	.04	350.03	.00	1.18	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:24:12

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet wsel = 349' from previous FIRM

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	4.500	349.000	41.00	8.35	1.08	350.08	.00	2.15	.00	2.500	.000	.00	1 .0
46.700	.0150					.0100	.47	4.50	.00	1.72	.013	.00	.00	PIPE
1046.700	345.200	4.267	349.467	41.00	8.35	1.08	350.55	.00	2.15	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	5.820	351.020	41.00	1.76	.05	351.07	.00	1.48	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:24:12

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet wsel = 349' from previous FIRM

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	4.500	349.000	50.00	10.19	1.61	350.61	.00	2.30	.00	2.500	.000	.00	1 .0
46.700	.0150					.0149	.69	4.50	.00	2.04	.013	.00	.00	PIPE
1046.700	345.200	4.494	349.694	50.00	10.19	1.61	351.31	.00	2.30	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	6.833	352.033	50.00	1.83	.05	352.09	.00	1.69	4.00	7.800	4.000	.00	0 .0

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date: 8-25-2008 Time:10:24:12

Forrester Creek Site
Preliminary Outlet from Detention Basin
Assume outlet wsel = 349' from previous FIRM

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	344.500	4.500	349.000	57.00	11.61	2.09	351.09	.00	2.37	.00	2.500	.000	.00	1 .0
46.700	.0150					.0193	.90	4.50	.00	2.50	.013	.00	.00	PIPE
1046.700	345.200	4.702	349.902	57.00	11.61	2.09	352.00	.00	2.37	.00	2.500	.000	.00	1 .0
WALL	ENTRANCE													
1046.700	345.200	7.764	352.964	57.00	1.84	.05	353.02	.00	1.85	4.00	7.800	4.000	.00	0 .0

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   04NOV08  TIME  20:06:51   *
*                                       *
*****************************************
```

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

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

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

                       *DIAGRAM
*** FREE ***
              1        ID   FORESTER CREEK PROJECT
              2        ID   CONCEPTUAL DETENTION BASIN ANALYSIS USING 11-2008 REPORT GRADING
              3        ID   AND ASSUMING OUTLET OF 30" RCP OUTLET PIPE IS FREE OUTFLOW.
              4        ID   100-YEAR STORM EVENT
              5        ID   RATIONAL METHOD HYDROGRAPH
              6        IT       2 01JAN90    1200     200

              7        KK   BASIN
              8        KM   6HR RAINFALL IS 2.4 INCHES
              9        KM   AVERAGE RATIONAL METHOD RUNOFF COEFFICIENT IS 0.83
             10        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 17.55 MIN.
             11        BA   .0645
             12        IN      18 01JAN90    1151
             13        QI       0       0       5     5.3     5.7     6.2     6.9     7.7     8.8    10.5
             14        QI    13.3    19.5    79.6    46.3    15.6    11.7     9.5     8.2     7.2     6.5
             15        QI       6     5.5     5.1       0       0       0       0       0       0       0
             16        QI       0       0       0

             17        KK  DETAIN
             18        RS       1    STOR      -1
             19        SV       0    0.15   1.273   2.395   3.518   4.080
             20        SQ       0     2.8      26      45      64      70
             21        SE   345.2     346     348     350     352     353
             22        ZZ
```

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

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

    7       BASIN
               V
               V
   17      DETAIN

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
**************************************                **************************************
*                                    *                *                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*                *    U.S. ARMY CORPS OF ENGINEERS    *
*              JUN   1998            *                *    HYDROLOGIC ENGINEERING CENTER   *
*           VERSION 4.1              *                *         609 SECOND STREET          *
*                                    *                *       DAVIS, CALIFORNIA 95616      *
*  RUN DATE   04NOV08  TIME  20:06:51*                *          (916) 756-1104            *
*                                    *                *                                    *
**************************************                **************************************
```

FORESTER CREEK PROJECT
CONCEPTUAL DETENTION BASIN ANALYSIS USING 11-2008 REPORT GRADING
AND ASSUMING OUTLET OF 30" RCP OUTLET PIPE IS FREE OUTFLOW.
100-YEAR STORM EVENT
RATIONAL METHOD HYDROGRAPH

```
    IT          HYDROGRAPH TIME DATA
                  NMIN          2  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1JAN90  STARTING DATE
                 ITIME        1200  STARTING TIME
                    NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      1JAN90  ENDING DATE
                NDTIME        1838  ENDING TIME
                ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .03 HOURS
                   TOTAL TIME BASE    6.63 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


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


          **************
          *            *
  7 KK    *     BASIN  *
          *            *
          **************
                  6HR RAINFALL IS 2.4 INCHES
                  AVERAGE RATIONAL METHOD RUNOFF COEFFICIENT IS 0.83
                  RATIONAL METHOD TIME OF CONCENTRATION IS 17.55 MIN.

 12 IN          TIME DATA FOR INPUT TIME SERIES
                  JXMIN         18  TIME INTERVAL IN MINUTES
                 JXDATE      1JAN90  STARTING DATE
                 JXTIME        1151  STARTING TIME

             SUBBASIN RUNOFF DATA

 11 BA          SUBBASIN CHARACTERISTICS
                  TAREA         .06  SUBBASIN AREA

                                                    ***

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

                                        HYDROGRAPH AT STATION    BASIN
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DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW
1 JAN 1200	1	0.	1 JAN 1340	51	7.	1 JAN 1520	101	56.	1 JAN 1700	151	8.
1 JAN 1202	2	0.	1 JAN 1342	52	7.	1 JAN 1522	102	63.	1 JAN 1702	152	8.
1 JAN 1204	3	0.	1 JAN 1344	53	7.	1 JAN 1524	103	70.	1 JAN 1704	153	8.
1 JAN 1206	4	0.	1 JAN 1346	54	7.	1 JAN 1526	104	76.	1 JAN 1706	154	8.
1 JAN 1208	5	0.	1 JAN 1348	55	7.	1 JAN 1528	105	78.	1 JAN 1708	155	8.
1 JAN 1210	6	0.	1 JAN 1350	56	7.	1 JAN 1530	106	74.	1 JAN 1710	156	7.
1 JAN 1212	7	1.	1 JAN 1352	57	7.	1 JAN 1532	107	70.	1 JAN 1712	157	7.
1 JAN 1214	8	1.	1 JAN 1354	58	8.	1 JAN 1534	108	67.	1 JAN 1714	158	7.
1 JAN 1216	9	2.	1 JAN 1356	59	8.	1 JAN 1536	109	63.	1 JAN 1716	159	7.
1 JAN 1218	10	3.	1 JAN 1358	60	8.	1 JAN 1538	110	59.	1 JAN 1718	160	7.
1 JAN 1220	11	3.	1 JAN 1400	61	8.	1 JAN 1540	111	56.	1 JAN 1720	161	7.
1 JAN 1222	12	4.	1 JAN 1402	62	8.	1 JAN 1542	112	52.	1 JAN 1722	162	7.
1 JAN 1224	13	4.	1 JAN 1404	63	8.	1 JAN 1544	113	48.	1 JAN 1724	163	7.
1 JAN 1226	14	5.	1 JAN 1406	64	8.	1 JAN 1546	114	45.	1 JAN 1726	164	7.
1 JAN 1228	15	5.	1 JAN 1408	65	8.	1 JAN 1548	115	41.	1 JAN 1728	165	7.
1 JAN 1230	16	5.	1 JAN 1410	66	8.	1 JAN 1550	116	38.	1 JAN 1730	166	7.
1 JAN 1232	17	5.	1 JAN 1412	67	9.	1 JAN 1552	117	34.	1 JAN 1732	167	7.
1 JAN 1234	18	5.	1 JAN 1414	68	9.	1 JAN 1554	118	31.	1 JAN 1734	168	6.
1 JAN 1236	19	5.	1 JAN 1416	69	9.	1 JAN 1556	119	28.	1 JAN 1736	169	6.
1 JAN 1238	20	5.	1 JAN 1418	70	9.	1 JAN 1558	120	24.	1 JAN 1738	170	6.
1 JAN 1240	21	5.	1 JAN 1420	71	9.	1 JAN 1600	121	21.	1 JAN 1740	171	6.
1 JAN 1242	22	5.	1 JAN 1422	72	9.	1 JAN 1602	122	17.	1 JAN 1742	172	6.
1 JAN 1244	23	5.	1 JAN 1424	73	10.	1 JAN 1604	123	15.	1 JAN 1744	173	6.
1 JAN 1246	24	5.	1 JAN 1426	74	10.	1 JAN 1606	124	15.	1 JAN 1746	174	6.
1 JAN 1248	25	5.	1 JAN 1428	75	10.	1 JAN 1608	125	15.	1 JAN 1748	175	6.
1 JAN 1250	26	5.	1 JAN 1430	76	10.	1 JAN 1610	126	14.	1 JAN 1750	176	6.
1 JAN 1252	27	5.	1 JAN 1432	77	10.	1 JAN 1612	127	14.	1 JAN 1752	177	6.
1 JAN 1254	28	6.	1 JAN 1434	78	11.	1 JAN 1614	128	13.	1 JAN 1754	178	6.
1 JAN 1256	29	6.	1 JAN 1436	79	11.	1 JAN 1616	129	13.	1 JAN 1756	179	6.
1 JAN 1258	30	6.	1 JAN 1438	80	11.	1 JAN 1618	130	12.	1 JAN 1758	180	6.
1 JAN 1300	31	6.	1 JAN 1440	81	12.	1 JAN 1620	131	12.	1 JAN 1800	181	6.
1 JAN 1302	32	6.	1 JAN 1442	82	12.	1 JAN 1622	132	12.	1 JAN 1802	182	6.
1 JAN 1304	33	6.	1 JAN 1444	83	12.	1 JAN 1624	133	11.	1 JAN 1804	183	6.
1 JAN 1306	34	6.	1 JAN 1446	84	13.	1 JAN 1626	134	11.	1 JAN 1806	184	6.
1 JAN 1308	35	6.	1 JAN 1448	85	13.	1 JAN 1628	135	11.	1 JAN 1808	185	6.
1 JAN 1310	36	6.	1 JAN 1450	86	13.	1 JAN 1630	136	11.	1 JAN 1810	186	5.
1 JAN 1312	37	6.	1 JAN 1452	87	14.	1 JAN 1632	137	10.	1 JAN 1812	187	5.
1 JAN 1314	38	6.	1 JAN 1454	88	14.	1 JAN 1634	138	10.	1 JAN 1814	188	5.
1 JAN 1316	39	6.	1 JAN 1456	89	15.	1 JAN 1636	139	10.	1 JAN 1816	189	5.
1 JAN 1318	40	6.	1 JAN 1458	90	16.	1 JAN 1638	140	10.	1 JAN 1818	190	5.
1 JAN 1320	41	6.	1 JAN 1500	91	16.	1 JAN 1640	141	9.	1 JAN 1820	191	5.
1 JAN 1322	42	6.	1 JAN 1502	92	17.	1 JAN 1642	142	9.	1 JAN 1822	192	5.
1 JAN 1324	43	6.	1 JAN 1504	93	18.	1 JAN 1644	143	9.	1 JAN 1824	193	5.
1 JAN 1326	44	6.	1 JAN 1506	94	18.	1 JAN 1646	144	9.	1 JAN 1826	194	5.
1 JAN 1328	45	6.	1 JAN 1508	95	19.	1 JAN 1648	145	9.	1 JAN 1828	195	5.
1 JAN 1330	46	7.	1 JAN 1510	96	23.	1 JAN 1650	146	9.	1 JAN 1830	196	4.
1 JAN 1332	47	7.	1 JAN 1512	97	30.	1 JAN 1652	147	9.	1 JAN 1832	197	4.
1 JAN 1334	48	7.	1 JAN 1514	98	36.	1 JAN 1654	148	8.	1 JAN 1834	198	3.
1 JAN 1336	49	7.	1 JAN 1516	99	43.	1 JAN 1656	149	8.	1 JAN 1836	199	3.
1 JAN 1338	50	7.	1 JAN 1518	100	50.	1 JAN 1658	150	8.	1 JAN 1838	200	2.

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 78.	3.47		14.	13.	13.	13.
		(INCHES)	2.054	2.088	2.088	2.088
		(AC-FT)	7.	7.	7.	7.

CUMULATIVE AREA = .06 SQ MI

```
          **************
          *            *
 17 KK    *   DETAIN   *
          *            *
          **************

             HYDROGRAPH ROUTING DATA

 18 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 19 SV           STORAGE          .0       .2      1.3      2.4      3.5      4.1

 20 SQ          DISCHARGE         0.       3.      26.      45.      64.      70.

 21 SE          ELEVATION      345.20   346.00   348.00   350.00   352.00   353.00

                                                    ***
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HYDROGRAPH AT STATION DETAIN

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	JAN	1200	1	0.	.0	345.2	1	JAN	1414	68	7.	.4	346.4	1	JAN	1628	135	26.	1.3	348.0
1	JAN	1202	2	0.	.0	345.2	1	JAN	1416	69	7.	.4	346.4	1	JAN	1630	136	25.	1.2	347.9
1	JAN	1204	3	0.	.0	345.2	1	JAN	1418	70	7.	.4	346.4	1	JAN	1632	137	24.	1.2	347.8
1	JAN	1206	4	0.	.0	345.2	1	JAN	1420	71	7.	.4	346.4	1	JAN	1634	138	23.	1.1	347.8
1	JAN	1208	5	0.	.0	345.2	1	JAN	1422	72	7.	.4	346.4	1	JAN	1636	139	23.	1.1	347.7
1	JAN	1210	6	0.	.0	345.2	1	JAN	1424	73	8.	.4	346.4	1	JAN	1638	140	22.	1.1	347.7
1	JAN	1212	7	0.	.0	345.2	1	JAN	1426	74	8.	.4	346.4	1	JAN	1640	141	21.	1.0	347.6
1	JAN	1214	8	0.	.0	345.2	1	JAN	1428	75	8.	.4	346.4	1	JAN	1642	142	21.	1.0	347.5
1	JAN	1216	9	0.	.0	345.2	1	JAN	1430	76	8.	.4	346.4	1	JAN	1644	143	20.	1.0	347.5
1	JAN	1218	10	0.	.0	345.3	1	JAN	1432	77	8.	.4	346.5	1	JAN	1646	144	19.	1.0	347.4
1	JAN	1220	11	0.	.0	345.3	1	JAN	1434	78	8.	.4	346.5	1	JAN	1648	145	19.	.9	347.4
1	JAN	1222	12	1.	.0	345.4	1	JAN	1436	79	8.	.4	346.5	1	JAN	1650	146	18.	.9	347.3
1	JAN	1224	13	1.	.0	345.4	1	JAN	1438	80	8.	.4	346.5	1	JAN	1652	147	18.	.9	347.3
1	JAN	1226	14	1.	.0	345.5	1	JAN	1440	81	9.	.4	346.5	1	JAN	1654	148	17.	.8	347.2
1	JAN	1228	15	1.	.1	345.5	1	JAN	1442	82	9.	.4	346.5	1	JAN	1656	149	17.	.8	347.2
1	JAN	1230	16	1.	.1	345.6	1	JAN	1444	83	9.	.4	346.5	1	JAN	1658	150	16.	.8	347.2
1	JAN	1232	17	1.	.1	345.6	1	JAN	1446	84	9.	.5	346.5	1	JAN	1700	151	16.	.8	347.1
1	JAN	1234	18	2.	.1	345.7	1	JAN	1448	85	9.	.5	346.6	1	JAN	1702	152	15.	.8	347.1
1	JAN	1236	19	2.	.1	345.7	1	JAN	1450	86	10.	.5	346.6	1	JAN	1704	153	15.	.7	347.0
1	JAN	1238	20	2.	.1	345.8	1	JAN	1452	87	10.	.5	346.6	1	JAN	1706	154	15.	.7	347.0
1	JAN	1240	21	2.	.1	345.8	1	JAN	1454	88	10.	.5	346.6	1	JAN	1708	155	14.	.7	347.0
1	JAN	1242	22	2.	.1	345.9	1	JAN	1456	89	10.	.5	346.6	1	JAN	1710	156	14.	.7	346.9
1	JAN	1244	23	2.	.1	345.9	1	JAN	1458	90	11.	.5	346.7	1	JAN	1712	157	13.	.7	346.9
1	JAN	1246	24	3.	.1	345.9	1	JAN	1500	91	11.	.5	346.7	1	JAN	1714	158	13.	.6	346.9
1	JAN	1248	25	3.	.1	346.0	1	JAN	1502	92	11.	.6	346.7	1	JAN	1716	159	13.	.6	346.9
1	JAN	1250	26	3.	.2	346.0	1	JAN	1504	93	12.	.6	346.8	1	JAN	1718	160	12.	.6	346.8
1	JAN	1252	27	3.	.2	346.0	1	JAN	1506	94	12.	.6	346.8	1	JAN	1720	161	12.	.6	346.8
1	JAN	1254	28	3.	.2	346.0	1	JAN	1508	95	12.	.6	346.8	1	JAN	1722	162	12.	.6	346.8
1	JAN	1256	29	3.	.2	346.0	1	JAN	1510	96	13.	.6	346.9	1	JAN	1724	163	12.	.6	346.8
1	JAN	1258	30	3.	.2	346.1	1	JAN	1512	97	14.	.7	346.9	1	JAN	1726	164	11.	.6	346.7
1	JAN	1300	31	4.	.2	346.1	1	JAN	1514	98	15.	.7	347.0	1	JAN	1728	165	11.	.6	346.7
1	JAN	1302	32	4.	.2	346.1	1	JAN	1516	99	16.	.8	347.1	1	JAN	1730	166	11.	.5	346.7
1	JAN	1304	33	4.	.2	346.1	1	JAN	1518	100	18.	.9	347.3	1	JAN	1732	167	11.	.5	346.7
1	JAN	1306	34	4.	.2	346.1	1	JAN	1520	101	20.	1.0	347.4	1	JAN	1734	168	10.	.5	346.7
1	JAN	1308	35	4.	.2	346.1	1	JAN	1522	102	22.	1.1	347.6	1	JAN	1736	169	10.	.5	346.6
1	JAN	1310	36	4.	.2	346.1	1	JAN	1524	103	24.	1.2	347.8	1	JAN	1738	170	10.	.5	346.6
1	JAN	1312	37	4.	.2	346.1	1	JAN	1526	104	27.	1.3	348.1	1	JAN	1740	171	10.	.5	346.6
1	JAN	1314	38	4.	.2	346.1	1	JAN	1528	105	29.	1.5	348.3	1	JAN	1742	172	10.	.5	346.6
1	JAN	1316	39	4.	.2	346.1	1	JAN	1530	106	31.	1.6	348.5	1	JAN	1744	173	9.	.5	346.6

1	JAN	1318	40	4.	.2	346.1	*	1	JAN	1532	107	33.	1.7	348.7	*	1	JAN	1746	174	9.	.5	346.6
1	JAN	1320	41	5.	.2	346.2	*	1	JAN	1534	108	35.	1.8	348.9	*	1	JAN	1748	175	9.	.5	346.5
1	JAN	1322	42	5.	.2	346.2	*	1	JAN	1536	109	36.	1.9	349.1	*	1	JAN	1750	176	9.	.4	346.5
1	JAN	1324	43	5.	.2	346.2	*	1	JAN	1538	110	37.	1.9	349.2	*	1	JAN	1752	177	9.	.4	346.5
1	JAN	1326	44	5.	.2	346.2	*	1	JAN	1540	111	38.	2.0	349.3	*	1	JAN	1754	178	9.	.4	346.5
1	JAN	1328	45	5.	.3	346.2	*	1	JAN	1542	112	39.	2.0	349.4	*	1	JAN	1756	179	8.	.4	346.5
1	JAN	1330	46	5.	.3	346.2	*	1	JAN	1544	113	39.	2.1	349.4	*	1	JAN	1758	180	8.	.4	346.5
1	JAN	1332	47	5.	.3	346.2	*	1	JAN	1546	114	40.	2.1	349.4	*	1	JAN	1800	181	8.	.4	346.5
1	JAN	1334	48	5.	.3	346.2	*	1	JAN	1548	115	40.	2.1	349.5	*	1	JAN	1802	182	8.	.4	346.4
1	JAN	1336	49	5.	.3	346.2	*	1	JAN	1550	116	40.	2.1	349.5	*	1	JAN	1804	183	8.	.4	346.4
1	JAN	1338	50	5.	.3	346.2	*	1	JAN	1552	117	40.	2.1	349.4	*	1	JAN	1806	184	8.	.4	346.4
1	JAN	1340	51	5.	.3	346.2	*	1	JAN	1554	118	39.	2.1	349.4	*	1	JAN	1808	185	8.	.4	346.4
1	JAN	1342	52	6.	.3	346.2	*	1	JAN	1556	119	39.	2.0	349.4	*	1	JAN	1810	186	7.	.4	346.4
1	JAN	1344	53	6.	.3	346.2	*	1	JAN	1558	120	38.	2.0	349.3	*	1	JAN	1812	187	7.	.4	346.4
1	JAN	1346	54	6.	.3	346.3	*	1	JAN	1600	121	38.	2.0	349.2	*	1	JAN	1814	188	7.	.4	346.4
1	JAN	1348	55	6.	.3	346.3	*	1	JAN	1602	122	37.	1.9	349.1	*	1	JAN	1816	189	7.	.4	346.4
1	JAN	1350	56	6.	.3	346.3	*	1	JAN	1604	123	36.	1.8	349.0	*	1	JAN	1818	190	7.	.4	346.4
1	JAN	1352	57	6.	.3	346.3	*	1	JAN	1606	124	35.	1.8	348.9	*	1	JAN	1820	191	7.	.4	346.4
1	JAN	1354	58	6.	.3	346.3	*	1	JAN	1608	125	34.	1.7	348.8	*	1	JAN	1822	192	7.	.3	346.4
1	JAN	1356	59	6.	.3	346.3	*	1	JAN	1610	126	33.	1.7	348.7	*	1	JAN	1824	193	7.	.3	346.3
1	JAN	1358	60	6.	.3	346.3	*	1	JAN	1612	127	32.	1.6	348.6	*	1	JAN	1826	194	7.	.3	346.3
1	JAN	1400	61	6.	.3	346.3	*	1	JAN	1614	128	31.	1.6	348.6	*	1	JAN	1828	195	7.	.3	346.3
1	JAN	1402	62	6.	.3	346.3	*	1	JAN	1616	129	30.	1.5	348.5	*	1	JAN	1830	196	6.	.3	346.3
1	JAN	1404	63	6.	.3	346.3	*	1	JAN	1618	130	30.	1.5	348.4	*	1	JAN	1832	197	6.	.3	346.3
1	JAN	1406	64	7.	.3	346.3	*	1	JAN	1620	131	29.	1.4	348.3	*	1	JAN	1834	198	6.	.3	346.3
1	JAN	1408	65	7.	.3	346.3	*	1	JAN	1622	132	28.	1.4	348.2	*	1	JAN	1836	199	6.	.3	346.3
1	JAN	1410	66	7.	.3	346.3	*	1	JAN	1624	133	27.	1.4	348.1	*	1	JAN	1838	200	6.	.3	346.3
1	JAN	1412	67	7.	.3	346.4	*	1	JAN	1626	134	27.	1.3	348.1	*							

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 40.	3.80		14.	13.	13.	13.
		(INCHES)	1.993	2.002	2.002	2.002
		(AC-FT)	7.	7.	7.	7.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	6.63-HR
+ (AC-FT)	(HR)				
2.	3.80	1.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	6.63-HR
+ (FEET)	(HR)				
349.45	3.80	346.98	346.82	346.82	346.82

CUMULATIVE AREA = .06 SQ MI

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	BASIN	78.	3.47	14.	13.	13.	.06		
+	ROUTED TO	DETAIN	40.	3.80	14.	13.	13.	.06		
+									349.45	3.80

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

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   04NOV08  TIME  20:06:41   *
*                                       *
*****************************************
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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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X     X  XXXXXXX   XXXXX          X
X     X  X       X     X        XX
X     X  X       X              X
XXXXXXX  XXXX    X        XXXXX  X
X     X  X       X              X
X     X  X       X     X        X
X     X  XXXXXXX   XXXXX        XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

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

                       *DIAGRAM
*** FREE ***
              1        ID   FORESTER CREEK PROJECT
              2        ID   CONCEPTUAL DETENTION BASIN ANALYSIS USING 11-2008 REPORT GRADING
              3        ID   AND ASSUMING DOWNSTREAM WSEL BELOW 30" RCP OUTLET PIPE IS 349'.
              4        ID   100-YEAR STORM EVENT
              5        ID   RATIONAL METHOD HYDROGRAPH
              6        IT       2 01JAN90    1200     200

              7        KK   BASIN
              8        KM   6HR RAINFALL IS 2.4 INCHES
              9        KM   AVERAGE RATIONAL METHOD RUNOFF COEFFICIENT IS 0.83
             10        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 17.55 MIN.
             11        BA   .0645
             12        IN      18 01JAN90    1151
             13        QI       0       0       5     5.3     5.7     6.2     6.9     7.7     8.8    10.5
             14        QI    13.3    19.5    79.6    46.3    15.6    11.7     9.5     8.2     7.2     6.5
             15        QI       6     5.5     5.1       0       0       0       0       0       0       0
             16        QI       0       0       0

             17        KK  DETAIN
             18        RS       1    STOR      -1
             19        SV       0    0.15   1.273   2.395   3.518   4.080
             20        SQ       0       0       0      29      50      57
             21        SE   345.2     346     348     350     352     353
             22        ZZ
```

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

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

    7       BASIN
               V
               V
   17      DETAIN

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   04NOV08  TIME  20:06:41   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 756-1104          *
*                                   *
*************************************
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FORESTER CREEK PROJECT
CONCEPTUAL DETENTION BASIN ANALYSIS USING 11-2008 REPORT GRADING
AND ASSUMING DOWNSTREAM WSEL BELOW 30" RCP OUTLET PIPE IS 349'.
100-YEAR STORM EVENT
RATIONAL METHOD HYDROGRAPH

```
    IT          HYDROGRAPH TIME DATA
                  NMIN          2  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1JAN90  STARTING DATE
                 ITIME        1200  STARTING TIME
                    NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      1JAN90  ENDING DATE
                NDTIME        1838  ENDING TIME
                ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .03 HOURS
                   TOTAL TIME BASE    6.63 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


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


          **************
          *            *
  7 KK    *     BASIN  *
          *            *
          **************
                  6HR RAINFALL IS 2.4 INCHES
                  AVERAGE RATIONAL METHOD RUNOFF COEFFICIENT IS 0.83
                  RATIONAL METHOD TIME OF CONCENTRATION IS 17.55 MIN.

 12 IN          TIME DATA FOR INPUT TIME SERIES
                   JXMIN         18  TIME INTERVAL IN MINUTES
                  JXDATE      1JAN90  STARTING DATE
                  JXTIME        1151  STARTING TIME

             SUBBASIN RUNOFF DATA

 11 BA          SUBBASIN CHARACTERISTICS
                   TAREA         .06  SUBBASIN AREA

                                                    ***

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

                                        HYDROGRAPH AT STATION    BASIN
```

DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW	DA MON HRMN	ORD	FLOW
1 JAN 1200	1	0.	1 JAN 1340	51	7.	1 JAN 1520	101	56.	1 JAN 1700	151	8.
1 JAN 1202	2	0.	1 JAN 1342	52	7.	1 JAN 1522	102	63.	1 JAN 1702	152	8.
1 JAN 1204	3	0.	1 JAN 1344	53	7.	1 JAN 1524	103	70.	1 JAN 1704	153	8.
1 JAN 1206	4	0.	1 JAN 1346	54	7.	1 JAN 1526	104	76.	1 JAN 1706	154	8.
1 JAN 1208	5	0.	1 JAN 1348	55	7.	1 JAN 1528	105	78.	1 JAN 1708	155	8.
1 JAN 1210	6	0.	1 JAN 1350	56	7.	1 JAN 1530	106	74.	1 JAN 1710	156	7.
1 JAN 1212	7	1.	1 JAN 1352	57	7.	1 JAN 1532	107	70.	1 JAN 1712	157	7.
1 JAN 1214	8	1.	1 JAN 1354	58	8.	1 JAN 1534	108	67.	1 JAN 1714	158	7.
1 JAN 1216	9	2.	1 JAN 1356	59	8.	1 JAN 1536	109	63.	1 JAN 1716	159	7.
1 JAN 1218	10	3.	1 JAN 1358	60	8.	1 JAN 1538	110	59.	1 JAN 1718	160	7.
1 JAN 1220	11	3.	1 JAN 1400	61	8.	1 JAN 1540	111	56.	1 JAN 1720	161	7.
1 JAN 1222	12	4.	1 JAN 1402	62	8.	1 JAN 1542	112	52.	1 JAN 1722	162	7.
1 JAN 1224	13	4.	1 JAN 1404	63	8.	1 JAN 1544	113	48.	1 JAN 1724	163	7.
1 JAN 1226	14	5.	1 JAN 1406	64	8.	1 JAN 1546	114	45.	1 JAN 1726	164	7.
1 JAN 1228	15	5.	1 JAN 1408	65	8.	1 JAN 1548	115	41.	1 JAN 1728	165	7.
1 JAN 1230	16	5.	1 JAN 1410	66	8.	1 JAN 1550	116	38.	1 JAN 1730	166	7.
1 JAN 1232	17	5.	1 JAN 1412	67	9.	1 JAN 1552	117	34.	1 JAN 1732	167	7.
1 JAN 1234	18	5.	1 JAN 1414	68	9.	1 JAN 1554	118	31.	1 JAN 1734	168	6.
1 JAN 1236	19	5.	1 JAN 1416	69	9.	1 JAN 1556	119	28.	1 JAN 1736	169	6.
1 JAN 1238	20	5.	1 JAN 1418	70	9.	1 JAN 1558	120	24.	1 JAN 1738	170	6.
1 JAN 1240	21	5.	1 JAN 1420	71	9.	1 JAN 1600	121	21.	1 JAN 1740	171	6.
1 JAN 1242	22	5.	1 JAN 1422	72	9.	1 JAN 1602	122	17.	1 JAN 1742	172	6.
1 JAN 1244	23	5.	1 JAN 1424	73	10.	1 JAN 1604	123	15.	1 JAN 1744	173	6.
1 JAN 1246	24	5.	1 JAN 1426	74	10.	1 JAN 1606	124	15.	1 JAN 1746	174	6.
1 JAN 1248	25	5.	1 JAN 1428	75	10.	1 JAN 1608	125	15.	1 JAN 1748	175	6.
1 JAN 1250	26	5.	1 JAN 1430	76	10.	1 JAN 1610	126	14.	1 JAN 1750	176	6.
1 JAN 1252	27	5.	1 JAN 1432	77	10.	1 JAN 1612	127	14.	1 JAN 1752	177	6.
1 JAN 1254	28	6.	1 JAN 1434	78	11.	1 JAN 1614	128	13.	1 JAN 1754	178	6.
1 JAN 1256	29	6.	1 JAN 1436	79	11.	1 JAN 1616	129	13.	1 JAN 1756	179	6.
1 JAN 1258	30	6.	1 JAN 1438	80	11.	1 JAN 1618	130	12.	1 JAN 1758	180	6.
1 JAN 1300	31	6.	1 JAN 1440	81	12.	1 JAN 1620	131	12.	1 JAN 1800	181	6.
1 JAN 1302	32	6.	1 JAN 1442	82	12.	1 JAN 1622	132	12.	1 JAN 1802	182	6.
1 JAN 1304	33	6.	1 JAN 1444	83	12.	1 JAN 1624	133	11.	1 JAN 1804	183	6.
1 JAN 1306	34	6.	1 JAN 1446	84	13.	1 JAN 1626	134	11.	1 JAN 1806	184	6.
1 JAN 1308	35	6.	1 JAN 1448	85	13.	1 JAN 1628	135	11.	1 JAN 1808	185	6.
1 JAN 1310	36	6.	1 JAN 1450	86	13.	1 JAN 1630	136	11.	1 JAN 1810	186	5.
1 JAN 1312	37	6.	1 JAN 1452	87	14.	1 JAN 1632	137	10.	1 JAN 1812	187	5.
1 JAN 1314	38	6.	1 JAN 1454	88	14.	1 JAN 1634	138	10.	1 JAN 1814	188	5.
1 JAN 1316	39	6.	1 JAN 1456	89	15.	1 JAN 1636	139	10.	1 JAN 1816	189	5.
1 JAN 1318	40	6.	1 JAN 1458	90	16.	1 JAN 1638	140	10.	1 JAN 1818	190	5.
1 JAN 1320	41	6.	1 JAN 1500	91	16.	1 JAN 1640	141	9.	1 JAN 1820	191	5.
1 JAN 1322	42	6.	1 JAN 1502	92	17.	1 JAN 1642	142	9.	1 JAN 1822	192	5.
1 JAN 1324	43	6.	1 JAN 1504	93	18.	1 JAN 1644	143	9.	1 JAN 1824	193	5.
1 JAN 1326	44	6.	1 JAN 1506	94	18.	1 JAN 1646	144	9.	1 JAN 1826	194	5.
1 JAN 1328	45	6.	1 JAN 1508	95	19.	1 JAN 1648	145	9.	1 JAN 1828	195	5.
1 JAN 1330	46	7.	1 JAN 1510	96	23.	1 JAN 1650	146	9.	1 JAN 1830	196	4.
1 JAN 1332	47	7.	1 JAN 1512	97	30.	1 JAN 1652	147	9.	1 JAN 1832	197	4.
1 JAN 1334	48	7.	1 JAN 1514	98	36.	1 JAN 1654	148	8.	1 JAN 1834	198	3.
1 JAN 1336	49	7.	1 JAN 1516	99	43.	1 JAN 1656	149	8.	1 JAN 1836	199	3.
1 JAN 1338	50	7.	1 JAN 1518	100	50.	1 JAN 1658	150	8.	1 JAN 1838	200	2.

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 78.	3.47		14.	13.	13.	13.
		(INCHES)	2.054	2.088	2.088	2.088
		(AC-FT)	7.	7.	7.	7.

CUMULATIVE AREA = .06 SQ MI

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          **************
          *            *
 17 KK    *   DETAIN   *
          *            *
          **************

             HYDROGRAPH ROUTING DATA

 18 RS         STORAGE ROUTING
                    NSTPS          1  NUMBER OF SUBREACHES
                     ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                        X         .00 WORKING R AND D COEFFICIENT

 19 SV          STORAGE          .0       .2      1.3      2.4      3.5      4.1

 20 SQ         DISCHARGE         0.       0.       0.      29.      50.      57.

 21 SE         ELEVATION      345.20   346.00   348.00   350.00   352.00   353.00

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HYDROGRAPH AT STATION DETAIN

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DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1	JAN	1200	1	0.	.2	346.0	1	JAN	1414	68	0.	1.2	347.8	1	JAN	1628	135	25.	2.2	349.7
1	JAN	1202	2	0.	.2	346.0	1	JAN	1416	69	0.	1.2	347.8	1	JAN	1630	136	24.	2.2	349.6
1	JAN	1204	3	0.	.2	346.0	1	JAN	1418	70	0.	1.2	347.9	1	JAN	1632	137	23.	2.2	349.6
1	JAN	1206	4	0.	.2	346.0	1	JAN	1420	71	0.	1.2	347.9	1	JAN	1634	138	22.	2.1	349.5
1	JAN	1208	5	0.	.2	346.0	1	JAN	1422	72	0.	1.3	348.0	1	JAN	1636	139	21.	2.1	349.5
1	JAN	1210	6	0.	.2	346.0	1	JAN	1424	73	0.	1.3	348.0	1	JAN	1638	140	20.	2.1	349.4
1	JAN	1212	7	0.	.2	346.0	1	JAN	1426	74	1.	1.3	348.1	1	JAN	1640	141	20.	2.0	349.4
1	JAN	1214	8	0.	.2	346.0	1	JAN	1428	75	2.	1.3	348.1	1	JAN	1642	142	19.	2.0	349.3
1	JAN	1216	9	0.	.2	346.0	1	JAN	1430	76	2.	1.4	348.1	1	JAN	1644	143	18.	2.0	349.3
1	JAN	1218	10	0.	.2	346.0	1	JAN	1432	77	3.	1.4	348.2	1	JAN	1646	144	18.	2.0	349.2
1	JAN	1220	11	0.	.2	346.0	1	JAN	1434	78	3.	1.4	348.2	1	JAN	1648	145	17.	1.9	349.2
1	JAN	1222	12	0.	.2	346.1	1	JAN	1436	79	4.	1.4	348.3	1	JAN	1650	146	16.	1.9	349.1
1	JAN	1224	13	0.	.2	346.1	1	JAN	1438	80	4.	1.4	348.3	1	JAN	1652	147	16.	1.9	349.1
1	JAN	1226	14	0.	.2	346.1	1	JAN	1440	81	5.	1.5	348.3	1	JAN	1654	148	15.	1.9	349.1
1	JAN	1228	15	0.	.2	346.1	1	JAN	1442	82	5.	1.5	348.4	1	JAN	1656	149	15.	1.8	349.0
1	JAN	1230	16	0.	.2	346.1	1	JAN	1444	83	6.	1.5	348.4	1	JAN	1658	150	14.	1.8	349.0
1	JAN	1232	17	0.	.2	346.2	1	JAN	1446	84	6.	1.5	348.4	1	JAN	1700	151	14.	1.8	349.0
1	JAN	1234	18	0.	.3	346.2	1	JAN	1448	85	7.	1.5	348.5	1	JAN	1702	152	14.	1.8	348.9
1	JAN	1236	19	0.	.3	346.2	1	JAN	1450	86	7.	1.5	348.5	1	JAN	1704	153	13.	1.8	348.9
1	JAN	1238	20	0.	.3	346.2	1	JAN	1452	87	8.	1.6	348.5	1	JAN	1706	154	13.	1.8	348.9
1	JAN	1240	21	0.	.3	346.3	1	JAN	1454	88	8.	1.6	348.5	1	JAN	1708	155	12.	1.8	348.9
1	JAN	1242	22	0.	.3	346.3	1	JAN	1456	89	8.	1.6	348.6	1	JAN	1710	156	12.	1.7	348.8
1	JAN	1244	23	0.	.3	346.3	1	JAN	1458	90	9.	1.6	348.6	1	JAN	1712	157	12.	1.7	348.8
1	JAN	1246	24	0.	.3	346.4	1	JAN	1500	91	9.	1.6	348.6	1	JAN	1714	158	11.	1.7	348.8
1	JAN	1248	25	0.	.4	346.4	1	JAN	1502	92	10.	1.7	348.7	1	JAN	1716	159	11.	1.7	348.8
1	JAN	1250	26	0.	.4	346.4	1	JAN	1504	93	10.	1.7	348.7	1	JAN	1718	160	11.	1.7	348.8
1	JAN	1252	27	0.	.4	346.4	1	JAN	1506	94	11.	1.7	348.8	1	JAN	1720	161	11.	1.7	348.7
1	JAN	1254	28	0.	.4	346.5	1	JAN	1508	95	11.	1.7	348.8	1	JAN	1722	162	10.	1.7	348.7
1	JAN	1256	29	0.	.4	346.5	1	JAN	1510	96	12.	1.7	348.8	1	JAN	1724	163	10.	1.7	348.7
1	JAN	1258	30	0.	.4	346.5	1	JAN	1512	97	13.	1.8	348.9	1	JAN	1726	164	10.	1.7	348.7
1	JAN	1300	31	0.	.5	346.5	1	JAN	1514	98	14.	1.8	349.0	1	JAN	1728	165	10.	1.6	348.7
1	JAN	1302	32	0.	.5	346.6	1	JAN	1516	99	16.	1.9	349.1	1	JAN	1730	166	9.	1.6	348.7
1	JAN	1304	33	0.	.5	346.6	1	JAN	1518	100	18.	2.0	349.3	1	JAN	1732	167	9.	1.6	348.6
1	JAN	1306	34	0.	.5	346.6	1	JAN	1520	101	21.	2.1	349.4	1	JAN	1734	168	9.	1.6	348.6
1	JAN	1308	35	0.	.5	346.7	1	JAN	1522	102	23.	2.2	349.6	1	JAN	1736	169	9.	1.6	348.6
1	JAN	1310	36	0.	.5	346.7	1	JAN	1524	103	26.	2.3	349.8	1	JAN	1738	170	9.	1.6	348.6
1	JAN	1312	37	0.	.5	346.7	1	JAN	1526	104	29.	2.4	350.0	1	JAN	1740	171	9.	1.6	348.6
1	JAN	1314	38	0.	.6	346.7	1	JAN	1528	105	32.	2.5	350.3	1	JAN	1742	172	8.	1.6	348.6
1	JAN	1316	39	0.	.6	346.8	1	JAN	1530	106	34.	2.7	350.5	1	JAN	1744	173	8.	1.6	348.6

1	JAN	1318	40	0.	.6	346.8	*	1	JAN	1532	107	36.	2.8	350.7	*	1	JAN	1746	174	8.	1.6	348.6
1	JAN	1320	41	0.	.6	346.8	*	1	JAN	1534	108	38.	2.9	350.8	*	1	JAN	1748	175	8.	1.6	348.6
1	JAN	1322	42	0.	.6	346.9	*	1	JAN	1536	109	39.	2.9	350.9	*	1	JAN	1750	176	8.	1.6	348.5
1	JAN	1324	43	0.	.6	346.9	*	1	JAN	1538	110	40.	3.0	351.0	*	1	JAN	1752	177	8.	1.6	348.5
1	JAN	1326	44	0.	.7	346.9	*	1	JAN	1540	111	41.	3.0	351.1	*	1	JAN	1754	178	8.	1.6	348.5
1	JAN	1328	45	0.	.7	347.0	*	1	JAN	1542	112	42.	3.1	351.2	*	1	JAN	1756	179	7.	1.6	348.5
1	JAN	1330	46	0.	.7	347.0	*	1	JAN	1544	113	42.	3.1	351.2	*	1	JAN	1758	180	7.	1.6	348.5
1	JAN	1332	47	0.	.7	347.0	*	1	JAN	1546	114	42.	3.1	351.3	*	1	JAN	1800	181	7.	1.6	348.5
1	JAN	1334	48	0.	.7	347.0	*	1	JAN	1548	115	42.	3.1	351.3	*	1	JAN	1802	182	7.	1.5	348.5
1	JAN	1336	49	0.	.8	347.1	*	1	JAN	1550	116	42.	3.1	351.2	*	1	JAN	1804	183	7.	1.5	348.5
1	JAN	1338	50	0.	.8	347.1	*	1	JAN	1552	117	42.	3.1	351.2	*	1	JAN	1806	184	7.	1.5	348.5
1	JAN	1340	51	0.	.8	347.1	*	1	JAN	1554	118	41.	3.1	351.2	*	1	JAN	1808	185	7.	1.5	348.5
1	JAN	1342	52	0.	.8	347.2	*	1	JAN	1556	119	41.	3.0	351.1	*	1	JAN	1810	186	7.	1.5	348.5
1	JAN	1344	53	0.	.8	347.2	*	1	JAN	1558	120	40.	3.0	351.0	*	1	JAN	1812	187	7.	1.5	348.5
1	JAN	1346	54	0.	.9	347.3	*	1	JAN	1600	121	39.	2.9	351.0	*	1	JAN	1814	188	7.	1.5	348.5
1	JAN	1348	55	0.	.9	347.3	*	1	JAN	1602	122	38.	2.9	350.9	*	1	JAN	1816	189	7.	1.5	348.4
1	JAN	1350	56	0.	.9	347.3	*	1	JAN	1604	123	37.	2.8	350.8	*	1	JAN	1818	190	6.	1.5	348.4
1	JAN	1352	57	0.	.9	347.4	*	1	JAN	1606	124	36.	2.8	350.7	*	1	JAN	1820	191	6.	1.5	348.4
1	JAN	1354	58	0.	.9	347.4	*	1	JAN	1608	125	35.	2.7	350.6	*	1	JAN	1822	192	6.	1.5	348.4
1	JAN	1356	59	0.	1.0	347.4	*	1	JAN	1610	126	34.	2.7	350.5	*	1	JAN	1824	193	6.	1.5	348.4
1	JAN	1358	60	0.	1.0	347.5	*	1	JAN	1612	127	33.	2.6	350.4	*	1	JAN	1826	194	6.	1.5	348.4
1	JAN	1400	61	0.	1.0	347.5	*	1	JAN	1614	128	32.	2.5	350.3	*	1	JAN	1828	195	6.	1.5	348.4
1	JAN	1402	62	0.	1.0	347.6	*	1	JAN	1616	129	31.	2.5	350.2	*	1	JAN	1830	196	6.	1.5	348.4
1	JAN	1404	63	0.	1.0	347.6	*	1	JAN	1618	130	30.	2.4	350.1	*	1	JAN	1832	197	6.	1.5	348.4
1	JAN	1406	64	0.	1.1	347.6	*	1	JAN	1620	131	29.	2.4	350.0	*	1	JAN	1834	198	6.	1.5	348.4
1	JAN	1408	65	0.	1.1	347.7	*	1	JAN	1622	132	28.	2.4	349.9	*	1	JAN	1836	199	5.	1.5	348.4
1	JAN	1410	66	0.	1.1	347.7	*	1	JAN	1624	133	27.	2.3	349.8	*	1	JAN	1838	200	5.	1.5	348.4
1	JAN	1412	67	0.	1.1	347.8	*	1	JAN	1626	134	26.	2.3	349.8	*							
							*								*							

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 42.	3.80		12.	11.	11.	11.
		(INCHES)	1.703	1.703	1.703	1.703
		(AC-FT)	6.	6.	6.	6.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	6.63-HR
+ (AC-FT)	(HR)				
3.	3.80	2.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	6.63-HR
+ (FEET)	(HR)				
351.26	3.80	348.57	348.33	348.33	348.33

CUMULATIVE AREA = .06 SQ MI

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	BASIN	78.	3.47	14.	13.	13.	.06		
+	ROUTED TO	DETAIN	42.	3.80	12.	11.	11.	.06		
+									351.26	3.80

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