CEQA DRAINAGE STUDY

FOR

GERMANN

TENTATIVE SUBDIVISION MAP

(Tract No. 5520 RPL 1, Project No. PDS2006-3100-5520)

December 14, 2016

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Civil Engineering ◦ Hydrology ◦ Hydraulics ◦ Sedimentation

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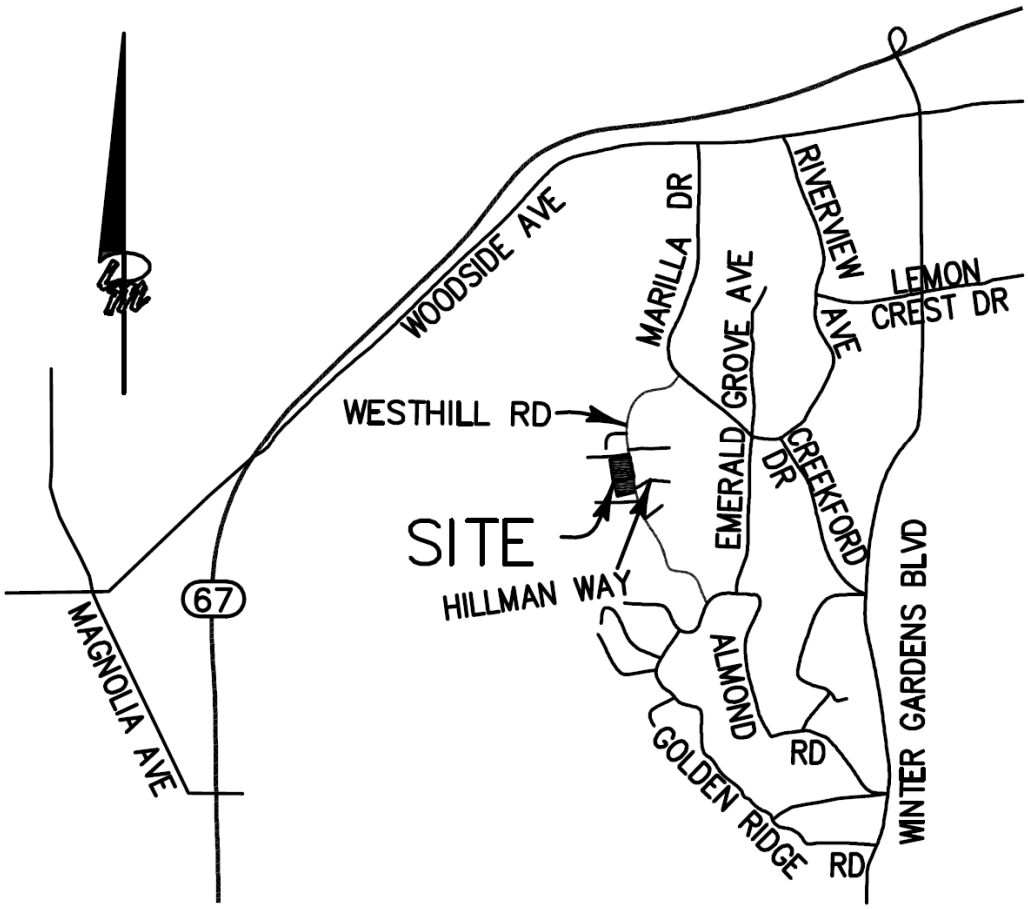
MAP POCKET

INTRODUCTION

The Germann Tentative Subdivision Map (Tract No. 5520 RPL 1, Project No. PDS2006-3100-5520) development will be located along the west side of Westhill Road at the intersection with Hillman Way in the county of San Diego (see Vicinity Map). The tentative subdivision map is being prepared by Farrington Engineering Consultants. The overall project will be located on 5.24 gross acres. The project proposes 14 single-family residential lots, a water quality/detention basin(s), two public streets, and improvements (widening and asphalt berm) along the west side of Westhill Road. The current project area is undeveloped except for a single-family home at the southwest corner and an asphalt roadway/driveway from Westhill Road serving the residence.



Vicinity Map

The drainage patterns at and near the site are as follows. The existing site generally slopes northwest and northeast at over 10 percent towards a lower lying area along the center of the site. This lower lying area conveys the runoff over the natural ground surface in a northerly direction to an existing Type F catch basin just beyond the northerly property line. An existing storm drain then conveys the flow away from the site in a northerly direction. There is over 42 acres of off-site area to the south that contributes storm runoff onto the site. The off-site flow enters the center of the southern end of the site and then continues north along the on-site lower lying area. There is also over 7 acres of off-site area to the southeast that contributes storm runoff onto the easterly edge of the site near the northern boundary. This runoff is directed onto the site by a

drainage culvert under Westhill Road. The runoff then flows over the natural ground surface towards the on-site lower lying area. The project will continue to direct on-site storm runoff north to the existing storm drain system at the north. In addition, new storm drain lines will be constructed to convey the southerly and southeasterly off-site flows through or along the site to the northerly storm drain. The new storm drain lines will prevent commingling of on- and off-site flows until after the on-site flow is treated.

This report contains preliminary existing and proposed condition hydrologic analyses for entitlement purposes. This report analyzes two tentative map alternatives, Alternative A and B. The existing pipe to the north that conveys flows away from the site is a 24-inch HDPE located on private property. The pipe is not sufficient to convey the existing condition tributary flows. An agreement has not been reached with the property owners allowing the pipe to be upsized. Alternative A assumes that an agreement will be reached with the property owners, so that the project will only mitigate for its flow increase. Alternative B assumes that an agreement will not be reached with the property owners, so the project will detain an additional amount to the capacity of the existing 24-inch HDPE. Under Alternative A, a combined water quality/detention basin will be installed at the north end of the site. Under Alternative B, an additional detention basin will be installed at the south end of the site. The southerly off-site flow will be directed to the south basin to meet the additional detention requirements.

HYDROLOGIC ANALYSES

The County of San Diego's 2003 *Hydrology Manual* rational method procedure was used for the 100-year hydrologic analyses. The existing and proposed condition rational method input parameters are summarized as follows:

- Precipitation: The 100-year, 6- and 24-hour precipitation values are 2.6 and 5.6 inches, respectively. The isopluvials are included in Appendix A.

- Drainage areas: The existing condition drainage areas were delineated from the 2-foot contour interval topographic mapping prepared for the project and the County of San Diego's 5-foot contour interval topographic mapping for the off-site areas. A site visit was performed to verify the drainage area delineation. The proposed condition on-site drainage areas were delineated from the tentative map. The Existing Condition Rational Method Work Map and Proposed Condition Rational Method Work Maps are included in the map pocket.

- Hydrologic soil groups: The hydrologic soil groups were determined from the National Resources Conservation Service's "Web Soil Survey." Nearly the entire drainage area contains the type B soil group. There is a small sliver of the upstream-most drainage subbasin that contains the type D soil group. For simplicity, the entire study area was assumed to consist of the type B soil group since the small amount of type D will not appreciably alter the results for entitlement purposes.

- Runoff coefficients: Runoff coefficients were established for each drainage basin based on the underlying land use or estimated impervious percentage (and soil type B). The existing condition land uses primarily include undisturbed natural terrain or low-density residential development. In addition, there is a lower drainage subbasin that contains a higher impervious percentage. This subbasin was assigned a high-density residential land use to reflect a 65 percent impervious cover.

  The proposed condition on-site land use was generally assumed to be low-density residential development (2.9 du/ac or less) within the subdivision area – the project proposes 14 lots in a 5.20 acre drainage area, which is 2.7 du/ac, so the assigned land use is slightly conservative. The other drainage areas were assigned land uses based on the underlying land use or the estimated percentage of impervious cover.

- Flow lengths and elevations: The flow lengths and elevations were digitized and obtained from the topographic mapping and tentative map.

The 100-year existing and proposed condition rational method results are in Appendix A. The analyses were performed using CivilDesign's San Diego County Rational Hydrology Program. The overall existing condition drainage area was set equal to the overall proposed condition drainage area to allow a comparison of the existing and proposed condition results. Table 1 summarizes the 100-year results. For proposed conditions, the undetained flow rate is given and is the essentially same for Alternative A and B. Table 1 shows that the project will increase 100-year runoff from the on- and off-site areas by 6 cubic feet per second (cfs). Detention will be provided to mitigate for the increase and is discussed in the next section.

Analysis	Overall Tributary Area, ac	Overall 100-Year Flow Rate, cfs
Existing Conditions	55.91	73
Proposed Conditions[1]	55.91	79

[1]The proposed condition undetained flow rates are similar for Alternatives A and B.

Table 1. Rational Method Results

Rational Method Nodes	Alternative A Pipe Size, in	Alternative B Pipe Size, in
36-26 (Alt A) 37-26 (Alt B)	30	24
26-38	36	24
38-52	36	24
52-58	36	24
58-60	36	24 (existing)
All others	18	18

Table 2. Preliminary Pipe Sizing (Proposed Sizes Except as Noted

The hydrologic analyses provide pipeflow normal depth routines to estimate the required pipe sizes. Table 2 summarizes the results assuming 18-inch is the minimum diameter. The Alternative B sizing reflects additional on-site detention that will reduce the flow rate in the rational method results. During final engineering detailed hydrologic and hydraulic analyses shall be performed to verify the sizing.

DETENTION ANALYSES

The County of San Diego can require the proposed condition 100-year runoff from the project to be no greater than the existing condition 100-year runoff. In order to meet this requirement, the project proposes to construct a detention facility within the northerly portion of the site. The detention basin will also address water quality and hydromodification requirements. A 100-year detention analysis was performed to estimate the storage volume needed to detain the on-site proposed condition flow by 6 cfs. The proposed condition rational method results from the 5.20 acre area tributary to the basin was converted to a hydrograph using the Rational Method Hydrograph Procedure from the County's *Hydrology Manual* (Alternative A yields a slightly higher flow rate tributary to the basin than Alternative B, so this was used). The Alternative A rational method 100-year flow rate at the basin is 7.5 cfs (rational method Node 16). The hydrograph was then entered into HEC-1.

The HEC-1 results are included in Appendix B and determined that the storage volume must be at least 0.26 acre-feet (11,326 cubic feet) to detain 7.5 cfs by 6.0 cfs to 1.5 cfs. The actual volume will likely be somewhat larger during the final engineering analyses when the actual outlet works are designed and freeboard is considered. Nonetheless, this volume with some contingency can be provided on the tentative subdivision map. The basin area on the tentative map covers 5,111 square feet and has retaining walls on all sides, so the ponded depth for 11,326 cubic feet is 2.22 feet. Per the SWQMP, the water quality surface ponding depth in the basin must be 1.63 feet, so the total surface storage depth is 3.85 feet.

Under Alternative B, an additional detention basin is proposed at the south side of the site to reduce the on- and off-site 100-year flow rate to the capacity of the existing 24-inch HDPE at the north. A Water Surface Pressure Gradient (WSPGW – Windows version) analysis was performed to determine the 24-inch HDPE capacity. WSPGW is a model developed by the LA County Department of Public Works for hydraulic analysis of pipes and open conduits, and is accepted by the County of San Diego per the *Hydraulic Design Manual*. The analysis was based on field survey elevations and is included in Appendix B. The results show that the capacity is approximately 32 cfs when the hydraulic grade line rises to ground level on the upper end.

Under Alternative B, the total undetained flow rate is 79 cfs per the rational method. This will be reduced by approximately 6 cfs due to the northerly detention basin. Therefore, the flow rate of 73 cfs must be lowered to 32 cfs by the southerly detention basin, i.e., the site must detain approximately 41 cfs (73 – 32 = 41). The Alternative B rational method results show that 59 cfs enters the south detention basin (rational method node 37). This will be detained to 18 cfs (59 – 41 = 18). The rational method results entering the southerly detention basin were converted to a hydrograph. The hydrograph was then entered into HEC-1.

The HEC-1 results are included in Appendix B and determined that the storage volume must be at least 1.35 acre-feet (58,806 cubic feet) to detain 59 cfs to 18 cfs. The basin footprint on the plans is 6,253 square feet, so the ponded depth will be 9.4 feet, which can be accommodated by the Alternative B tentative map.

CONCLUSION

Hydrologic and hydraulic analyses have been performed for the Germann Tentative Subdivision Map (Tract No. 5520 RPL 1) development being designed by Farrington Engineering Consultants. The analyses have been used to determine the existing and proposed condition 100-year flow rates. The results show that the total proposed condition 100-year runoff will increase due to development, so detention is needed to mitigate for the flow increase. Analyses have been performed for two proposed condition alternatives. Alternative A assumes detention only needs to mitigate for the project increases, while Alternative B assumes that detention will reduce flows to the receiving pipe capacity. The analyses in this report have been performed at a planning-level for the entitlement process and demonstrate the feasibility of the project from a drainage standpoint. More detailed analyses will be performed during final design. Table 3 provides a summary of the entitlement level analyses at the single discharge point from the site.

The project will not substantially alter the existing drainage pattern of the site. Under existing conditions, off-site runoff enters from the south, continues north through the site collecting on-site runoff, and exits in a pipe to the north. This existing pattern is being maintained. A stream or river do not exist within the site. The project will increase the 100-year runoff, but this will be mitigated by an on-site detention basin to avoid flooding impacts. The proposed on-site drainage facilities will be designed for the flood frequencies (50- and 100-year) required by the County. The project proposes an Alternative A and B, which will either increase the size of the off-site pipe so it can convey the existing condition runoff or over detain to the existing off-site pipe capacity.

The project site has not been mapped with a federal Flood Hazard Boundary, Flood Insurance Rate Map, nor other flood hazard delineation including the County Floodplain Maps. Therefore, the project will not place housing in such flood hazard or floodplain areas. In addition, the project will not place structures in a 100-year flood hazard area that would impede or redirect flood flows.

There are no levees or dams in the watershed tributary to the project, so the project will not expose people or structures to risk associated with failure of a levee or dam.

DECLARATION OF RESPONSIBLE CHARGE

I hereby declare that I am the civil engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

December 14, 2016

Wayne W. Chang
RCE 46548
Exp. June 30, 2017

Date

Condition	T_c, min.	I, in/hr	Area, ac	V_{100}, fps	Q_{100} w/o mitigation, cfs	Q_{100} w/ mitigation, cfs
Existing	13.60	3.62	55.91	14.3	73	N/A
Proposed Alt A	12.61	3.79	55.91	18.9[1]	79	73
Proposed Alt B	12.70	3.77	55.91	18.9	79	32

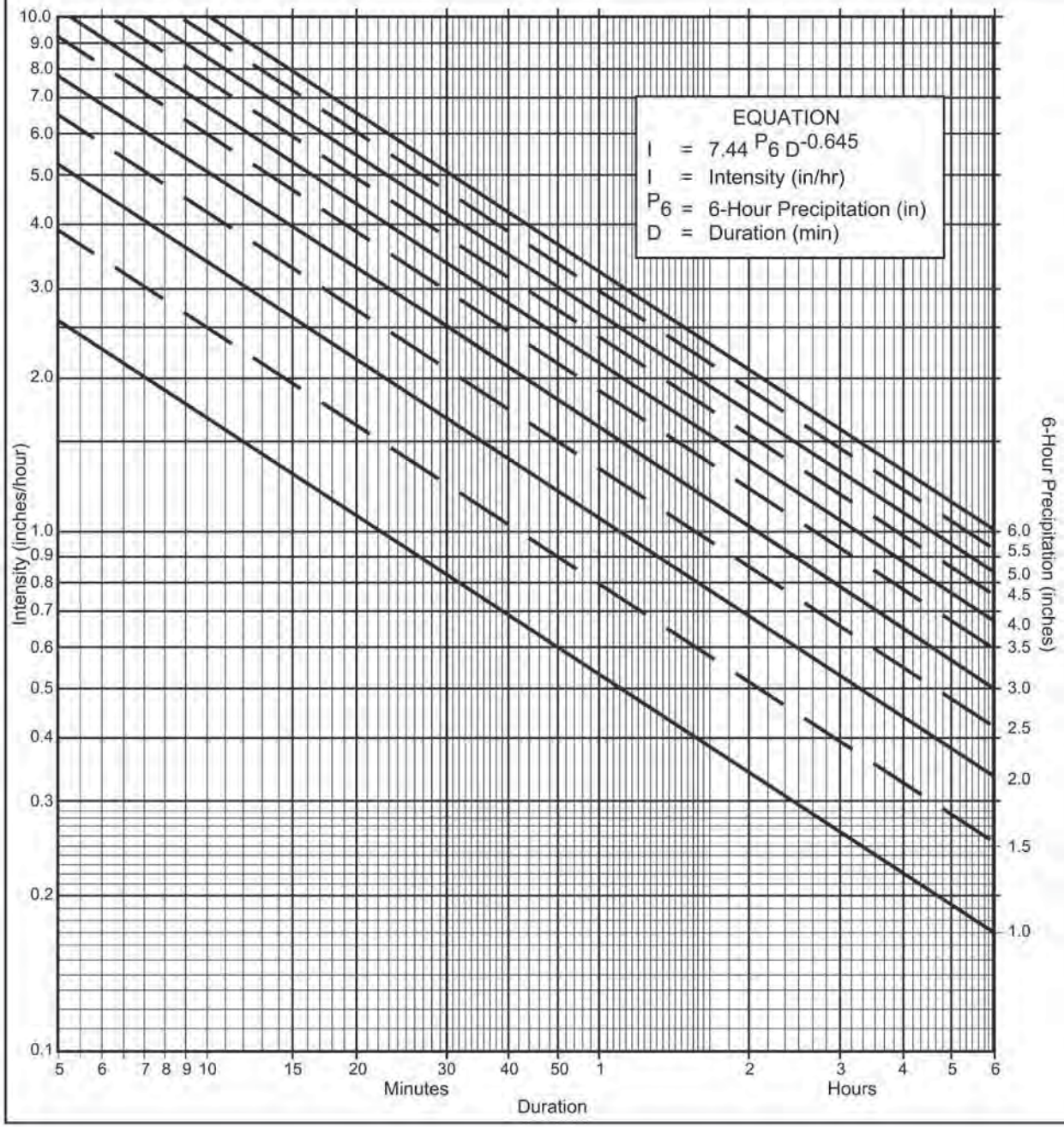
[1]Riprap shall be installed at the pipe outlet the mitigate for the flow velocities.

Table 3. Summary of Rational Method Results at Northerly Discharge Point from Site

APPENDIX A

100-YEAR RATIONAL METHOD

DATA AND RESULTS



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.6 in., P_{24} = 5.6, $\frac{P_6}{P_{24}}$ = 46 %(2)

(c) Adjusted P_6(2) = 2.6 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

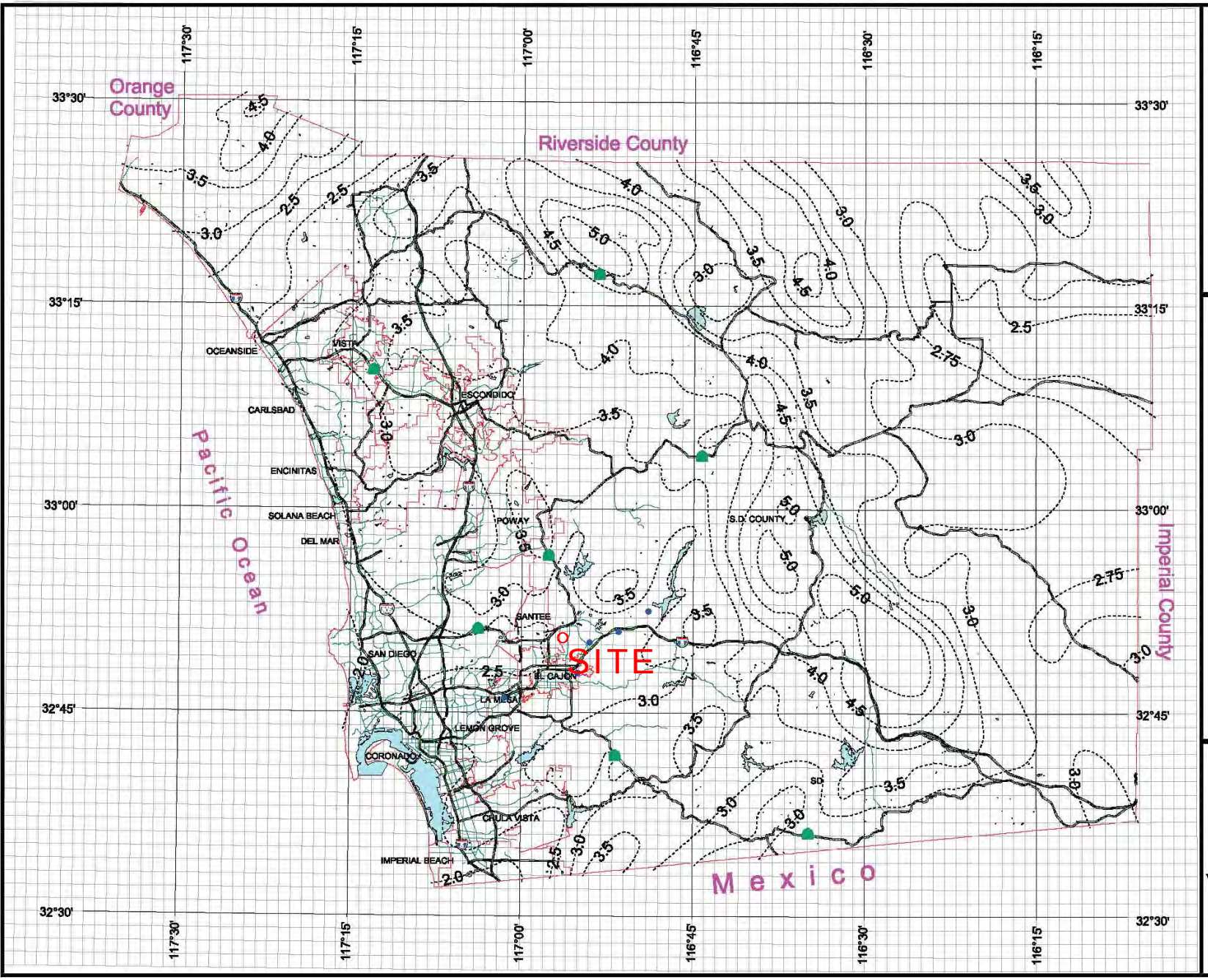
See CivilD analyses.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE 3-1



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6 = 2.6"

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

N W E S

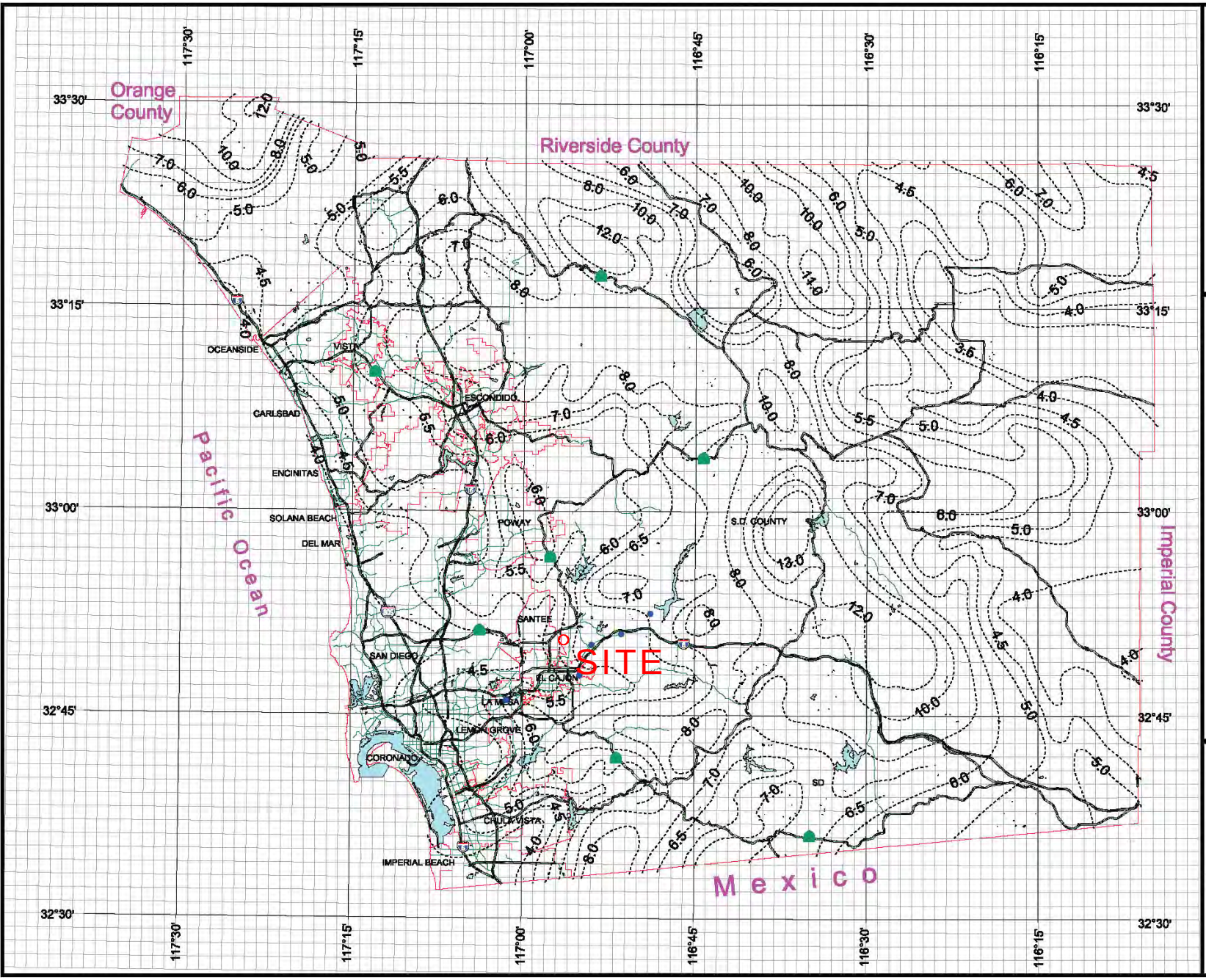
3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)



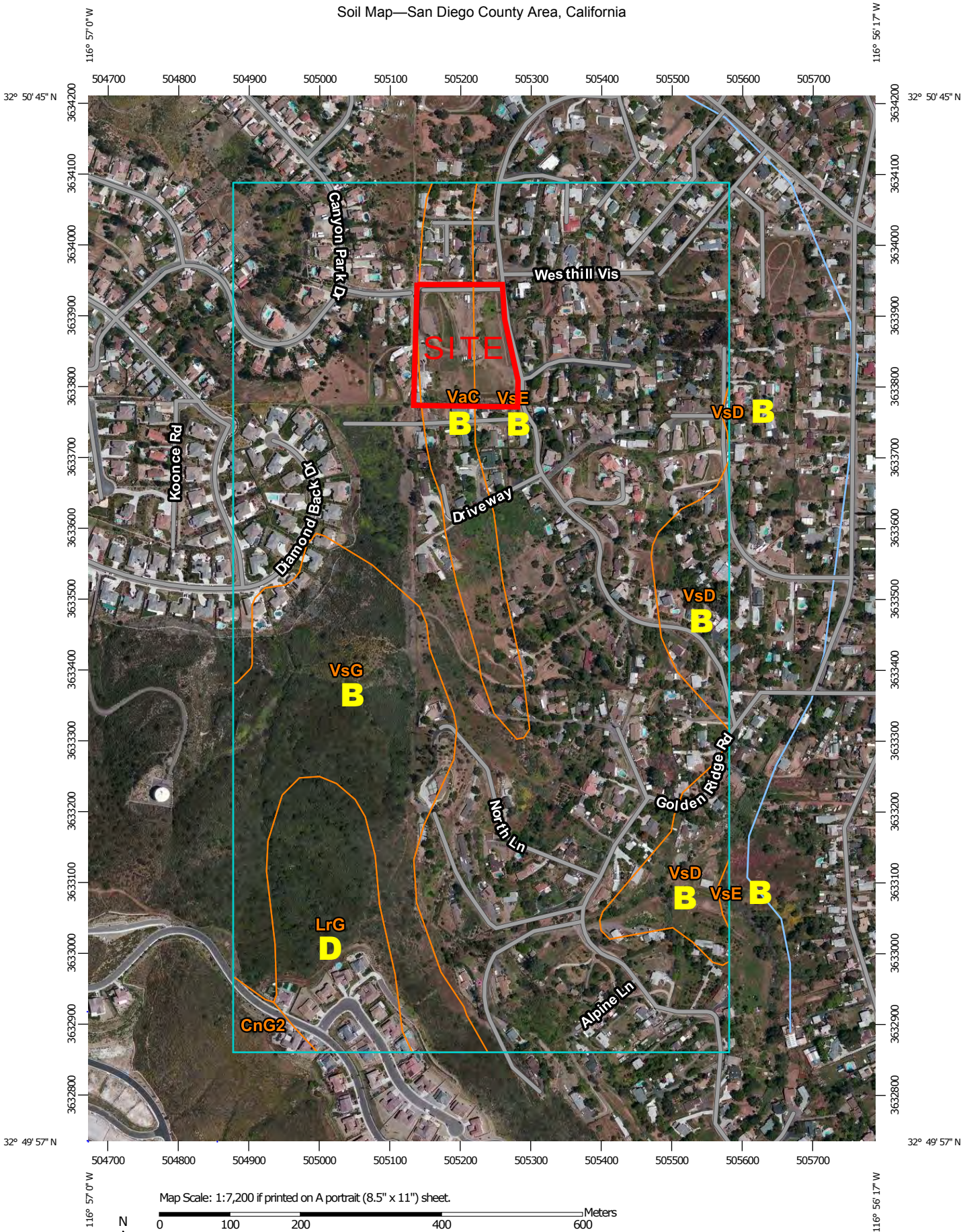
P24 = 5.6"

DPW GIS
Department of Public Works Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles


116° 57' 0" W
116° 56' 17" W
32° 50' 45" N
32° 49' 57" N
504700
504800
504900
505000
505100
505200
505300
505400
505500
505600
505700
3634200
3634100
3634000
3633900
3633800
3633700
3633600
3633500
3633400
3633300
3633200
3633100
3633000
3632900
3632800
Canyon Park Dr
Westhill Vis
SITE
VaC
B
VsE
B
VsD
B
Koonce Rd
Diamond Back Dr
Driveway
VsD
B
VsG
B
Golden Ridge Rd
North Ln
VsD
B
VsE
B
LrG
D
CnG2
Alpine Ln
Map Scale: 1:7,200 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
100
200
400
600
Feet
0
350
700
1400
2100
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- 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

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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 7, Nov 15, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 2, 2010—May 6, 2010

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.

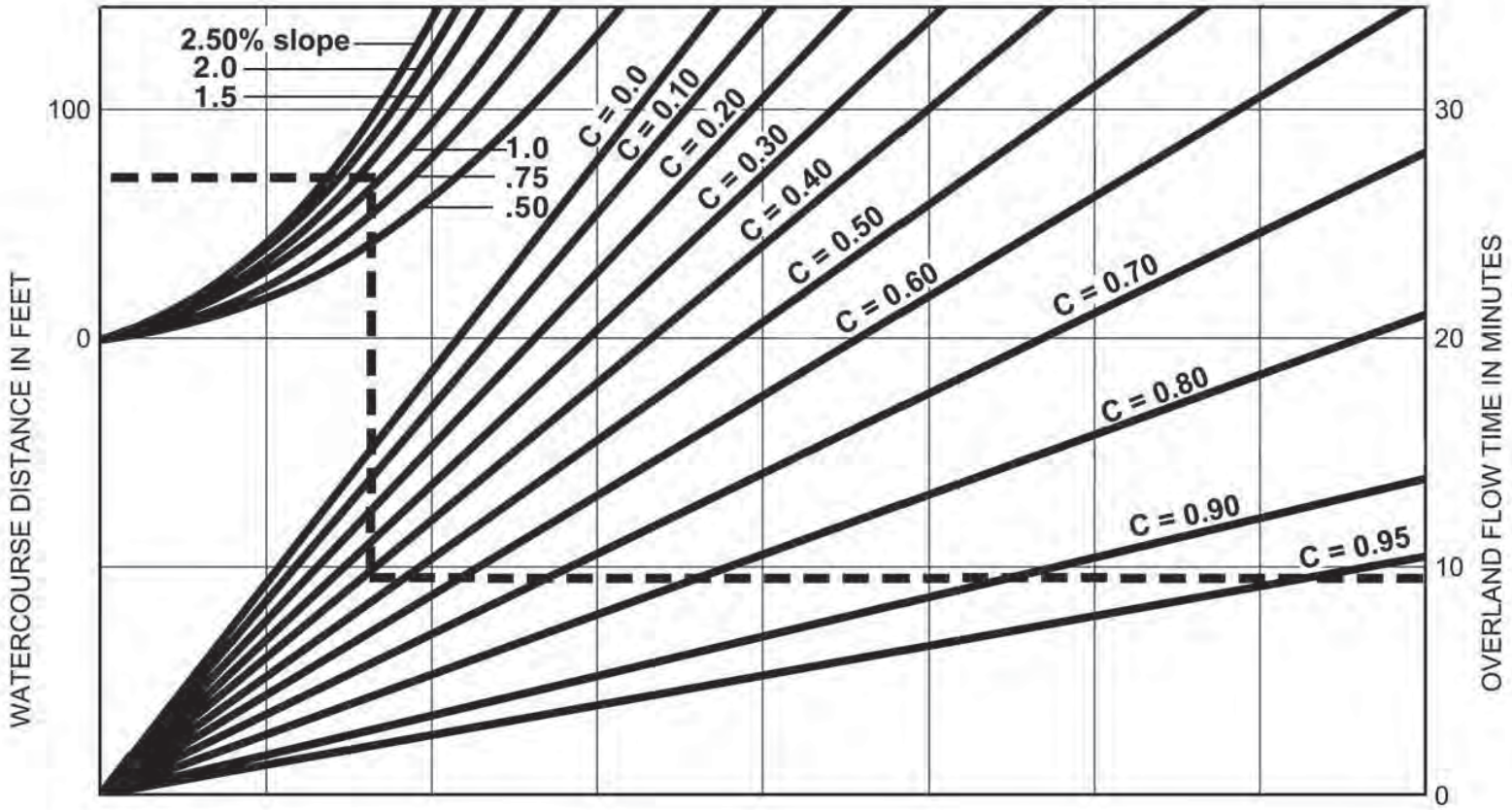
Map Unit Legend

San Diego County Area, California (CA638)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent s lopes, eroded	1.8	0.8%
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slope s	14.2	6.6%
VaC	Visalia sandy loam, 5 to 9 percent slopes	13.3	6.2%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes	13.6	6.4%
VsE	Vista coarse sandy loam, 15 to 30 percent slopes	139.4	65.0%
VsG	Vista coarse sandy loam, 30 to 65 percent slopes	32.1	15.0%
Totals for Area of Interest		**214.3**	**100.0%**

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

FIGURE 3-3

Rational Formula - Overland Time of Flow Nomograph

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/06/16

Germann Tentative Subdivision Map
Tract No. 5520 RPL 1
Existing Conditions
100-Year Storm Event

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.600
24 hour precipitation(inches) = 5.600
P6/P24 = 46.4%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(1.0 DU/A or Less)
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance = 595.000(Ft.)
Highest elevation = 1085.000(Ft.)
Lowest elevation = 850.000(Ft.)
Elevation difference = 235.000(Ft.) Slope = 39.496 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of 39.50 %, in a development type of
1.0 DU/A or Less
In Accordance With Figure 3-3

```
Initial Area Time of Concentration =   4.12 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  39.496^(1/3)]=   4.12
The initial area total distance of  595.00 (Ft.) entered leaves a
remaining distance of  495.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.33 minutes
for a distance of 495.00 (Ft.) and a slope of 39.50 %
with an elevation difference of 195.51(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.327 Minutes
Tt=[(11.9*0.0938^3)/(195.51)]^.385=  1.33
Total initial area Ti =   4.12 minutes from Figure 3-3 formula plus
  1.33 minutes from the Figure 3-4 formula =   5.45 minutes
Rainfall intensity (I) =      6.480(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      9.021(CFS)
Total initial stream area =        4.350(Ac.)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Process from Point/Station       12.000 to Point/Station       14.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   850.000(Ft.)
Downstream point elevation =   690.000(Ft.)
Channel length thru subarea  =   973.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     16.733(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     16.733(CFS)
Depth of flow =   0.386(Ft.), Average velocity =   7.040(Ft/s)
Channel flow top width =    7.316(Ft.)
Flow Velocity =    7.04(Ft/s)
Travel time  =    2.30 min.
Time of concentration =    7.75 min.
Critical depth =      0.617(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.162(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      5.162(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      4.723
```

```
Subarea runoff =     15.362(CFS) for     10.410(Ac.)
Total runoff =     24.382(CFS)   Total area =      14.760(Ac.)
Depth of flow =   0.477(Ft.), Average velocity =   7.943(Ft/s)
Critical depth =      0.766(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   690.000(Ft.)
Downstream point elevation =   590.500(Ft.)
Channel length thru subarea  =  1608.000(Ft.)
Channel base width    =    8.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     41.715(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     41.715(CFS)
Depth of flow =   0.672(Ft.), Average velocity =   6.199(Ft/s)
Channel flow top width =   12.031(Ft.)
Flow Velocity =    6.20(Ft/s)
Travel time  =    4.32 min.
Time of concentration =   12.08 min.
Critical depth =      0.844(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      3.879(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Rainfall intensity =      3.879(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.359  CA =     15.207
Subarea runoff =     34.604(CFS) for     27.590(Ac.)
Total runoff =     58.986(CFS)   Total area =      42.350(Ac.)
Depth of flow =   0.816(Ft.), Average velocity =   6.919(Ft/s)
Critical depth =      1.039(Ft.)


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Process from Point/Station       16.000 to Point/Station       18.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   591.300(Ft.)
Downstream point elevation =   568.000(Ft.)
Channel length thru subarea  =   528.000(Ft.)
```

```
Channel base width    =    3.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     59.432(CFS)
Manning's 'N'    = 0.035
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     59.432(CFS)
Depth of flow =   1.071(Ft.), Average velocity =   6.642(Ft/s)
Channel flow top width =   13.709(Ft.)
Flow Velocity =    6.64(Ft/s)
Travel time  =    1.32 min.
Time of concentration =   13.40 min.
Critical depth =      1.281(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      3.627(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Rainfall intensity =      3.627(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.347  CA =     16.495
Subarea runoff =      0.839(CFS) for      5.150(Ac.)
Total runoff =     59.825(CFS)   Total area =      47.500(Ac.)
Depth of flow =   1.074(Ft.), Average velocity =   6.654(Ft/s)
Critical depth =      1.281(Ft.)


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Process from Point/Station       16.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.500(Ac.)
Runoff from this stream =     59.825(CFS)
Time of concentration =   13.40 min.
Rainfall intensity =     3.627(In/Hr)


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Process from Point/Station       20.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Initial subarea total flow distance  =   96.000(Ft.)
Highest elevation =  713.000(Ft.)
Lowest elevation =  697.000(Ft.)
Elevation difference =   16.000(Ft.) Slope = 16.667 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  16.67 %, in a development type of
 2.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.07 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3800)*( 100.000^.5)/(  16.667^(1/3)]=   5.07
Rainfall intensity (I) =      6.786(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.380
Subarea runoff =      0.593(CFS)
Total initial stream area =        0.230(Ac.)


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Process from Point/Station       22.000 to Point/Station       24.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   697.000(Ft.)
Downstream point elevation =   675.000(Ft.)
Channel length thru subarea  =   397.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      2.011(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.011(CFS)
Depth of flow =   0.150(Ft.), Average velocity =   3.443(Ft/s)
Channel flow top width =    7.793(Ft.)
Flow Velocity =    3.44(Ft/s)
Travel time  =    1.92 min.
Time of concentration =    7.00 min.
Critical depth =      0.206(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.516(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Rainfall intensity =      5.516(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      0.612
Subarea runoff =      2.782(CFS) for      1.380(Ac.)
Total runoff =      3.375(CFS)   Total area =       1.610(Ac.)
Depth of flow =   0.182(Ft.), Average velocity =   3.919(Ft/s)
Critical depth =      0.254(Ft.)


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Process from Point/Station       24.000 to Point/Station       26.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   675.000(Ft.)
Downstream point elevation =   588.000(Ft.)
Channel length thru subarea  =  1001.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      8.582(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      8.582(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   5.859(Ft/s)
Channel flow top width =   12.342(Ft.)
Flow Velocity =    5.86(Ft/s)
Travel time  =    2.85 min.
Time of concentration =    9.84 min.
Critical depth =      0.367(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.404  CA =      3.096
Subarea runoff =     10.329(CFS) for      6.060(Ac.)
Total runoff =     13.704(CFS)   Total area =       7.670(Ac.)
Depth of flow =   0.283(Ft.), Average velocity =   6.586(Ft/s)
Critical depth =      0.445(Ft.)


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Process from Point/Station       26.000 to Point/Station       28.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   585.000(Ft.)
```

```
Downstream point/station elevation =   583.000(Ft.)
Pipe length  =    34.00(Ft.) Slope =   0.0588  Manning's N = 0.024
No. of pipes = 1  Required pipe flow  =    13.704(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    13.704(CFS)
Normal flow depth in pipe =   14.63(In.)
Flow top width inside pipe =   14.05(In.)
Critical Depth =   16.47(In.)
Pipe flow velocity =      8.90(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =     9.91 min.


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Process from Point/Station       28.000 to Point/Station       18.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   583.000(Ft.)
Downstream point elevation =   568.000(Ft.)
Channel length thru subarea  =   162.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   2.000
Manning's 'N'    = 0.035
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     13.704(CFS)
Depth of flow =   0.747(Ft.), Average velocity =   7.352(Ft/s)
Channel flow top width =    3.989(Ft.)
Flow Velocity =    7.35(Ft/s)
Travel time  =    0.37 min.
Time of concentration =   10.27 min.
Critical depth =      1.016(Ft.)


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Process from Point/Station       28.000 to Point/Station       18.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      7.670(Ac.)
Runoff from this stream =     13.704(CFS)
Time of concentration =   10.27 min.
Rainfall intensity =     4.305(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       59.825     13.40            3.627
2       13.704     10.27            4.305
Qmax(1) =
```

```
        1.000 *    1.000 *    59.825) +
        0.842 *    1.000 *    13.704) + =      71.370
Qmax(2) =
        1.000 *    0.767 *    59.825) +
        1.000 *    1.000 *    13.704) + =      59.566

Total of 2 streams to confluence:
Flow rates before confluence point:
      59.825      13.704
Maximum flow rates at confluence using above data:
       71.370       59.566
Area of streams before confluence:
       47.500        7.670
Results of confluence:
Total flow rate =     71.370(CFS)
Time of concentration =    13.401 min.
Effective stream area after confluence =     55.170(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       30.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   568.000(Ft.)
Downstream point elevation =   563.600(Ft.)
Channel length thru subarea  =    41.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =  50.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     71.370(CFS)
Depth of flow =   0.369(Ft.), Average velocity =  10.508(Ft/s)
Channel flow top width =   36.856(Ft.)
Flow Velocity =   10.51(Ft/s)
Travel time  =    0.07 min.
Time of concentration =   13.47 min.
Critical depth =      0.660(Ft.)


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Process from Point/Station       18.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     55.170(Ac.)
Runoff from this stream =     71.370(CFS)
Time of concentration =   13.47 min.
Rainfall intensity =     3.616(In/Hr)


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Process from Point/Station       32.000 to Point/Station       30.000
**** INITIAL AREA EVALUATION ****
----------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[HIGH DENSITY RESIDENTIAL                    ]
(24.0 DU/A or Less      )
Impervious value, Ai = 0.650
Sub-Area C Value = 0.670
Initial subarea total flow distance  =  765.000(Ft.)
Highest elevation =  632.000(Ft.)
Lowest elevation =  563.600(Ft.)
Elevation difference =   68.400(Ft.) Slope =  8.941 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.94 %, in a development type of
 24.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   3.73 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.6700)*( 100.000^.5)/(   8.940^(1/3)]=   3.73
The initial area total distance of  765.00 (Ft.) entered leaves a
remaining distance of  665.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   2.95 minutes
for a distance of 665.00 (Ft.) and a slope of  8.94 %
with an elevation difference of  59.45(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    2.951 Minutes
Tt=[(11.9*0.1259^3)/( 59.45)]^.385=  2.95
Total initial area Ti =   3.73 minutes from Figure 3-3 formula plus
  2.95 minutes from the Figure 3-4 formula =   6.68 minutes
Rainfall intensity (I) =      5.683(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.670
Subarea runoff =      2.818(CFS)
Total initial stream area =        0.740(Ac.)


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Process from Point/Station       32.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.740(Ac.)
Runoff from this stream =      2.818(CFS)
Time of concentration =    6.68 min.
Rainfall intensity =     5.683(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)
```

```
1       71.370     13.47            3.616
2        2.818      6.68            5.683
Qmax(1) =
        1.000 *    1.000 *    71.370) +
        0.636 *    1.000 *     2.818) + =      73.163
Qmax(2) =
        1.000 *    0.496 *    71.370) +
        1.000 *    1.000 *     2.818) + =      38.220

Total of 2 streams to confluence:
Flow rates before confluence point:
      71.370       2.818
Maximum flow rates at confluence using above data:
       73.163       38.220
Area of streams before confluence:
       55.170        0.740
Results of confluence:
Total flow rate =     73.163(CFS)
Time of concentration =    13.466 min.
Effective stream area after confluence =     55.910(Ac.)


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Process from Point/Station       30.000 to Point/Station       34.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   555.570(Ft.)
Downstream point/station elevation =   553.300(Ft.)
Pipe length  =   115.00(Ft.) Slope =   0.0197  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    73.163(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    73.163(CFS)
Normal flow depth in pipe =   26.63(In.)
Flow top width inside pipe =   26.06(In.)
Critical depth could not be calculated.
Pipe flow velocity =     14.26(Ft/s)
Travel time through pipe =    0.13 min.
Time of concentration (TC) =    13.60 min.
End of computations, total study area =          55.910 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/16

Germann Tentative Subdivision Map
Tract No. 5520 RPL 1 - Alternative A
Proposed Conditions
100-Year Storm Event

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.600
24 hour precipitation(inches) = 5.600
P6/P24 = 46.4%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(2.9 DU/A or Less)
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Initial subarea total flow distance = 156.000(Ft.)
Highest elevation = 594.500(Ft.)
Lowest elevation = 592.900(Ft.)
Elevation difference = 1.600(Ft.) Slope = 1.026 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.03 %, in a development type of
2.9 DU/A or Less
In Accordance With Figure 3-3

```
Initial Area Time of Concentration =  10.30 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*(  70.000^.5)/(   1.026^(1/3)]=  10.30
The initial area total distance of  156.00 (Ft.) entered leaves a
remaining distance of   86.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.41 minutes
for a distance of  86.00 (Ft.) and a slope of  1.03 %
with an elevation difference of   0.88(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.406 Minutes
Tt=[(11.9*0.0163^3)/(  0.88)]^.385=  1.41
Total initial area Ti =  10.30 minutes from Figure 3-3 formula plus
  1.41 minutes from the Figure 3-4 formula =  11.71 minutes
Rainfall intensity (I) =      3.957(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.503(CFS)
Total initial stream area =        0.310(Ac.)


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Process from Point/Station       12.000 to Point/Station       14.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   592.500(Ft.)
End of street segment elevation =   573.170(Ft.)
Length of street segment  =   425.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.797(CFS)
Depth of flow =   0.262(Ft.), Average velocity =   3.632(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.360(Ft.)
Flow velocity =   3.63(Ft/s)
Travel time =    1.95 min.     TC =   13.66  min.
 Adding area flow to street
Rainfall intensity (I) =      3.583(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      3.583(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      1.402
Subarea runoff =      4.521(CFS) for      3.110(Ac.)
Total runoff =      5.024(CFS)   Total area =       3.420(Ac.)
Street flow at end of street =      5.024(CFS)
Half street flow at end of street =      5.024(CFS)
Depth of flow =   0.308(Ft.), Average velocity =   4.151(Ft/s)
Flow width (from curb towards crown)=  10.672(Ft.)


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Process from Point/Station       14.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   569.660(Ft.)
Downstream point/station elevation =   569.500(Ft.)
Pipe length  =     8.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.024(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     5.024(CFS)
Normal flow depth in pipe =    9.80(In.)
Flow top width inside pipe =    9.29(In.)
Critical Depth =   11.02(In.)
Pipe flow velocity =      7.31(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    13.68 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.420(Ac.)
Runoff from this stream =      5.024(CFS)
Time of concentration =   13.68 min.
Rainfall intensity =     3.580(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       20.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  189.000(Ft.)
Highest elevation =  630.600(Ft.)
Lowest elevation =  624.000(Ft.)
Elevation difference =    6.600(Ft.) Slope =  3.492 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
for the top area slope value of   3.49 %, in a development type of
 2.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.98 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*(  95.000^.5)/(   3.492^(1/3)]=   7.98
The initial area total distance of  189.00 (Ft.) entered leaves a
remaining distance of   94.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.94 minutes
for a distance of  94.00 (Ft.) and a slope of  3.49 %
with an elevation difference of   3.28(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.939 Minutes
Tt=[(11.9*0.0178^3)/(  3.28)]^.385=  0.94
Total initial area Ti =   7.98 minutes from Figure 3-3 formula plus
  0.94 minutes from the Figure 3-4 formula =   8.92 minutes
Rainfall intensity (I) =      4.716(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.309(CFS)
Total initial stream area =        0.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   624.000(Ft.)
Downstream point elevation =   590.000(Ft.)
Channel length thru subarea  =   271.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   0.100
Estimated mean flow rate at midpoint of channel =      0.715(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      0.715(CFS)
Depth of flow =   0.089(Ft.), Average velocity =   3.622(Ft/s)
Channel flow top width =    4.449(Ft.)
Flow Velocity =    3.62(Ft/s)
Travel time  =    1.25 min.
Time of concentration =   10.17 min.
Critical depth =      0.139(Ft.)
 Adding area flow to channel
```

```
Rainfall intensity (I) =      4.335(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.335(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      0.238
Subarea runoff =      0.721(CFS) for      0.420(Ac.)
Total runoff =      1.031(CFS)   Total area =       0.580(Ac.)
Depth of flow =   0.102(Ft.), Average velocity =   3.969(Ft/s)
Critical depth =      0.160(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   590.000(Ft.)
End of street segment elevation =   572.670(Ft.)
Length of street segment  =   195.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.871(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   4.340(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   5.998(Ft.)
Flow velocity =   4.34(Ft/s)
Travel time =    0.75 min.     TC =   10.91  min.
 Adding area flow to street
Rainfall intensity (I) =      4.140(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.9 DU/A or Less       )
```

```
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.140(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      0.640
Subarea runoff =      1.617(CFS) for      0.980(Ac.)
Total runoff =      2.648(CFS)   Total area =       1.560(Ac.)
Street flow at end of street =      2.648(CFS)
Half street flow at end of street =      2.648(CFS)
Depth of flow =   0.236(Ft.), Average velocity =   4.663(Ft/s)
Flow width (from curb towards crown)=   7.048(Ft.)


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Process from Point/Station       24.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   569.660(Ft.)
Downstream point/station elevation =   569.500(Ft.)
Pipe length  =     8.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.648(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.648(CFS)
Normal flow depth in pipe =    6.18(In.)
Flow top width inside pipe =   11.99(In.)
Critical Depth =    8.37(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    10.93 min.


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Process from Point/Station       24.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.560(Ac.)
Runoff from this stream =      2.648(CFS)
Time of concentration =   10.93 min.
Rainfall intensity =     4.135(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        5.024     13.68            3.580
2        2.648     10.93            4.135
Qmax(1) =
        1.000 *    1.000 *     5.024) +
        0.866 *    1.000 *     2.648) + =       7.316
Qmax(2) =
```

```
        1.000 *    0.800 *     5.024) +
        1.000 *    1.000 *     2.648) + =       6.665

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.024       2.648
Maximum flow rates at confluence using above data:
        7.316        6.665
Area of streams before confluence:
        3.420        1.560
Results of confluence:
Total flow rate =      7.316(CFS)
Time of concentration =    13.677 min.
Effective stream area after confluence =      4.980(Ac.)


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Process from Point/Station       16.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.580(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Time of concentration =    13.68 min.
Rainfall intensity =      3.580(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.403  CA =      2.097
Subarea runoff =      0.190(CFS) for      0.220(Ac.)
Total runoff =      7.506(CFS)   Total area =       5.200(Ac.)


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Process from Point/Station       16.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   563.440(Ft.)
Downstream point/station elevation =   562.500(Ft.)
Pipe length  =    47.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.506(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.506(CFS)
Normal flow depth in pipe =   10.35(In.)
Flow top width inside pipe =   13.88(In.)
Critical Depth =   13.07(In.)
Pipe flow velocity =      8.31(Ft/s)
Travel time through pipe =    0.09 min.
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Time of concentration (TC) =    13.77 min.


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Process from Point/Station       16.000 to Point/Station       26.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.200(Ac.)
Runoff from this stream =      7.506(CFS)
Time of concentration =   13.77 min.
Rainfall intensity =     3.564(In/Hr)


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Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  595.000(Ft.)
Highest elevation = 1085.000(Ft.)
Lowest elevation =  850.000(Ft.)
Elevation difference =  235.000(Ft.) Slope = 39.496 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  39.50 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.12 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  39.496^(1/3)]=   4.12
The initial area total distance of  595.00 (Ft.) entered leaves a
remaining distance of  495.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.33 minutes
for a distance of 495.00 (Ft.) and a slope of 39.50 %
with an elevation difference of 195.51(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.327 Minutes
Tt=[(11.9*0.0938^3)/(195.51)]^.385=  1.33
Total initial area Ti =   4.12 minutes from Figure 3-3 formula plus
  1.33 minutes from the Figure 3-4 formula =   5.45 minutes
Rainfall intensity (I) =      6.480(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      9.021(CFS)
Total initial stream area =        4.350(Ac.)
```

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Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   850.000(Ft.)
Downstream point elevation =   690.000(Ft.)
Channel length thru subarea  =   973.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     16.733(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     16.733(CFS)
Depth of flow =   0.386(Ft.), Average velocity =   7.040(Ft/s)
Channel flow top width =    7.316(Ft.)
Flow Velocity =    7.04(Ft/s)
Travel time  =    2.30 min.
Time of concentration =    7.75 min.
Critical depth =      0.617(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.162(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      5.162(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      4.723
Subarea runoff =     15.362(CFS) for     10.410(Ac.)
Total runoff =     24.382(CFS)   Total area =      14.760(Ac.)
Depth of flow =   0.477(Ft.), Average velocity =   7.943(Ft/s)
Critical depth =      0.766(Ft.)


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Process from Point/Station       34.000 to Point/Station       36.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   690.000(Ft.)
Downstream point elevation =   590.500(Ft.)
Channel length thru subarea  =  1608.000(Ft.)
Channel base width    =    8.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     41.715(CFS)
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```
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     41.715(CFS)
Depth of flow =   0.672(Ft.), Average velocity =   6.199(Ft/s)
Channel flow top width =   12.031(Ft.)
Flow Velocity =    6.20(Ft/s)
Travel time  =    4.32 min.
Time of concentration =   12.08 min.
Critical depth =      0.844(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      3.879(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Rainfall intensity =      3.879(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.359  CA =     15.207
Subarea runoff =     34.604(CFS) for     27.590(Ac.)
Total runoff =     58.986(CFS)   Total area =      42.350(Ac.)
Depth of flow =   0.816(Ft.), Average velocity =   6.919(Ft/s)
Critical depth =      1.039(Ft.)


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Process from Point/Station       36.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   590.500(Ft.)
Downstream point/station elevation =   562.500(Ft.)
Pipe length  =   469.00(Ft.) Slope =   0.0597  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    58.986(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    58.986(CFS)
Normal flow depth in pipe =   17.93(In.)
Flow top width inside pipe =   25.51(In.)
Critical depth could not be calculated.
Pipe flow velocity =     21.04(Ft/s)
Travel time through pipe =    0.37 min.
Time of concentration (TC) =    12.45 min.


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Process from Point/Station       36.000 to Point/Station       26.000
**** CONFLUENCE OF MINOR STREAMS ****
----------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     42.350(Ac.)
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Runoff from this stream =     58.986(CFS)
Time of concentration =   12.45 min.
Rainfall intensity =     3.804(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        7.506     13.77            3.564
2       58.986     12.45            3.804
Qmax(1) =
        1.000 *    1.000 *     7.506) +
        0.937 *    1.000 *    58.986) + =      62.771
Qmax(2) =
        1.000 *    0.904 *     7.506) +
        1.000 *    1.000 *    58.986) + =      65.771

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.506      58.986
Maximum flow rates at confluence using above data:
       62.771       65.771
Area of streams before confluence:
        5.200       42.350
Results of confluence:
Total flow rate =     65.771(CFS)
Time of concentration =    12.448 min.
Effective stream area after confluence =     47.550(Ac.)


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Process from Point/Station       26.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   562.000(Ft.)
Downstream point/station elevation =   561.500(Ft.)
Pipe length  =    25.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    65.771(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    65.771(CFS)
Normal flow depth in pipe =   24.00(In.)
Flow top width inside pipe =   29.39(In.)
Critical Depth =   30.65(In.)
Pipe flow velocity =     14.21(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    12.48 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       38.000
**** CONFLUENCE OF MINOR STREAMS ****
```

```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.550(Ac.)
Runoff from this stream =     65.771(CFS)
Time of concentration =   12.48 min.
Rainfall intensity =     3.798(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       42.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Initial subarea total flow distance  =   96.000(Ft.)
Highest elevation =  713.000(Ft.)
Lowest elevation =  697.000(Ft.)
Elevation difference =   16.000(Ft.) Slope = 16.667 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  16.67 %, in a development type of
 2.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.07 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3800)*( 100.000^.5)/(  16.667^(1/3)]=   5.07
Rainfall intensity (I) =      6.786(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.380
Subarea runoff =      0.593(CFS)
Total initial stream area =        0.230(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       44.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   697.000(Ft.)
Downstream point elevation =   675.000(Ft.)
Channel length thru subarea  =   397.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      2.011(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.011(CFS)
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Depth of flow =   0.150(Ft.), Average velocity =   3.443(Ft/s)
Channel flow top width =    7.793(Ft.)
Flow Velocity =    3.44(Ft/s)
Travel time  =    1.92 min.
Time of concentration =    7.00 min.
Critical depth =      0.206(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.516(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Rainfall intensity =      5.516(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      0.612
Subarea runoff =      2.782(CFS) for      1.380(Ac.)
Total runoff =      3.375(CFS)   Total area =       1.610(Ac.)
Depth of flow =   0.182(Ft.), Average velocity =   3.919(Ft/s)
Critical depth =      0.254(Ft.)


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Process from Point/Station       44.000 to Point/Station       46.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   675.000(Ft.)
Downstream point elevation =   588.000(Ft.)
Channel length thru subarea  =  1001.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      8.582(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      8.582(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   5.859(Ft/s)
Channel flow top width =   12.342(Ft.)
Flow Velocity =    5.86(Ft/s)
Travel time  =    2.85 min.
Time of concentration =    9.84 min.
Critical depth =      0.367(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.404  CA =      3.096
Subarea runoff =     10.329(CFS) for      6.060(Ac.)
Total runoff =     13.704(CFS)   Total area =       7.670(Ac.)
Depth of flow =   0.283(Ft.), Average velocity =   6.586(Ft/s)
Critical depth =      0.445(Ft.)


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Process from Point/Station       46.000 to Point/Station       48.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   585.000(Ft.)
Downstream point/station elevation =   578.000(Ft.)
Pipe length  =    37.00(Ft.) Slope =   0.1892  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.704(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    13.704(CFS)
Normal flow depth in pipe =    8.77(In.)
Flow top width inside pipe =   10.65(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.28(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.87 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       48.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------------
Rainfall intensity (I) =      4.418(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Time of concentration =     9.87 min.
Rainfall intensity =      4.418(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.426  CA =      3.427
Subarea runoff =      1.436(CFS) for      0.380(Ac.)
Total runoff =     15.140(CFS)   Total area =       8.050(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station       48.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   578.000(Ft.)
Downstream point/station elevation =   562.000(Ft.)
Pipe length  =   211.00(Ft.) Slope =   0.0758  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.140(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    15.140(CFS)
Normal flow depth in pipe =   10.64(In.)
Flow top width inside pipe =   13.62(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.28(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =    10.09 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       48.000 to Point/Station       38.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      8.050(Ac.)
Runoff from this stream =     15.140(CFS)
Time of concentration =   10.09 min.
Rainfall intensity =     4.356(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       65.771     12.48            3.798
2       15.140     10.09            4.356
Qmax(1) =
        1.000 *    1.000 *    65.771) +
        0.872 *    1.000 *    15.140) + =      78.969
Qmax(2) =
        1.000 *    0.808 *    65.771) +
        1.000 *    1.000 *    15.140) + =      68.307

Total of 2 streams to confluence:
Flow rates before confluence point:
      65.771      15.140
Maximum flow rates at confluence using above data:
       78.969       68.307
Area of streams before confluence:
       47.550        8.050
Results of confluence:
Total flow rate =     78.969(CFS)
Time of concentration =    12.477 min.
Effective stream area after confluence =     55.600(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       52.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   561.500(Ft.)
Downstream point/station elevation =   560.720(Ft.)
Pipe length  =    20.00(Ft.) Slope =   0.0390  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    78.969(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    78.969(CFS)
Normal flow depth in pipe =   23.95(In.)
Flow top width inside pipe =   24.07(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.81(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    12.49 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       52.000
**** CONFLUENCE OF MINOR STREAMS ****
------------------------------------------------------------------------
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     55.600(Ac.)
Runoff from this stream =     78.969(CFS)
Time of concentration =   12.49 min.
Rainfall intensity =     3.794(In/Hr)


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Process from Point/Station       54.000 to Point/Station       56.000
**** INITIAL AREA EVALUATION ****
------------------------------------------------------------------------
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  166.000(Ft.)
Highest elevation =  582.000(Ft.)
Lowest elevation =  579.000(Ft.)
Elevation difference =    3.000(Ft.) Slope =  1.807 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   1.81 %, in a development type of
 2.9 DU/A or Less
In Accordance With Figure 3-3
```

```
Initial Area Time of Concentration =   9.40 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*(  85.000^.5)/(   1.807^(1/3)]=   9.40
The initial area total distance of  166.00 (Ft.) entered leaves a
remaining distance of   81.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.08 minutes
for a distance of  81.00 (Ft.) and a slope of  1.81 %
with an elevation difference of   1.46(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.079 Minutes
Tt=[(11.9*0.0153^3)/(  1.46)]^.385=  1.08
Total initial area Ti =   9.40 minutes from Figure 3-3 formula plus
  1.08 minutes from the Figure 3-4 formula =  10.48 minutes
Rainfall intensity (I) =      4.250(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.244(CFS)
Total initial stream area =        0.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       52.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   577.000(Ft.)
Downstream point/station elevation =   560.720(Ft.)
Pipe length  =   121.00(Ft.) Slope =   0.1345  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.244(CFS)
Nearest computed pipe diameter  =      3.00(In.)
Calculated individual pipe flow  =     0.244(CFS)
Normal flow depth in pipe =    1.94(In.)
Flow top width inside pipe =    2.87(In.)
Critical depth could not be calculated.
Pipe flow velocity =      7.25(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    10.76 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       52.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.140(Ac.)
Runoff from this stream =      0.244(CFS)
Time of concentration =   10.76 min.
Rainfall intensity =     4.179(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)
```

```
1       78.969     12.49            3.794
2        0.244     10.76            4.179
Qmax(1) =
        1.000 *    1.000 *    78.969) +
        0.908 *    1.000 *     0.244) + =      79.191
Qmax(2) =
        1.000 *    0.861 *    78.969) +
        1.000 *    1.000 *     0.244) + =      68.240

Total of 2 streams to confluence:
Flow rates before confluence point:
      78.969       0.244
Maximum flow rates at confluence using above data:
       79.191       68.240
Area of streams before confluence:
       55.600        0.140
Results of confluence:
Total flow rate =     79.191(CFS)
Time of concentration =    12.495 min.
Effective stream area after confluence =     55.740(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       52.000 to Point/Station       58.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   560.720(Ft.)
Downstream point/station elevation =   559.830(Ft.)
Pipe length  =    23.00(Ft.) Slope =   0.0387  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    79.191(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    79.191(CFS)
Normal flow depth in pipe =   24.09(In.)
Flow top width inside pipe =   23.86(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.74(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    12.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       58.000 to Point/Station       58.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.790(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
```

```
Sub-Area C Value = 0.250
The area added to the existing stream causes a
a lower flow rate of Q =     78.960(CFS)
therefore the upstream flow rate of Q =     79.191(CFS) is being used
Time of concentration =    12.52 min.
Rainfall intensity =      3.790(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.373  CA =     20.831
Subarea runoff =      0.000(CFS) for      0.170(Ac.)
Total runoff =     79.191(CFS)   Total area =      55.910(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       58.000 to Point/Station       60.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   559.830(Ft.)
Downstream point/station elevation =   555.500(Ft.)
Pipe length  =   110.00(Ft.) Slope =   0.0394  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    79.191(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    79.191(CFS)
Normal flow depth in pipe =   23.91(In.)
Flow top width inside pipe =   24.14(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.89(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    12.61 min.
End of computations, total study area =          55.910 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 07/07/16

Germann Tentative Subdivision Map
Tract No. 5520 RPL 1 - Alternative B
Proposed Conditions
100-Year Storm Event

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.600
24 hour precipitation(inches) = 5.600
P6/P24 = 46.4%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL]
(2.9 DU/A or Less)
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Initial subarea total flow distance = 124.000(Ft.)
Highest elevation = 594.500(Ft.)
Lowest elevation = 593.250(Ft.)
Elevation difference = 1.250(Ft.) Slope = 1.008 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 70.00 (Ft)
for the top area slope value of 1.01 %, in a development type of
2.9 DU/A or Less
In Accordance With Figure 3-3

```
Initial Area Time of Concentration =  10.36 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*(  70.000^.5)/(   1.008^(1/3)]=  10.36
The initial area total distance of  124.00 (Ft.) entered leaves a
remaining distance of   54.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.99 minutes
for a distance of  54.00 (Ft.) and a slope of  1.01 %
with an elevation difference of   0.54(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.989 Minutes
Tt=[(11.9*0.0102^3)/(  0.54)]^.385=  0.99
Total initial area Ti =  10.36 minutes from Figure 3-3 formula plus
  0.99 minutes from the Figure 3-4 formula =  11.35 minutes
Rainfall intensity (I) =      4.037(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.381(CFS)
Total initial stream area =        0.230(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       14.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   592.500(Ft.)
End of street segment elevation =   573.170(Ft.)
Length of street segment  =   466.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.531(CFS)
Depth of flow =   0.258(Ft.), Average velocity =   3.427(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.169(Ft.)
Flow velocity =   3.43(Ft/s)
Travel time =    2.27 min.     TC =   13.62  min.
 Adding area flow to street
Rainfall intensity (I) =      3.589(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      3.589(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      1.283
Subarea runoff =      4.226(CFS) for      2.900(Ac.)
Total runoff =      4.606(CFS)   Total area =       3.130(Ac.)
Street flow at end of street =      4.606(CFS)
Half street flow at end of street =      4.606(CFS)
Depth of flow =   0.305(Ft.), Average velocity =   3.927(Ft/s)
Flow width (from curb towards crown)=  10.496(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   569.660(Ft.)
Downstream point/station elevation =   569.500(Ft.)
Pipe length  =     8.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.606(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.606(CFS)
Normal flow depth in pipe =    9.02(In.)
Flow top width inside pipe =   10.37(In.)
Critical Depth =   10.73(In.)
Pipe flow velocity =      7.27(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    13.64 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.130(Ac.)
Runoff from this stream =      4.606(CFS)
Time of concentration =   13.64 min.
Rainfall intensity =     3.586(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       20.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  189.000(Ft.)
Highest elevation =  630.600(Ft.)
Lowest elevation =  624.000(Ft.)
Elevation difference =    6.600(Ft.) Slope =  3.492 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
for the top area slope value of   3.49 %, in a development type of
 2.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.98 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*(  95.000^.5)/(   3.492^(1/3)]=   7.98
The initial area total distance of  189.00 (Ft.) entered leaves a
remaining distance of   94.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.94 minutes
for a distance of  94.00 (Ft.) and a slope of  3.49 %
with an elevation difference of   3.28(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.939 Minutes
Tt=[(11.9*0.0178^3)/(  3.28)]^.385=  0.94
Total initial area Ti =   7.98 minutes from Figure 3-3 formula plus
  0.94 minutes from the Figure 3-4 formula =   8.92 minutes
Rainfall intensity (I) =      4.716(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.309(CFS)
Total initial stream area =        0.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   624.000(Ft.)
Downstream point elevation =   590.000(Ft.)
Channel length thru subarea  =   271.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   0.100
Estimated mean flow rate at midpoint of channel =      0.715(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      0.715(CFS)
Depth of flow =   0.089(Ft.), Average velocity =   3.622(Ft/s)
Channel flow top width =    4.449(Ft.)
Flow Velocity =    3.62(Ft/s)
Travel time  =    1.25 min.
Time of concentration =   10.17 min.
Critical depth =      0.139(Ft.)
 Adding area flow to channel
```

```
Rainfall intensity (I) =      4.335(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.335(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      0.238
Subarea runoff =      0.721(CFS) for      0.420(Ac.)
Total runoff =      1.031(CFS)   Total area =       0.580(Ac.)
Depth of flow =   0.102(Ft.), Average velocity =   3.969(Ft/s)
Critical depth =      0.160(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       24.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
----------------------------------------------------------------------
Top of street segment elevation =   590.000(Ft.)
End of street segment elevation =   572.670(Ft.)
Length of street segment  =   195.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.871(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   4.340(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   5.998(Ft.)
Flow velocity =   4.34(Ft/s)
Travel time =    0.75 min.     TC =   10.91  min.
 Adding area flow to street
Rainfall intensity (I) =      4.140(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.9 DU/A or Less       )
```

```
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.140(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      0.640
Subarea runoff =      1.617(CFS) for      0.980(Ac.)
Total runoff =      2.648(CFS)   Total area =       1.560(Ac.)
Street flow at end of street =      2.648(CFS)
Half street flow at end of street =      2.648(CFS)
Depth of flow =   0.236(Ft.), Average velocity =   4.663(Ft/s)
Flow width (from curb towards crown)=   7.048(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   569.660(Ft.)
Downstream point/station elevation =   569.500(Ft.)
Pipe length  =     8.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.648(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.648(CFS)
Normal flow depth in pipe =    6.18(In.)
Flow top width inside pipe =   11.99(In.)
Critical Depth =    8.37(In.)
Pipe flow velocity =      6.50(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    10.93 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       24.000 to Point/Station       16.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.560(Ac.)
Runoff from this stream =      2.648(CFS)
Time of concentration =   10.93 min.
Rainfall intensity =     4.135(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        4.606     13.64            3.586
2        2.648     10.93            4.135
Qmax(1) =
        1.000 *    1.000 *     4.606) +
        0.867 *    1.000 *     2.648) + =       6.903
Qmax(2) =
```

```
        1.000 *    0.802 *     4.606) +
        1.000 *    1.000 *     2.648) + =       6.342

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.606       2.648
Maximum flow rates at confluence using above data:
        6.903        6.342
Area of streams before confluence:
        3.130        1.560
Results of confluence:
Total flow rate =      6.903(CFS)
Time of concentration =    13.637 min.
Effective stream area after confluence =      4.690(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.586(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Time of concentration =    13.64 min.
Rainfall intensity =      3.586(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.403  CA =      1.978
Subarea runoff =      0.190(CFS) for      0.220(Ac.)
Total runoff =      7.093(CFS)   Total area =       4.910(Ac.)


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Process from Point/Station       16.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   563.440(Ft.)
Downstream point/station elevation =   562.500(Ft.)
Pipe length  =    47.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.093(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     7.093(CFS)
Normal flow depth in pipe =    9.94(In.)
Flow top width inside pipe =   14.19(In.)
Critical Depth =   12.79(In.)
Pipe flow velocity =      8.23(Ft/s)
Travel time through pipe =    0.10 min.
```

```
Time of concentration (TC) =    13.73 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       26.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.910(Ac.)
Runoff from this stream =      7.093(CFS)
Time of concentration =   13.73 min.
Rainfall intensity =     3.570(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  595.000(Ft.)
Highest elevation = 1085.000(Ft.)
Lowest elevation =  850.000(Ft.)
Elevation difference =  235.000(Ft.) Slope = 39.496 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  39.50 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.12 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  39.496^(1/3)]=   4.12
The initial area total distance of  595.00 (Ft.) entered leaves a
remaining distance of  495.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.33 minutes
for a distance of 495.00 (Ft.) and a slope of 39.50 %
with an elevation difference of 195.51(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.327 Minutes
Tt=[(11.9*0.0938^3)/(195.51)]^.385=  1.33
Total initial area Ti =   4.12 minutes from Figure 3-3 formula plus
  1.33 minutes from the Figure 3-4 formula =   5.45 minutes
Rainfall intensity (I) =      6.480(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      9.021(CFS)
Total initial stream area =        4.350(Ac.)
```

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Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   850.000(Ft.)
Downstream point elevation =   690.000(Ft.)
Channel length thru subarea  =   973.000(Ft.)
Channel base width    =    5.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     16.733(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     16.733(CFS)
Depth of flow =   0.386(Ft.), Average velocity =   7.040(Ft/s)
Channel flow top width =    7.316(Ft.)
Flow Velocity =    7.04(Ft/s)
Travel time  =    2.30 min.
Time of concentration =    7.75 min.
Critical depth =      0.617(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.162(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      5.162(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      4.723
Subarea runoff =     15.362(CFS) for     10.410(Ac.)
Total runoff =     24.382(CFS)   Total area =      14.760(Ac.)
Depth of flow =   0.477(Ft.), Average velocity =   7.943(Ft/s)
Critical depth =      0.766(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       36.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   690.000(Ft.)
Downstream point elevation =   590.500(Ft.)
Channel length thru subarea  =  1608.000(Ft.)
Channel base width    =    8.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     41.715(CFS)
```

```
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     41.715(CFS)
Depth of flow =   0.672(Ft.), Average velocity =   6.199(Ft/s)
Channel flow top width =   12.031(Ft.)
Flow Velocity =    6.20(Ft/s)
Travel time  =    4.32 min.
Time of concentration =   12.08 min.
Critical depth =      0.844(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      3.879(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Rainfall intensity =      3.879(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.359  CA =     15.207
Subarea runoff =     34.604(CFS) for     27.590(Ac.)
Total runoff =     58.986(CFS)   Total area =      42.350(Ac.)
Depth of flow =   0.816(Ft.), Average velocity =   6.919(Ft/s)
Critical depth =      1.039(Ft.)


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Process from Point/Station       36.000 to Point/Station       37.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   593.200(Ft.)
Downstream point elevation =   592.750(Ft.)
Channel length thru subarea  =    27.000(Ft.)
Channel base width    =   10.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Estimated mean flow rate at midpoint of channel =     59.050(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     59.050(CFS)
Depth of flow =   1.027(Ft.), Average velocity =   5.748(Ft/s)
Channel flow top width =   10.000(Ft.)
Flow Velocity =    5.75(Ft/s)
Travel time  =    0.08 min.
Time of concentration =   12.15 min.
Critical depth =      1.031(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      3.863(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
Rainfall intensity =      3.863(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.358  CA =     15.280
Subarea runoff =      0.035(CFS) for      0.290(Ac.)
Total runoff =     59.021(CFS)   Total area =      42.640(Ac.)
Depth of flow =   1.027(Ft.), Average velocity =   5.747(Ft/s)
Critical depth =      1.031(Ft.)


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Process from Point/Station       37.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   585.000(Ft.)
Downstream point/station elevation =   562.500(Ft.)
Pipe length  =   445.00(Ft.) Slope =   0.0506  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    59.021(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    59.021(CFS)
Normal flow depth in pipe =   19.08(In.)
Flow top width inside pipe =   24.59(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.65(Ft/s)
Travel time through pipe =    0.38 min.
Time of concentration (TC) =    12.53 min.


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Process from Point/Station       36.000 to Point/Station       26.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     42.640(Ac.)
Runoff from this stream =     59.021(CFS)
Time of concentration =   12.53 min.
Rainfall intensity =     3.787(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1        7.093     13.73            3.570
2       59.021     12.53            3.787
Qmax(1) =
        1.000 *    1.000 *     7.093) +
```

```
        0.943 *    1.000 *    59.021) + =      62.732
Qmax(2) =
        1.000 *    0.913 *     7.093) +
        1.000 *    1.000 *    59.021) + =      65.494

Total of 2 streams to confluence:
Flow rates before confluence point:
       7.093      59.021
Maximum flow rates at confluence using above data:
      62.732       65.494
Area of streams before confluence:
        4.910       42.640
Results of confluence:
Total flow rate =     65.494(CFS)
Time of concentration =    12.532 min.
Effective stream area after confluence =     47.550(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   562.000(Ft.)
Downstream point/station elevation =   561.500(Ft.)
Pipe length  =    25.00(Ft.) Slope =   0.0200  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    65.494(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    65.494(CFS)
Normal flow depth in pipe =   23.93(In.)
Flow top width inside pipe =   29.47(In.)
Critical Depth =   30.60(In.)
Pipe flow velocity =     14.20(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    12.56 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       26.000 to Point/Station       38.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     47.550(Ac.)
Runoff from this stream =     65.494(CFS)
Time of concentration =   12.56 min.
Rainfall intensity =     3.781(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       40.000 to Point/Station       42.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
```

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Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Initial subarea total flow distance  =   96.000(Ft.)
Highest elevation =  713.000(Ft.)
Lowest elevation =  697.000(Ft.)
Elevation difference =   16.000(Ft.) Slope = 16.667 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  16.67 %, in a development type of
 2.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.07 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3800)*( 100.000^.5)/(  16.667^(1/3)]=   5.07
Rainfall intensity (I) =      6.786(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.380
Subarea runoff =      0.593(CFS)
Total initial stream area =        0.230(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       44.000
**** IMPROVED CHANNEL TRAVEL TIME ****
------------------------------------------------------------------------
Upstream point elevation =   697.000(Ft.)
Downstream point elevation =   675.000(Ft.)
Channel length thru subarea  =   397.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      2.011(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      2.011(CFS)
Depth of flow =   0.150(Ft.), Average velocity =   3.443(Ft/s)
Channel flow top width =    7.793(Ft.)
Flow Velocity =    3.44(Ft/s)
Travel time  =    1.92 min.
Time of concentration =    7.00 min.
Critical depth =      0.206(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.516(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
```

```
(2.0 DU/A or Less       )
Impervious value, Ai = 0.200
Sub-Area C Value = 0.380
Rainfall intensity =      5.516(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.380  CA =      0.612
Subarea runoff =      2.782(CFS) for      1.380(Ac.)
Total runoff =      3.375(CFS)   Total area =       1.610(Ac.)
Depth of flow =   0.182(Ft.), Average velocity =   3.919(Ft/s)
Critical depth =      0.254(Ft.)


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Process from Point/Station       44.000 to Point/Station       46.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________________
Upstream point elevation =   675.000(Ft.)
Downstream point elevation =   588.000(Ft.)
Channel length thru subarea  =  1001.000(Ft.)
Channel base width    =    0.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      8.582(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      8.582(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   5.859(Ft/s)
Channel flow top width =   12.342(Ft.)
Flow Velocity =    5.86(Ft/s)
Travel time  =    2.85 min.
Time of concentration =    9.84 min.
Critical depth =      0.367(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      4.426(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Rainfall intensity =      4.426(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.404  CA =      3.096
Subarea runoff =     10.329(CFS) for      6.060(Ac.)
Total runoff =     13.704(CFS)   Total area =       7.670(Ac.)
Depth of flow =   0.283(Ft.), Average velocity =   6.586(Ft/s)
Critical depth =      0.445(Ft.)


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Process from Point/Station       46.000 to Point/Station       48.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   585.000(Ft.)
Downstream point/station elevation =   578.000(Ft.)
Pipe length  =    37.00(Ft.) Slope =   0.1892  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.704(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =    13.704(CFS)
Normal flow depth in pipe =    8.77(In.)
Flow top width inside pipe =   10.65(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.28(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.87 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       48.000
**** SUBAREA FLOW ADDITION ****
------------------------------------------------------------------------
Rainfall intensity (I) =      4.418(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Time of concentration =     9.87 min.
Rainfall intensity =      4.418(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.426  CA =      3.427
Subarea runoff =      1.436(CFS) for      0.380(Ac.)
Total runoff =     15.140(CFS)   Total area =       8.050(Ac.)


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Process from Point/Station       48.000 to Point/Station       38.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   578.000(Ft.)
Downstream point/station elevation =   562.000(Ft.)
Pipe length  =   211.00(Ft.) Slope =   0.0758  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.140(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =    15.140(CFS)
Normal flow depth in pipe =   10.64(In.)
Flow top width inside pipe =   13.62(In.)
Critical depth could not be calculated.
Pipe flow velocity =     16.28(Ft/s)
```

```
Travel time through pipe =    0.22 min.
Time of concentration (TC) =    10.09 min.


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Process from Point/Station       48.000 to Point/Station       38.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      8.050(Ac.)
Runoff from this stream =     15.140(CFS)
Time of concentration =   10.09 min.
Rainfall intensity =     4.356(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       65.494     12.56            3.781
2       15.140     10.09            4.356
Qmax(1) =
        1.000 *    1.000 *    65.494) +
        0.868 *    1.000 *    15.140) + =      78.635
Qmax(2) =
        1.000 *    0.803 *    65.494) +
        1.000 *    1.000 *    15.140) + =      67.729

Total of 2 streams to confluence:
Flow rates before confluence point:
      65.494      15.140
Maximum flow rates at confluence using above data:
       78.635       67.729
Area of streams before confluence:
       47.550        8.050
Results of confluence:
Total flow rate =     78.635(CFS)
Time of concentration =    12.562 min.
Effective stream area after confluence =     55.600(Ac.)


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Process from Point/Station       38.000 to Point/Station       52.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   561.500(Ft.)
Downstream point/station elevation =   560.720(Ft.)
Pipe length  =    20.00(Ft.) Slope =   0.0390  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    78.635(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    78.635(CFS)
Normal flow depth in pipe =   23.81(In.)
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Flow top width inside pipe =   24.28(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.80(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    12.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       52.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     55.600(Ac.)
Runoff from this stream =     78.635(CFS)
Time of concentration =   12.58 min.
Rainfall intensity =     3.778(In/Hr)


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Process from Point/Station       54.000 to Point/Station       56.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(2.9 DU/A or Less       )
Impervious value, Ai = 0.250
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  166.000(Ft.)
Highest elevation =  582.000(Ft.)
Lowest elevation =  579.000(Ft.)
Elevation difference =    3.000(Ft.) Slope =  1.807 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of   1.81 %, in a development type of
 2.9 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.40 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*(  85.000^.5)/(   1.807^(1/3)]=   9.40
The initial area total distance of  166.00 (Ft.) entered leaves a
remaining distance of   81.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.08 minutes
for a distance of  81.00 (Ft.) and a slope of  1.81 %
with an elevation difference of   1.46(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.079 Minutes
Tt=[(11.9*0.0153^3)/(  1.46)]^.385=  1.08
Total initial area Ti =   9.40 minutes from Figure 3-3 formula plus
  1.08 minutes from the Figure 3-4 formula =  10.48 minutes
```

```
Rainfall intensity (I) =      4.250(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.244(CFS)
Total initial stream area =        0.140(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       52.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   577.000(Ft.)
Downstream point/station elevation =   560.720(Ft.)
Pipe length  =   121.00(Ft.) Slope =   0.1345  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.244(CFS)
Nearest computed pipe diameter  =      3.00(In.)
Calculated individual pipe flow  =     0.244(CFS)
Normal flow depth in pipe =    1.94(In.)
Flow top width inside pipe =    2.87(In.)
Critical depth could not be calculated.
Pipe flow velocity =      7.25(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    10.76 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       56.000 to Point/Station       52.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.140(Ac.)
Runoff from this stream =      0.244(CFS)
Time of concentration =   10.76 min.
Rainfall intensity =     4.179(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       78.635     12.58            3.778
2        0.244     10.76            4.179
Qmax(1) =
        1.000 *    1.000 *    78.635) +
        0.904 *    1.000 *     0.244) + =      78.856
Qmax(2) =
        1.000 *    0.855 *    78.635) +
        1.000 *    1.000 *     0.244) + =      67.499

Total of 2 streams to confluence:
Flow rates before confluence point:
      78.635       0.244
Maximum flow rates at confluence using above data:
```

```
       78.856       67.499
Area of streams before confluence:
       55.600        0.140
Results of confluence:
Total flow rate =     78.856(CFS)
Time of concentration =    12.579 min.
Effective stream area after confluence =     55.740(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       52.000 to Point/Station       58.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   560.720(Ft.)
Downstream point/station elevation =   559.830(Ft.)
Pipe length  =    23.00(Ft.) Slope =   0.0387  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    78.856(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    78.856(CFS)
Normal flow depth in pipe =   24.00(In.)
Flow top width inside pipe =   24.00(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.73(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    12.60 min.

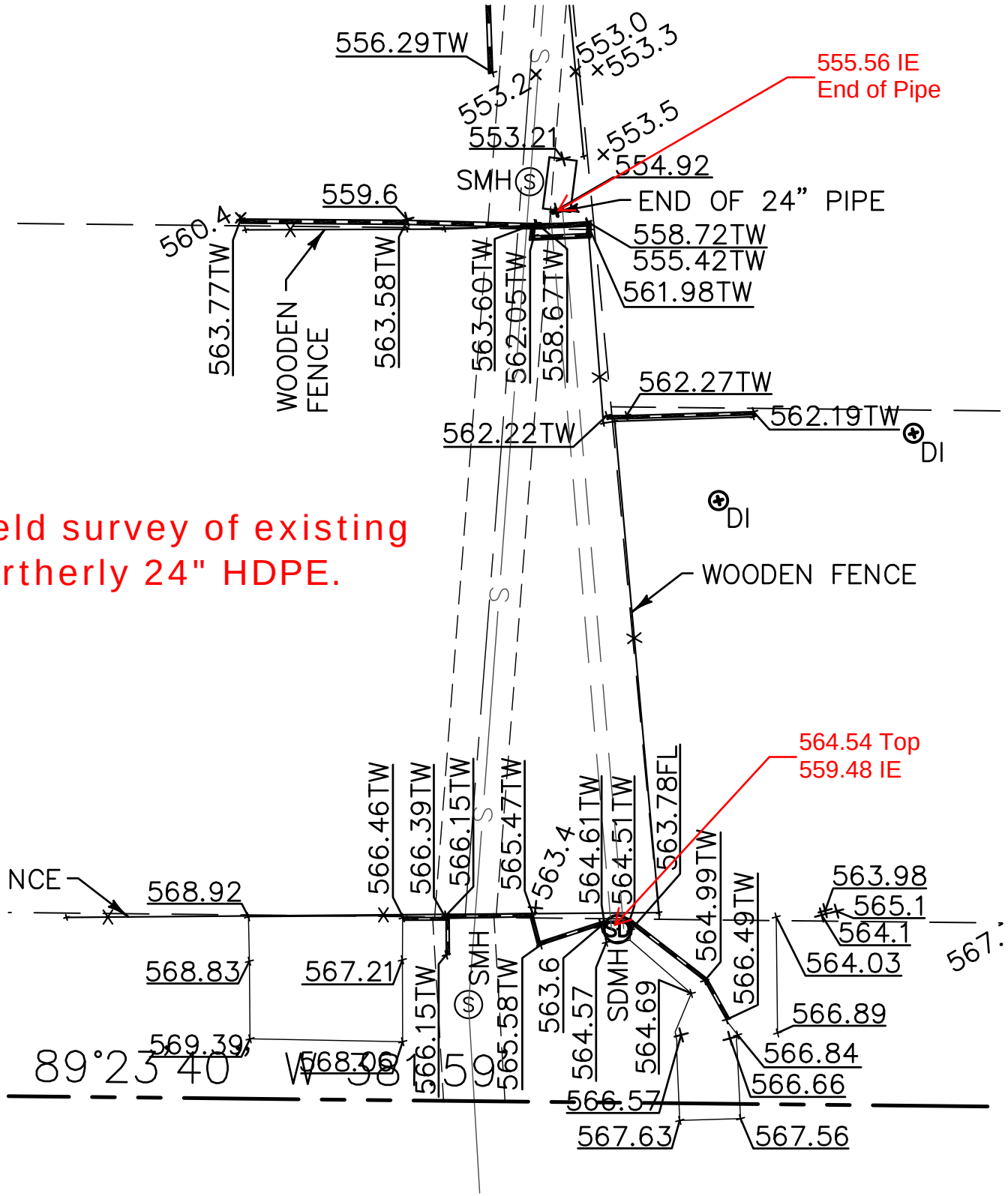

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       58.000 to Point/Station       58.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      3.774(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[UNDISTURBED NATURAL TERRAIN                ]
(Permanent Open Space   )
Impervious value, Ai = 0.000
Sub-Area C Value = 0.250
The area added to the existing stream causes a
a lower flow rate of Q =     78.444(CFS)
therefore the upstream flow rate of Q =     78.856(CFS) is being used
Time of concentration =    12.60 min.
Rainfall intensity =      3.774(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.372  CA =     20.785
Subarea runoff =      0.000(CFS) for      0.170(Ac.)
Total runoff =     78.856(CFS)   Total area =      55.910(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station       58.000 to Point/Station       60.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   559.830(Ft.)
Downstream point/station elevation =   555.500(Ft.)
Pipe length  =   110.00(Ft.) Slope =   0.0394  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    78.856(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    78.856(CFS)
Normal flow depth in pipe =   23.81(In.)
Flow top width inside pipe =   24.28(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.89(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    12.70 min.
End of computations, total study area =          55.910 (Ac.)
```

APPENDIX B

100-YEAR WSPGW AND DETENTION RESULTS


556.29TW
553.2
553.0
553.3
555.56 IE
End of Pipe
553.21
553.5
554.92
SMH
559.6
END OF 24" PIPE
560.4
558.72TW
555.42TW
561.98TW
563.77TW
WOODEN FENCE
563.58TW
563.60TW
562.05TW
558.67TW
562.27TW
562.19TW
562.22TW
DI
DI
Field survey of existing northerly 24" HDPE.
WOODEN FENCE
564.54 Top
559.48 IE
566.46TW
566.39TW
566.15TW
565.47TW
563.4
564.61TW
564.51TW
563.78FL
564.99TW
566.49TW
563.98
565.1
564.1
564.03
NCE
568.92
568.83
567.21
566.15TW
SMH
565.58TW
563.6
564.57
SDMH
564.69
566.89
566.84
566.66
566.57
567.63
567.56
569.39
89°23'40" W 381.51

Program Package Serial Number: 1559

WATER SURFACE PROFILE LISTING Date:11-18-2014 Time:10:36:21

Tract 5520
Existing 24" HDPE Off-site Storm Drain
Capacity Analysis

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width / "N"	Height/Dia.-FT / X-Fall	Base Wt or I.D. / ZR	ZL	No Wth Prs/Pip / Type Ch
1000.000	555.560	1.352	556.912	32.00	14.16	3.11	560.02	.00	1.89	1.87	2.000	.000	.00	1 .0
29.362	.0341					.0305	.90	1.35	2.27	1.31	.013	.00	.00	PIPE
1029.362	556.561	1.378	557.939	32.00	13.86	2.98	560.92	.00	1.89	1.85	2.000	.000	.00	1 .0
35.406	.0341					.0281	1.00	1.38	2.19	1.31	.013	.00	.00	PIPE
1064.768	557.768	1.439	559.207	32.00	13.22	2.71	561.92	.00	1.89	1.80	2.000	.000	.00	1 .0
20.036	.0341					.0252	.50	1.44	2.01	1.31	.013	.00	.00	PIPE
1084.804	558.451	1.507	559.958	32.00	12.60	2.47	562.42	.00	1.89	1.72	2.000	.000	.00	1 .0
13.182	.0341					.0226	.30	1.51	1.83	1.31	.013	.00	.00	PIPE
1097.985	558.900	1.580	560.480	32.00	12.01	2.24	562.72	.00	1.89	1.63	2.000	.000	.00	1 .0
8.792	.0341					.0205	.18	1.58	1.66	1.31	.013	.00	.00	PIPE
1106.777	559.200	1.664	560.864	32.00	11.46	2.04	562.90	.00	1.89	1.50	2.000	.000	.00	1 .0
5.749	.0341					.0187	.11	1.66	1.48	1.31	.013	.00	.00	PIPE
1112.526	559.396	1.761	561.157	32.00	10.92	1.85	563.01	.00	1.89	1.30	2.000	.000	.00	1 .0
2.474	.0341					.0176	.04	1.76	1.28	1.31	.013	.00	.00	PIPE
1115.000	559.480	1.890	561.370	32.00	10.41	1.68	563.05	.00	1.89	.91	2.000	.000	.00	1 .0
WALL	ENTRANCE													
1115.000	559.480	5.108	564.588	32.00	1.57	.04	564.63	.00	1.26	4.00	5.000	4.000	.00	0 .0

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   07JUL16  TIME  16:05:53   *
*                                       *
*****************************************
```


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


```
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   GERMANN TENTATIVE SUBDIVISION MAP, TRACT 5520 RPL 1
              2        ID   100-YEAR DETENTION ANALYSIS
              3        ID   ASSUMES DETENTION FOR PROJECT AREA TRIBUTARY TO RATIONAL METHOD NODE 16
              4        ID   DETAIN 7.5 CFS BY 6.0 CFS TO 1.5 CFS IN NORTHERLY BASIN
              5        IT       2 01JAN90    1200     200

              6        KK   BASIN
              7        KM   RATIONAL METHOD HYDROGRAPH CONVERSION
              8        KM   6-HOUR RAINFALL IS 2.6 INCHES
              9        KM   WEIGHTED AVERAGE RATIONAL METHOD RUNOFF COEFFICIENT IS 0.41
             10        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 13.77 MINUTES
             11        BA  0.0081
             12        IN      14 01JAN90    1155
             13        QI       0     0.3     0.3     0.4     0.4     0.4     0.4     0.4     0.5     0.5
             14        QI     0.6     0.6     0.7     0.7     0.9       1     1.5     2.1     7.5     1.2
             15        QI     0.8     0.6     0.5     0.5     0.4     0.4     0.3       0       0       0
             16        QI       0       0       0       0       0       0       0       0

             17        KK  DETAIN
             18        RS       1    STOR      -1
             19        SV       0    0.26
             20        SQ       0     1.5
             21        SE     100     101
             22        ZZ
```

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

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

    6       BASIN
              V
              V
   17      DETAIN

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

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   07JUL16  TIME  16:05:53   *
*                                       *
*****************************************
```

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

GERMANN TENTATIVE SUBDIVISION MAP, TRACT 5520 RPL 1
100-YEAR DETENTION ANALYSIS
ASSUMES DETENTION FOR PROJECT AREA TRIBUTARY TO RATIONAL METHOD NODE 16
DETAIN 7.5 CFS BY 6.0 CFS TO 1.5 CFS IN NORTHERLY BASIN

```
    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


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


           **************
           *            *
  6 KK     *     BASIN  *
           *            *
           **************
                      RATIONAL METHOD HYDROGRAPH CONVERSION
                      6-HOUR RAINFALL IS 2.6 INCHES
                      WEIGHTED AVERAGE RATIONAL METHOD RUNOFF COEFFICIENT IS 0.41
                      RATIONAL METHOD TIME OF CONCENTRATION IS 13.77 MINUTES

  12 IN         TIME DATA FOR INPUT TIME SERIES
                     JXMIN         14  TIME INTERVAL IN MINUTES
                    JXDATE      1JAN90  STARTING DATE
                    JXTIME        1155  STARTING TIME

              SUBBASIN RUNOFF DATA

  11 BA         SUBBASIN CHARACTERISTICS
                     TAREA        .01  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	0.	1 JAN 1520	101	1.	1 JAN 1700	151	1.
1 JAN 1202	2	0.	1 JAN 1342	52	0.	1 JAN 1522	102	1.	1 JAN 1702	152	1.
1 JAN 1204	3	0.	1 JAN 1344	53	0.	1 JAN 1524	103	1.	1 JAN 1704	153	1.
1 JAN 1206	4	0.	1 JAN 1346	54	0.	1 JAN 1526	104	1.	1 JAN 1706	154	1.
1 JAN 1208	5	0.	1 JAN 1348	55	1.	1 JAN 1528	105	1.	1 JAN 1708	155	1.
1 JAN 1210	6	0.	1 JAN 1350	56	1.	1 JAN 1530	106	1.	1 JAN 1710	156	1.
1 JAN 1212	7	0.	1 JAN 1352	57	1.	1 JAN 1532	107	1.	1 JAN 1712	157	1.
1 JAN 1214	8	0.	1 JAN 1354	58	1.	1 JAN 1534	108	1.	1 JAN 1714	158	1.
1 JAN 1216	9	0.	1 JAN 1356	59	1.	1 JAN 1536	109	1.	1 JAN 1716	159	1.
1 JAN 1218	10	0.	1 JAN 1358	60	1.	1 JAN 1538	110	1.	1 JAN 1718	160	0.
1 JAN 1220	11	0.	1 JAN 1400	61	1.	1 JAN 1540	111	2.	1 JAN 1720	161	0.
1 JAN 1222	12	0.	1 JAN 1402	62	1.	1 JAN 1542	112	2.	1 JAN 1722	162	0.
1 JAN 1224	13	0.	1 JAN 1404	63	1.	1 JAN 1544	113	2.	1 JAN 1724	163	0.
1 JAN 1226	14	0.	1 JAN 1406	64	1.	1 JAN 1546	114	2.	1 JAN 1726	164	0.
1 JAN 1228	15	0.	1 JAN 1408	65	1.	1 JAN 1548	115	2.	1 JAN 1728	165	0.
1 JAN 1230	16	0.	1 JAN 1410	66	1.	1 JAN 1550	116	2.	1 JAN 1730	166	0.
1 JAN 1232	17	0.	1 JAN 1412	67	1.	1 JAN 1552	117	2.	1 JAN 1732	167	0.
1 JAN 1234	18	0.	1 JAN 1414	68	1.	1 JAN 1554	118	2.	1 JAN 1734	168	0.
1 JAN 1236	19	0.	1 JAN 1416	69	1.	1 JAN 1556	119	3.	1 JAN 1736	169	0.
1 JAN 1238	20	0.	1 JAN 1418	70	1.	1 JAN 1558	120	4.	1 JAN 1738	170	0.
1 JAN 1240	21	0.	1 JAN 1420	71	1.	1 JAN 1600	121	5.	1 JAN 1740	171	0.
1 JAN 1242	22	0.	1 JAN 1422	72	1.	1 JAN 1602	122	6.	1 JAN 1742	172	0.
1 JAN 1244	23	0.	1 JAN 1424	73	1.	1 JAN 1604	123	6.	1 JAN 1744	173	0.
1 JAN 1246	24	0.	1 JAN 1426	74	1.	1 JAN 1606	124	7.	1 JAN 1746	174	0.
1 JAN 1248	25	0.	1 JAN 1428	75	1.	1 JAN 1608	125	7.	1 JAN 1748	175	0.
1 JAN 1250	26	0.	1 JAN 1430	76	1.	1 JAN 1610	126	6.	1 JAN 1750	176	0.
1 JAN 1252	27	0.	1 JAN 1432	77	1.	1 JAN 1612	127	5.	1 JAN 1752	177	0.
1 JAN 1254	28	0.	1 JAN 1434	78	1.	1 JAN 1614	128	4.	1 JAN 1754	178	0.
1 JAN 1256	29	0.	1 JAN 1436	79	1.	1 JAN 1616	129	3.	1 JAN 1756	179	0.
1 JAN 1258	30	0.	1 JAN 1438	80	1.	1 JAN 1618	130	3.	1 JAN 1758	180	0.
1 JAN 1300	31	0.	1 JAN 1440	81	1.	1 JAN 1620	131	2.	1 JAN 1800	181	0.
1 JAN 1302	32	0.	1 JAN 1442	82	1.	1 JAN 1622	132	1.	1 JAN 1802	182	0.
1 JAN 1304	33	0.	1 JAN 1444	83	1.	1 JAN 1624	133	1.	1 JAN 1804	183	0.
1 JAN 1306	34	0.	1 JAN 1446	84	1.	1 JAN 1626	134	1.	1 JAN 1806	184	0.
1 JAN 1308	35	0.	1 JAN 1448	85	1.	1 JAN 1628	135	1.	1 JAN 1808	185	0.
1 JAN 1310	36	0.	1 JAN 1450	86	1.	1 JAN 1630	136	1.	1 JAN 1810	186	0.
1 JAN 1312	37	0.	1 JAN 1452	87	1.	1 JAN 1632	137	1.	1 JAN 1812	187	0.
1 JAN 1314	38	0.	1 JAN 1454	88	1.	1 JAN 1634	138	1.	1 JAN 1814	188	0.
1 JAN 1316	39	0.	1 JAN 1456	89	1.	1 JAN 1636	139	1.	1 JAN 1816	189	0.
1 JAN 1318	40	0.	1 JAN 1458	90	1.	1 JAN 1638	140	1.	1 JAN 1818	190	0.
1 JAN 1320	41	0.	1 JAN 1500	91	1.	1 JAN 1640	141	1.	1 JAN 1820	191	0.
1 JAN 1322	42	0.	1 JAN 1502	92	1.	1 JAN 1642	142	1.	1 JAN 1822	192	0.
1 JAN 1324	43	0.	1 JAN 1504	93	1.	1 JAN 1644	143	1.	1 JAN 1824	193	0.
1 JAN 1326	44	0.	1 JAN 1506	94	1.	1 JAN 1646	144	1.	1 JAN 1826	194	0.
1 JAN 1328	45	0.	1 JAN 1508	95	1.	1 JAN 1648	145	1.	1 JAN 1828	195	0.
1 JAN 1330	46	0.	1 JAN 1510	96	1.	1 JAN 1650	146	1.	1 JAN 1830	196	0.
1 JAN 1332	47	0.	1 JAN 1512	97	1.	1 JAN 1652	147	1.	1 JAN 1832	197	0.
1 JAN 1334	48	0.	1 JAN 1514	98	1.	1 JAN 1654	148	1.	1 JAN 1834	198	0.
1 JAN 1336	49	0.	1 JAN 1516	99	1.	1 JAN 1656	149	1.	1 JAN 1836	199	0.
1 JAN 1338	50	0.	1 JAN 1518	100	1.	1 JAN 1658	150	1.	1 JAN 1838	200	0.

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)				
		(CFS)			
+ 7.	4.10	1.	1.	1.	1.
		(INCHES) 1.061	1.066	1.066	1.066
		(AC-FT) 0.	0.	0.	0.

CUMULATIVE AREA = .01 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       .3

 20 SQ          DISCHARGE          0.       2.

 21 SE          ELEVATION      100.00   101.00

                                                    ***
```

****

HYDROGRAPH AT STATION DETAIN

****

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	100.1	1	JAN	1414	68	0.	.1	100.2	1	JAN	1628	135	1.	.3	101.0
1	JAN	1202	2	0.	.0	100.1	1	JAN	1416	69	0.	.1	100.2	1	JAN	1630	136	1.	.3	101.0
1	JAN	1204	3	0.	.0	100.1	1	JAN	1418	70	0.	.1	100.2	1	JAN	1632	137	1.	.3	101.0
1	JAN	1206	4	0.	.0	100.1	1	JAN	1420	71	0.	.1	100.2	1	JAN	1634	138	1.	.2	101.0
1	JAN	1208	5	0.	.0	100.1	1	JAN	1422	72	0.	.1	100.2	1	JAN	1636	139	1.	.2	100.9
1	JAN	1210	6	0.	.0	100.1	1	JAN	1424	73	0.	.1	100.2	1	JAN	1638	140	1.	.2	100.9
1	JAN	1212	7	0.	.0	100.1	1	JAN	1426	74	0.	.1	100.2	1	JAN	1640	141	1.	.2	100.9
1	JAN	1214	8	0.	.0	100.1	1	JAN	1428	75	0.	.1	100.2	1	JAN	1642	142	1.	.2	100.9
1	JAN	1216	9	0.	.0	100.1	1	JAN	1430	76	0.	.1	100.2	1	JAN	1644	143	1.	.2	100.9
1	JAN	1218	10	0.	.0	100.1	1	JAN	1432	77	0.	.1	100.2	1	JAN	1646	144	1.	.2	100.9
1	JAN	1220	11	0.	.0	100.1	1	JAN	1434	78	0.	.1	100.2	1	JAN	1648	145	1.	.2	100.9
1	JAN	1222	12	0.	.0	100.1	1	JAN	1436	79	0.	.1	100.2	1	JAN	1650	146	1.	.2	100.9
1	JAN	1224	13	0.	.0	100.1	1	JAN	1438	80	0.	.1	100.2	1	JAN	1652	147	1.	.2	100.9
1	JAN	1226	14	0.	.0	100.1	1	JAN	1440	81	0.	.1	100.2	1	JAN	1654	148	1.	.2	100.9
1	JAN	1228	15	0.	.0	100.1	1	JAN	1442	82	0.	.1	100.3	1	JAN	1656	149	1.	.2	100.9
1	JAN	1230	16	0.	.0	100.1	1	JAN	1444	83	0.	.1	100.3	1	JAN	1658	150	1.	.2	100.9
1	JAN	1232	17	0.	.0	100.1	1	JAN	1446	84	0.	.1	100.3	1	JAN	1700	151	1.	.2	100.9
1	JAN	1234	18	0.	.0	100.1	1	JAN	1448	85	0.	.1	100.3	1	JAN	1702	152	1.	.2	100.8
1	JAN	1236	19	0.	.0	100.1	1	JAN	1450	86	0.	.1	100.3	1	JAN	1704	153	1.	.2	100.8
1	JAN	1238	20	0.	.0	100.1	1	JAN	1452	87	0.	.1	100.3	1	JAN	1706	154	1.	.2	100.8
1	JAN	1240	21	0.	.0	100.1	1	JAN	1454	88	0.	.1	100.3	1	JAN	1708	155	1.	.2	100.8
1	JAN	1242	22	0.	.0	100.1	1	JAN	1456	89	0.	.1	100.3	1	JAN	1710	156	1.	.2	100.8
1	JAN	1244	23	0.	.0	100.1	1	JAN	1458	90	0.	.1	100.3	1	JAN	1712	157	1.	.2	100.8
1	JAN	1246	24	0.	.0	100.1	1	JAN	1500	91	0.	.1	100.3	1	JAN	1714	158	1.	.2	100.8
1	JAN	1248	25	0.	.0	100.1	1	JAN	1502	92	0.	.1	100.3	1	JAN	1716	159	1.	.2	100.8
1	JAN	1250	26	0.	.0	100.1	1	JAN	1504	93	0.	.1	100.3	1	JAN	1718	160	1.	.2	100.8
1	JAN	1252	27	0.	.0	100.1	1	JAN	1506	94	0.	.1	100.3	1	JAN	1720	161	1.	.2	100.8
1	JAN	1254	28	0.	.0	100.1	1	JAN	1508	95	0.	.1	100.3	1	JAN	1722	162	1.	.2	100.8
1	JAN	1256	29	0.	.0	100.1	1	JAN	1510	96	0.	.1	100.3	1	JAN	1724	163	1.	.2	100.8
1	JAN	1258	30	0.	.0	100.1	1	JAN	1512	97	0.	.1	100.3	1	JAN	1726	164	1.	.2	100.8
1	JAN	1300	31	0.	.0	100.1	1	JAN	1514	98	0.	.1	100.3	1	JAN	1728	165	1.	.2	100.8
1	JAN	1302	32	0.	.0	100.1	1	JAN	1516	99	0.	.1	100.3	1	JAN	1730	166	1.	.2	100.7
1	JAN	1304	33	0.	.0	100.1	1	JAN	1518	100	0.	.1	100.3	1	JAN	1732	167	1.	.2	100.7
1	JAN	1306	34	0.	.0	100.1	1	JAN	1520	101	0.	.1	100.3	1	JAN	1734	168	1.	.2	100.7
1	JAN	1308	35	0.	.0	100.1	1	JAN	1522	102	0.	.1	100.3	1	JAN	1736	169	1.	.2	100.7
1	JAN	1310	36	0.	.0	100.1	1	JAN	1524	103	1.	.1	100.3	1	JAN	1738	170	1.	.2	100.7
1	JAN	1312	37	0.	.0	100.1	1	JAN	1526	104	1.	.1	100.3	1	JAN	1740	171	1.	.2	100.7
1	JAN	1314	38	0.	.0	100.1	1	JAN	1528	105	1.	.1	100.3	1	JAN	1742	172	1.	.2	100.7
1	JAN	1316	39	0.	.0	100.1	1	JAN	1530	106	1.	.1	100.4	1	JAN	1744	173	1.	.2	100.7

1	JAN	1318	40	0.	.0	100.1	*	1	JAN	1532	107	1.	.1	100.4	*	1	JAN	1746	174	1.	.2	100.7
1	JAN	1320	41	0.	.0	100.2	*	1	JAN	1534	108	1.	.1	100.4	*	1	JAN	1748	175	1.	.2	100.7
1	JAN	1322	42	0.	.0	100.2	*	1	JAN	1536	109	1.	.1	100.4	*	1	JAN	1750	176	1.	.2	100.7
1	JAN	1324	43	0.	.0	100.2	*	1	JAN	1538	110	1.	.1	100.4	*	1	JAN	1752	177	1.	.2	100.7
1	JAN	1326	44	0.	.0	100.2	*	1	JAN	1540	111	1.	.1	100.4	*	1	JAN	1754	178	1.	.2	100.7
1	JAN	1328	45	0.	.0	100.2	*	1	JAN	1542	112	1.	.1	100.4	*	1	JAN	1756	179	1.	.2	100.7
1	JAN	1330	46	0.	.0	100.2	*	1	JAN	1544	113	1.	.1	100.4	*	1	JAN	1758	180	1.	.2	100.6
1	JAN	1332	47	0.	.0	100.2	*	1	JAN	1546	114	1.	.1	100.4	*	1	JAN	1800	181	1.	.2	100.6
1	JAN	1334	48	0.	.0	100.2	*	1	JAN	1548	115	1.	.1	100.4	*	1	JAN	1802	182	1.	.2	100.6
1	JAN	1336	49	0.	.0	100.2	*	1	JAN	1550	116	1.	.1	100.5	*	1	JAN	1804	183	1.	.2	100.6
1	JAN	1338	50	0.	.0	100.2	*	1	JAN	1552	117	1.	.1	100.5	*	1	JAN	1806	184	1.	.2	100.6
1	JAN	1340	51	0.	.0	100.2	*	1	JAN	1554	118	1.	.1	100.5	*	1	JAN	1808	185	1.	.2	100.6
1	JAN	1342	52	0.	.0	100.2	*	1	JAN	1556	119	1.	.1	100.5	*	1	JAN	1810	186	1.	.2	100.6
1	JAN	1344	53	0.	.0	100.2	*	1	JAN	1558	120	1.	.1	100.5	*	1	JAN	1812	187	1.	.2	100.6
1	JAN	1346	54	0.	.0	100.2	*	1	JAN	1600	121	1.	.1	100.6	*	1	JAN	1814	188	1.	.2	100.6
1	JAN	1348	55	0.	.0	100.2	*	1	JAN	1602	122	1.	.2	100.6	*	1	JAN	1816	189	1.	.1	100.6
1	JAN	1350	56	0.	.0	100.2	*	1	JAN	1604	123	1.	.2	100.7	*	1	JAN	1818	190	1.	.1	100.6
1	JAN	1352	57	0.	.0	100.2	*	1	JAN	1606	124	1.	.2	100.7	*	1	JAN	1820	191	1.	.1	100.6
1	JAN	1354	58	0.	.0	100.2	*	1	JAN	1608	125	1.	.2	100.8	*	1	JAN	1822	192	1.	.1	100.5
1	JAN	1356	59	0.	.0	100.2	*	1	JAN	1610	126	1.	.2	100.9	*	1	JAN	1824	193	1.	.1	100.5
1	JAN	1358	60	0.	.0	100.2	*	1	JAN	1612	127	1.	.2	100.9	*	1	JAN	1826	194	1.	.1	100.5
1	JAN	1400	61	0.	.1	100.2	*	1	JAN	1614	128	1.	.2	100.9	*	1	JAN	1828	195	1.	.1	100.5
1	JAN	1402	62	0.	.1	100.2	*	1	JAN	1616	129	1.	.3	101.0	*	1	JAN	1830	196	1.	.1	100.5
1	JAN	1404	63	0.	.1	100.2	*	1	JAN	1618	130	1.	.3	101.0	*	1	JAN	1832	197	1.	.1	100.5
1	JAN	1406	64	0.	.1	100.2	*	1	JAN	1620	131	1.	.3	101.0	*	1	JAN	1834	198	1.	.1	100.5
1	JAN	1408	65	0.	.1	100.2	*	1	JAN	1622	132	1.	.3	101.0	*	1	JAN	1836	199	1.	.1	100.5
1	JAN	1410	66	0.	.1	100.2	*	1	JAN	1624	133	1.	.3	101.0	*	1	JAN	1838	200	1.	.1	100.5
1	JAN	1412	67	0.	.1	100.2	*	1	JAN	1626	134	1.	.3	101.0	*							

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 1.	4.33		1.	1.	1.	1.
		(INCHES)	.805	.821	.821	.821
		(AC-FT)	0.	0.	0.	0.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	6.63-HR
+ (AC-FT)	(HR)				
0.	4.33	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	6.63-HR
+ (FEET)	(HR)				
100.99	4.33	100.47	100.43	100.43	100.43

CUMULATIVE AREA = .01 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	7.	4.10	1.	1.	1.	.01		
	ROUTED TO									
+		DETAIN	1.	4.33	1.	1.	1.	.01		
+									100.99	4.33

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

```
****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*               JUN   1998             *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   07JUL16  TIME  15:50:06  *
*                                      *
****************************************
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```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

```
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   GERMANN TENTATIVE SUBDIVISION MAP, TRACT 5520 RPL 1
              2        ID   100-YEAR DETENTION ANALYSIS
              3        ID   ASSUMES DETENTION FOR PROJECT AREA TO CAPACITY OF EXISTING 24" HDPE
              4        ID   DETAIN 59.0 CFS TO 15.2 CFS AT SOUTH DETENTION BASIN
              5        IT       2 01JAN90    1200     200

              6        KK   BASIN
              7        KM   RATIONAL METHOD HYDROGRAPH CONVERSION
              8        KM   6-HOUR RAINFALL IS 2.6 INCHES
              9        KM   RATIONAL METHOD RUNOFF COEFFICIENT IS 0.36
             10        KM   RATIONAL METHOD TIME OF CONCENTRATION IS 12.15  MINUTES
             11        BA  0.0666
             12        IN      12 01JAN90    1154
             13        QI       0     2.4     2.4     2.6     2.6     2.8     2.8       3     3.1     3.4
             14        QI     3.5     3.8       4     4.4     4.7     5.3     5.8     7.1     8.1    11.8
             15        QI    17.5      59     9.5     6.4       5     4.2     3.6     3.2     2.9     2.7
             16        QI     2.5       0       0       0       0       0       0       0       0       0
             17        QI       0       0

             18        KK  DETAIN
             19        RS       1    STOR      -1
             20        SV       0    1.35
             21        SQ       0      18
             22        SE     100     101
             23        ZZ
```

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

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

    6       BASIN
              V
              V
   18      DETAIN

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

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   07JUL16  TIME  15:50:06   *
*                                       *
*****************************************
```

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

GERMANN TENTATIVE SUBDIVISION MAP, TRACT 5520 RPL 1
100-YEAR DETENTION ANALYSIS
ASSUMES DETENTION FOR PROJECT AREA TO CAPACITY OF EXISTING 24" HDPE
DETAIN 59.0 CFS TO 15.2 CFS AT SOUTH DETENTION BASIN

```
    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


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


          **************
          *            *
  6 KK    *     BASIN  *
          *            *
          **************
                      RATIONAL METHOD HYDROGRAPH CONVERSION
                      6-HOUR RAINFALL IS 2.6 INCHES
                      RATIONAL METHOD RUNOFF COEFFICIENT IS 0.36
                      RATIONAL METHOD TIME OF CONCENTRATION IS 12.15  MINUTES

 12 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         12  TIME INTERVAL IN MINUTES
                    JXDATE      1JAN90  STARTING DATE
                    JXTIME        1154  STARTING TIME

             SUBBASIN RUNOFF DATA

 11 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .07  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	1.	1 JAN 1340	51	3.	1 JAN 1520	101	7.	1 JAN 1700	151	4.
1 JAN 1202	2	2.	1 JAN 1342	52	3.	1 JAN 1522	102	7.	1 JAN 1702	152	4.
1 JAN 1204	3	2.	1 JAN 1344	53	3.	1 JAN 1524	103	8.	1 JAN 1704	153	4.
1 JAN 1206	4	2.	1 JAN 1346	54	3.	1 JAN 1526	104	8.	1 JAN 1706	154	4.
1 JAN 1208	5	2.	1 JAN 1348	55	3.	1 JAN 1528	105	8.	1 JAN 1708	155	4.
1 JAN 1210	6	2.	1 JAN 1350	56	3.	1 JAN 1530	106	8.	1 JAN 1710	156	3.
1 JAN 1212	7	2.	1 JAN 1352	57	3.	1 JAN 1532	107	9.	1 JAN 1712	157	3.
1 JAN 1214	8	2.	1 JAN 1354	58	4.	1 JAN 1534	108	9.	1 JAN 1714	158	3.
1 JAN 1216	9	2.	1 JAN 1356	59	4.	1 JAN 1536	109	10.	1 JAN 1716	159	3.
1 JAN 1218	10	2.	1 JAN 1358	60	4.	1 JAN 1538	110	11.	1 JAN 1718	160	3.
1 JAN 1220	11	2.	1 JAN 1400	61	4.	1 JAN 1540	111	11.	1 JAN 1720	161	3.
1 JAN 1222	12	2.	1 JAN 1402	62	4.	1 JAN 1542	112	12.	1 JAN 1722	162	3.
1 JAN 1224	13	3.	1 JAN 1404	63	4.	1 JAN 1544	113	13.	1 JAN 1724	163	3.
1 JAN 1226	14	3.	1 JAN 1406	64	4.	1 JAN 1546	114	14.	1 JAN 1726	164	3.
1 JAN 1228	15	3.	1 JAN 1408	65	4.	1 JAN 1548	115	15.	1 JAN 1728	165	3.
1 JAN 1230	16	3.	1 JAN 1410	66	4.	1 JAN 1550	116	16.	1 JAN 1730	166	3.
1 JAN 1232	17	3.	1 JAN 1412	67	4.	1 JAN 1552	117	17.	1 JAN 1732	167	3.
1 JAN 1234	18	3.	1 JAN 1414	68	4.	1 JAN 1554	118	18.	1 JAN 1734	168	3.
1 JAN 1236	19	3.	1 JAN 1416	69	4.	1 JAN 1556	119	24.	1 JAN 1736	169	3.
1 JAN 1238	20	3.	1 JAN 1418	70	4.	1 JAN 1558	120	31.	1 JAN 1738	170	3.
1 JAN 1240	21	3.	1 JAN 1420	71	4.	1 JAN 1600	121	38.	1 JAN 1740	171	3.
1 JAN 1242	22	3.	1 JAN 1422	72	4.	1 JAN 1602	122	45.	1 JAN 1742	172	3.
1 JAN 1244	23	3.	1 JAN 1424	73	4.	1 JAN 1604	123	52.	1 JAN 1744	173	3.
1 JAN 1246	24	3.	1 JAN 1426	74	4.	1 JAN 1606	124	59.	1 JAN 1746	174	3.
1 JAN 1248	25	3.	1 JAN 1428	75	4.	1 JAN 1608	125	51.	1 JAN 1748	175	3.
1 JAN 1250	26	3.	1 JAN 1430	76	4.	1 JAN 1610	126	43.	1 JAN 1750	176	3.
1 JAN 1252	27	3.	1 JAN 1432	77	4.	1 JAN 1612	127	34.	1 JAN 1752	177	3.
1 JAN 1254	28	3.	1 JAN 1434	78	5.	1 JAN 1614	128	26.	1 JAN 1754	178	3.
1 JAN 1256	29	3.	1 JAN 1436	79	5.	1 JAN 1616	129	18.	1 JAN 1756	179	2.
1 JAN 1258	30	3.	1 JAN 1438	80	5.	1 JAN 1618	130	10.	1 JAN 1758	180	2.
1 JAN 1300	31	3.	1 JAN 1440	81	5.	1 JAN 1620	131	9.	1 JAN 1800	181	1.
1 JAN 1302	32	3.	1 JAN 1442	82	5.	1 JAN 1622	132	8.	1 JAN 1802	182	1.
1 JAN 1304	33	3.	1 JAN 1444	83	5.	1 JAN 1624	133	8.	1 JAN 1804	183	0.
1 JAN 1306	34	3.	1 JAN 1446	84	5.	1 JAN 1626	134	7.	1 JAN 1806	184	0.
1 JAN 1308	35	3.	1 JAN 1448	85	5.	1 JAN 1628	135	7.	1 JAN 1808	185	0.
1 JAN 1310	36	3.	1 JAN 1450	86	5.	1 JAN 1630	136	6.	1 JAN 1810	186	0.
1 JAN 1312	37	3.	1 JAN 1452	87	5.	1 JAN 1632	137	6.	1 JAN 1812	187	0.
1 JAN 1314	38	3.	1 JAN 1454	88	5.	1 JAN 1634	138	6.	1 JAN 1814	188	0.
1 JAN 1316	39	3.	1 JAN 1456	89	5.	1 JAN 1636	139	6.	1 JAN 1816	189	0.
1 JAN 1318	40	3.	1 JAN 1458	90	5.	1 JAN 1638	140	5.	1 JAN 1818	190	0.
1 JAN 1320	41	3.	1 JAN 1500	91	6.	1 JAN 1640	141	5.	1 JAN 1820	191	0.
1 JAN 1322	42	3.	1 JAN 1502	92	6.	1 JAN 1642	142	5.	1 JAN 1822	192	0.
1 JAN 1324	43	3.	1 JAN 1504	93	6.	1 JAN 1644	143	5.	1 JAN 1824	193	0.
1 JAN 1326	44	3.	1 JAN 1506	94	6.	1 JAN 1646	144	5.	1 JAN 1826	194	0.
1 JAN 1328	45	3.	1 JAN 1508	95	6.	1 JAN 1648	145	5.	1 JAN 1828	195	0.
1 JAN 1330	46	3.	1 JAN 1510	96	6.	1 JAN 1650	146	4.	1 JAN 1830	196	0.
1 JAN 1332	47	3.	1 JAN 1512	97	6.	1 JAN 1652	147	4.	1 JAN 1832	197	0.
1 JAN 1334	48	3.	1 JAN 1514	98	7.	1 JAN 1654	148	4.	1 JAN 1834	198	0.
1 JAN 1336	49	3.	1 JAN 1516	99	7.	1 JAN 1656	149	4.	1 JAN 1836	199	0.
1 JAN 1338	50	3.	1 JAN 1518	100	7.	1 JAN 1658	150	4.	1 JAN 1838	200	0.

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 59.	4.10		7.	6.	6.	6.
		(INCHES)	.928	.930	.930	.930
		(AC-FT)	3.	3.	3.	3.

CUMULATIVE AREA = .07 SQ MI

*** ***

```
          **************
          *            *
 18 KK    *    DETAIN  *
          *            *
          **************

             HYDROGRAPH ROUTING DATA

 19 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

 20 SV            STORAGE          .0       1.4

 21 SQ          DISCHARGE          0.       18.

 22 SE          ELEVATION      100.00    101.00

                                                    ***

WARNING --- ROUTED OUTFLOW (     18.) IS GREATER THAN MAXIMUM OUTFLOW (     18.) IN STORAGE-OUTFLOW TABLE
```

HYDROGRAPH AT STATION DETAIN

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	1.	.1	100.1	1	JAN	1414	68	3.	.2	100.2	1	JAN	1628	135	16.	1.2	100.9
1	JAN	1202	2	1.	.1	100.1	1	JAN	1416	69	3.	.2	100.2	1	JAN	1630	136	16.	1.2	100.9
1	JAN	1204	3	1.	.1	100.1	1	JAN	1418	70	3.	.2	100.2	1	JAN	1632	137	16.	1.2	100.9
1	JAN	1206	4	1.	.1	100.1	1	JAN	1420	71	3.	.2	100.2	1	JAN	1634	138	15.	1.1	100.8
1	JAN	1208	5	1.	.1	100.1	1	JAN	1422	72	3.	.2	100.2	1	JAN	1636	139	15.	1.1	100.8
1	JAN	1210	6	1.	.1	100.1	1	JAN	1424	73	3.	.2	100.2	1	JAN	1638	140	15.	1.1	100.8
1	JAN	1212	7	1.	.1	100.1	1	JAN	1426	74	3.	.2	100.2	1	JAN	1640	141	14.	1.1	100.8
1	JAN	1214	8	1.	.1	100.1	1	JAN	1428	75	3.	.2	100.2	1	JAN	1642	142	14.	1.0	100.8
1	JAN	1216	9	1.	.1	100.1	1	JAN	1430	76	3.	.3	100.2	1	JAN	1644	143	14.	1.0	100.8
1	JAN	1218	10	1.	.1	100.1	1	JAN	1432	77	3.	.3	100.2	1	JAN	1646	144	13.	1.0	100.7
1	JAN	1220	11	2.	.1	100.1	1	JAN	1434	78	3.	.3	100.2	1	JAN	1648	145	13.	1.0	100.7
1	JAN	1222	12	2.	.1	100.1	1	JAN	1436	79	3.	.3	100.2	1	JAN	1650	146	13.	.9	100.7
1	JAN	1224	13	2.	.1	100.1	1	JAN	1438	80	4.	.3	100.2	1	JAN	1652	147	12.	.9	100.7
1	JAN	1226	14	2.	.1	100.1	1	JAN	1440	81	4.	.3	100.2	1	JAN	1654	148	12.	.9	100.7
1	JAN	1228	15	2.	.1	100.1	1	JAN	1442	82	4.	.3	100.2	1	JAN	1656	149	12.	.9	100.7
1	JAN	1230	16	2.	.1	100.1	1	JAN	1444	83	4.	.3	100.2	1	JAN	1658	150	11.	.9	100.6
1	JAN	1232	17	2.	.1	100.1	1	JAN	1446	84	4.	.3	100.2	1	JAN	1700	151	11.	.8	100.6
1	JAN	1234	18	2.	.1	100.1	1	JAN	1448	85	4.	.3	100.2	1	JAN	1702	152	11.	.8	100.6
1	JAN	1236	19	2.	.1	100.1	1	JAN	1450	86	4.	.3	100.2	1	JAN	1704	153	11.	.8	100.6
1	JAN	1238	20	2.	.1	100.1	1	JAN	1452	87	4.	.3	100.2	1	JAN	1706	154	10.	.8	100.6
1	JAN	1240	21	2.	.1	100.1	1	JAN	1454	88	4.	.3	100.2	1	JAN	1708	155	10.	.8	100.6
1	JAN	1242	22	2.	.1	100.1	1	JAN	1456	89	4.	.3	100.2	1	JAN	1710	156	10.	.7	100.6
1	JAN	1244	23	2.	.1	100.1	1	JAN	1458	90	4.	.3	100.2	1	JAN	1712	157	10.	.7	100.5
1	JAN	1246	24	2.	.1	100.1	1	JAN	1500	91	4.	.3	100.2	1	JAN	1714	158	9.	.7	100.5
1	JAN	1248	25	2.	.1	100.1	1	JAN	1502	92	4.	.3	100.2	1	JAN	1716	159	9.	.7	100.5
1	JAN	1250	26	2.	.1	100.1	1	JAN	1504	93	4.	.3	100.2	1	JAN	1718	160	9.	.7	100.5
1	JAN	1252	27	2.	.2	100.1	1	JAN	1506	94	4.	.3	100.2	1	JAN	1720	161	9.	.7	100.5
1	JAN	1254	28	2.	.2	100.1	1	JAN	1508	95	4.	.3	100.2	1	JAN	1722	162	9.	.6	100.5
1	JAN	1256	29	2.	.2	100.1	1	JAN	1510	96	4.	.3	100.2	1	JAN	1724	163	8.	.6	100.5
1	JAN	1258	30	2.	.2	100.1	1	JAN	1512	97	4.	.3	100.2	1	JAN	1726	164	8.	.6	100.5
1	JAN	1300	31	2.	.2	100.1	1	JAN	1514	98	4.	.3	100.2	1	JAN	1728	165	8.	.6	100.4
1	JAN	1302	32	2.	.2	100.1	1	JAN	1516	99	5.	.3	100.3	1	JAN	1730	166	8.	.6	100.4
1	JAN	1304	33	2.	.2	100.1	1	JAN	1518	100	5.	.3	100.3	1	JAN	1732	167	8.	.6	100.4
1	JAN	1306	34	2.	.2	100.1	1	JAN	1520	101	5.	.4	100.3	1	JAN	1734	168	7.	.6	100.4
1	JAN	1308	35	2.	.2	100.1	1	JAN	1522	102	5.	.4	100.3	1	JAN	1736	169	7.	.5	100.4
1	JAN	1310	36	2.	.2	100.1	1	JAN	1524	103	5.	.4	100.3	1	JAN	1738	170	7.	.5	100.4
1	JAN	1312	37	2.	.2	100.1	1	JAN	1526	104	5.	.4	100.3	1	JAN	1740	171	7.	.5	100.4

1	JAN	1314	38	2.	.2	100.1	*	1	JAN	1528	105	5.	.4	100.3	*	1	JAN	1742	172	7.	.5	100.4
1	JAN	1316	39	2.	.2	100.1	*	1	JAN	1530	106	5.	.4	100.3	*	1	JAN	1744	173	7.	.5	100.4
1	JAN	1318	40	2.	.2	100.1	*	1	JAN	1532	107	5.	.4	100.3	*	1	JAN	1746	174	7.	.5	100.4
1	JAN	1320	41	2.	.2	100.1	*	1	JAN	1534	108	5.	.4	100.3	*	1	JAN	1748	175	6.	.5	100.4
1	JAN	1322	42	2.	.2	100.1	*	1	JAN	1536	109	6.	.4	100.3	*	1	JAN	1750	176	6.	.5	100.3
1	JAN	1324	43	2.	.2	100.1	*	1	JAN	1538	110	6.	.4	100.3	*	1	JAN	1752	177	6.	.5	100.3
1	JAN	1326	44	2.	.2	100.1	*	1	JAN	1540	111	6.	.4	100.3	*	1	JAN	1754	178	6.	.5	100.3
1	JAN	1328	45	2.	.2	100.1	*	1	JAN	1542	112	6.	.5	100.3	*	1	JAN	1756	179	6.	.4	100.3
1	JAN	1330	46	2.	.2	100.1	*	1	JAN	1544	113	6.	.5	100.4	*	1	JAN	1758	180	6.	.4	100.3
1	JAN	1332	47	2.	.2	100.1	*	1	JAN	1546	114	7.	.5	100.4	*	1	JAN	1800	181	6.	.4	100.3
1	JAN	1334	48	3.	.2	100.1	*	1	JAN	1548	115	7.	.5	100.4	*	1	JAN	1802	182	5.	.4	100.3
1	JAN	1336	49	3.	.2	100.1	*	1	JAN	1550	116	7.	.5	100.4	*	1	JAN	1804	183	5.	.4	100.3
1	JAN	1338	50	3.	.2	100.1	*	1	JAN	1552	117	8.	.6	100.4	*	1	JAN	1806	184	5.	.4	100.3
1	JAN	1340	51	3.	.2	100.1	*	1	JAN	1554	118	8.	.6	100.4	*	1	JAN	1808	185	5.	.4	100.3
1	JAN	1342	52	3.	.2	100.1	*	1	JAN	1556	119	8.	.6	100.5	*	1	JAN	1810	186	5.	.4	100.3
1	JAN	1344	53	3.	.2	100.1	*	1	JAN	1558	120	9.	.7	100.5	*	1	JAN	1812	187	5.	.3	100.3
1	JAN	1346	54	3.	.2	100.1	*	1	JAN	1600	121	10.	.7	100.6	*	1	JAN	1814	188	4.	.3	100.2
1	JAN	1348	55	3.	.2	100.2	*	1	JAN	1602	122	11.	.8	100.6	*	1	JAN	1816	189	4.	.3	100.2
1	JAN	1350	56	3.	.2	100.2	*	1	JAN	1604	123	12.	.9	100.7	*	1	JAN	1818	190	4.	.3	100.2
1	JAN	1352	57	3.	.2	100.2	*	1	JAN	1606	124	14.	1.1	100.8	*	1	JAN	1820	191	4.	.3	100.2
1	JAN	1354	58	3.	.2	100.2	*	1	JAN	1608	125	16.	1.2	100.9	*	1	JAN	1822	192	4.	.3	100.2
1	JAN	1356	59	3.	.2	100.2	*	1	JAN	1610	126	17.	1.2	100.9	*	1	JAN	1824	193	4.	.3	100.2
1	JAN	1358	60	3.	.2	100.2	*	1	JAN	1612	127	17.	1.3	101.0	*	1	JAN	1826	194	4.	.3	100.2
1	JAN	1400	61	3.	.2	100.2	*	1	JAN	1614	128	18.	1.3	101.0	*	1	JAN	1828	195	3.	.3	100.2
1	JAN	1402	62	3.	.2	100.2	*	1	JAN	1616	129	18.	1.4	101.0	*	1	JAN	1830	196	3.	.2	100.2
1	JAN	1404	63	3.	.2	100.2	*	1	JAN	1618	130	18.	1.3	101.0	*	1	JAN	1832	197	3.	.2	100.2
1	JAN	1406	64	3.	.2	100.2	*	1	JAN	1620	131	18.	1.3	101.0	*	1	JAN	1834	198	3.	.2	100.2
1	JAN	1408	65	3.	.2	100.2	*	1	JAN	1622	132	17.	1.3	101.0	*	1	JAN	1836	199	3.	.2	100.2
1	JAN	1410	66	3.	.2	100.2	*	1	JAN	1624	133	17.	1.3	100.9	*	1	JAN	1838	200	3.	.2	100.2
1	JAN	1412	67	3.	.2	100.2	*	1	JAN	1626	134	17.	1.2	100.9	*							

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.63-HR
+ (CFS)	(HR)					
		(CFS)				
+ 18.	4.27		6.	6.	6.	6.
		(INCHES)	.874	.896	.896	.896
		(AC-FT)	3.	3.	3.	3.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
			6-HR	24-HR	72-HR	6.63-HR
+ (AC-FT)	(HR)					
1.	4.27		0.	0.	0.	0.

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
			6-HR	24-HR	72-HR	6.63-HR
+ (FEET)	(HR)					
101.00	4.27		100.35	100.32	100.32	100.32

CUMULATIVE AREA = .07 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	59.	4.10	7.	6.	6.	.07		
+	ROUTED TO	DETAIN	18.	4.27	6.	6.	6.	.07		
+									101.00	4.27

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

1” = 200’

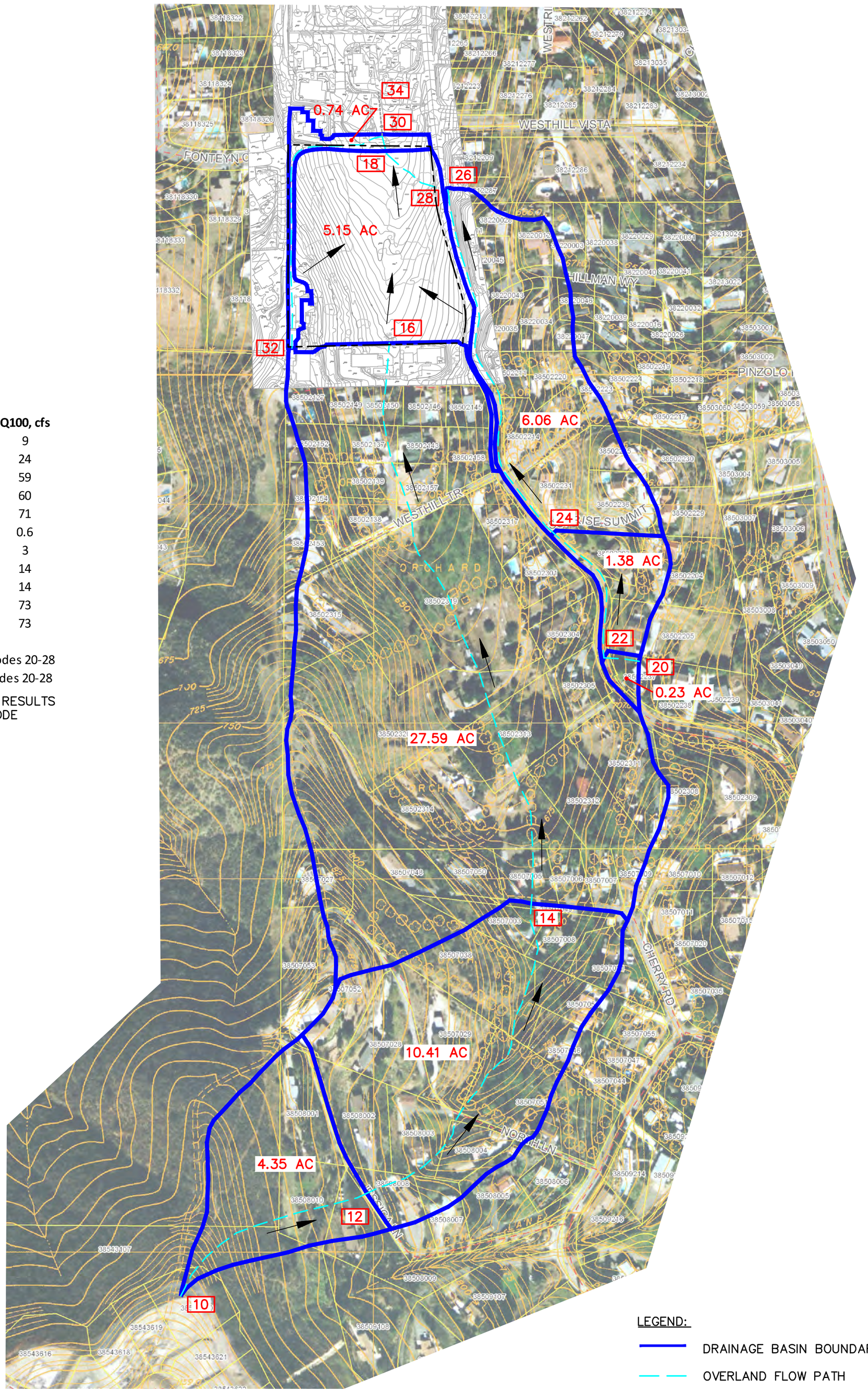
0 200

Node	Area, ac	Q100, cfs
12	4.35	9
14	14.76	24
16	42.35	59
18*	47.5	60
18**	55.17	71
22	0.23	0.6
24	1.61	3
26	7.67	14
28	7.67	14
30	55.91	73
34	55.91	73

*Before confluence with Nodes 20-28

**After confluence with Nodes 20-28

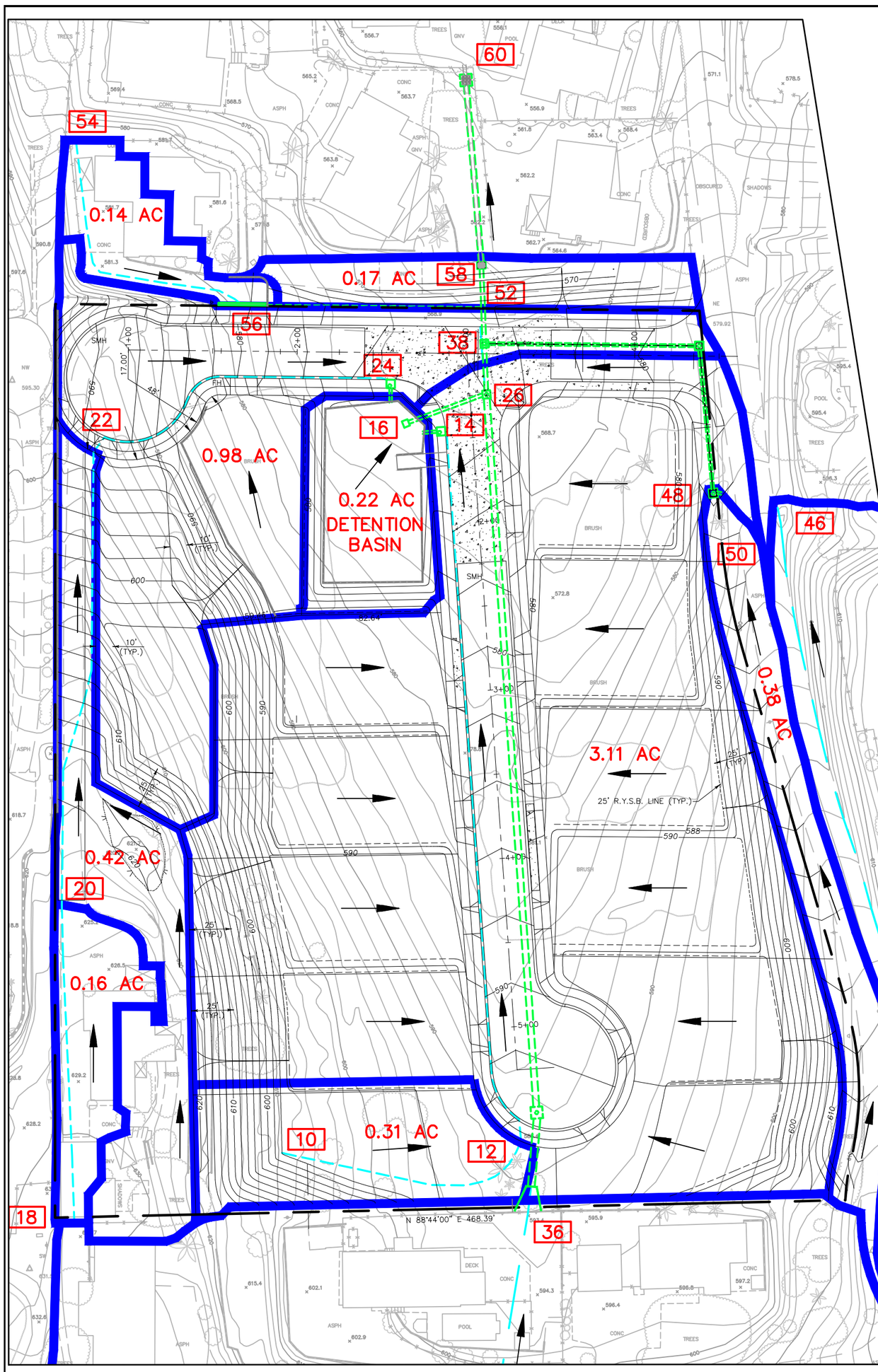
SUMMARY OF OVERALL RESULTS
TRIBUTARY TO NODE

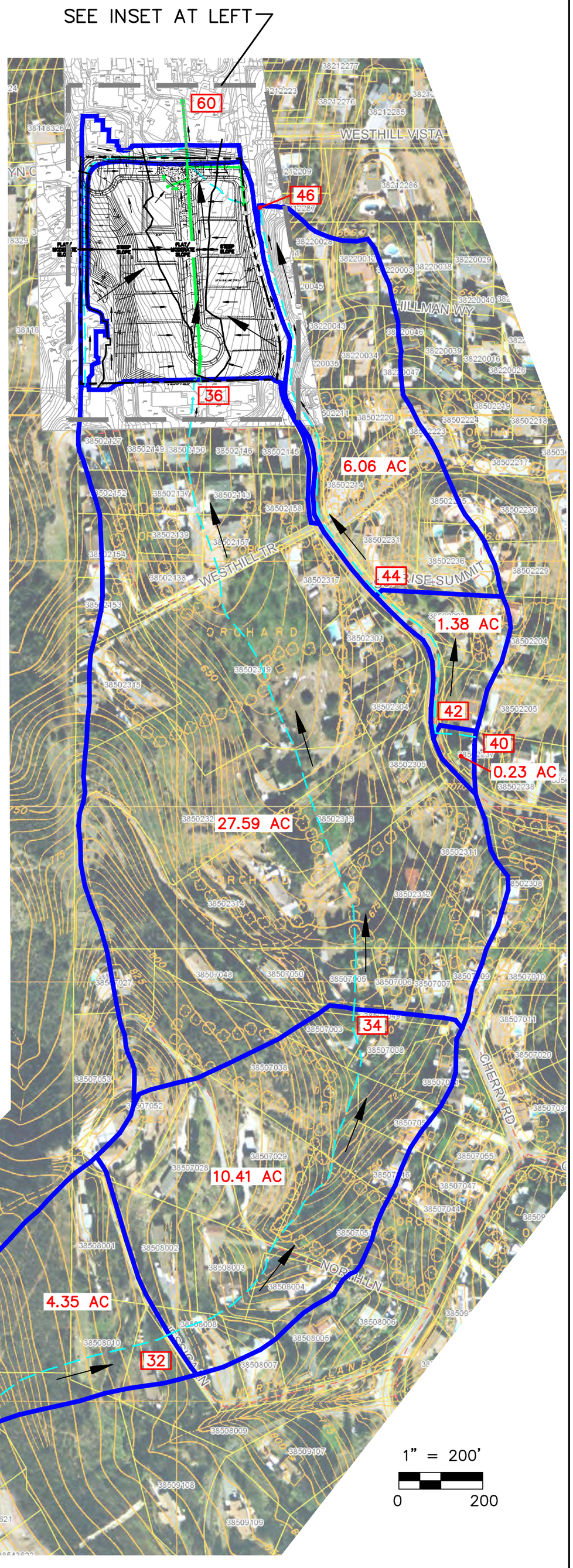


LEGEND:

- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- DIRECTION OF FLOW
- PROPERTY BOUNDARY

EXISTING CONDITION
RATIONAL METHOD WORK MAP





Node	Area, ac	Q100, cfs
12	0.31	0.5
14	3.42	5
16	5.20	8
20	0.16	0.3
22	0.58	1
24	1.56	3
26	47.55	66
32	4.35	9
34	14.76	24
36	42.35	59
38	55.60	79
42	0.23	0.6
44	1.61	3
46	7.67	14
48	8.05	15
52	55.74	79
56	0.14	0.2
58	55.91	79
60	55.91	79

SUMMARY OF OVERALL RESULTS
TRIBUTARY TO NODE

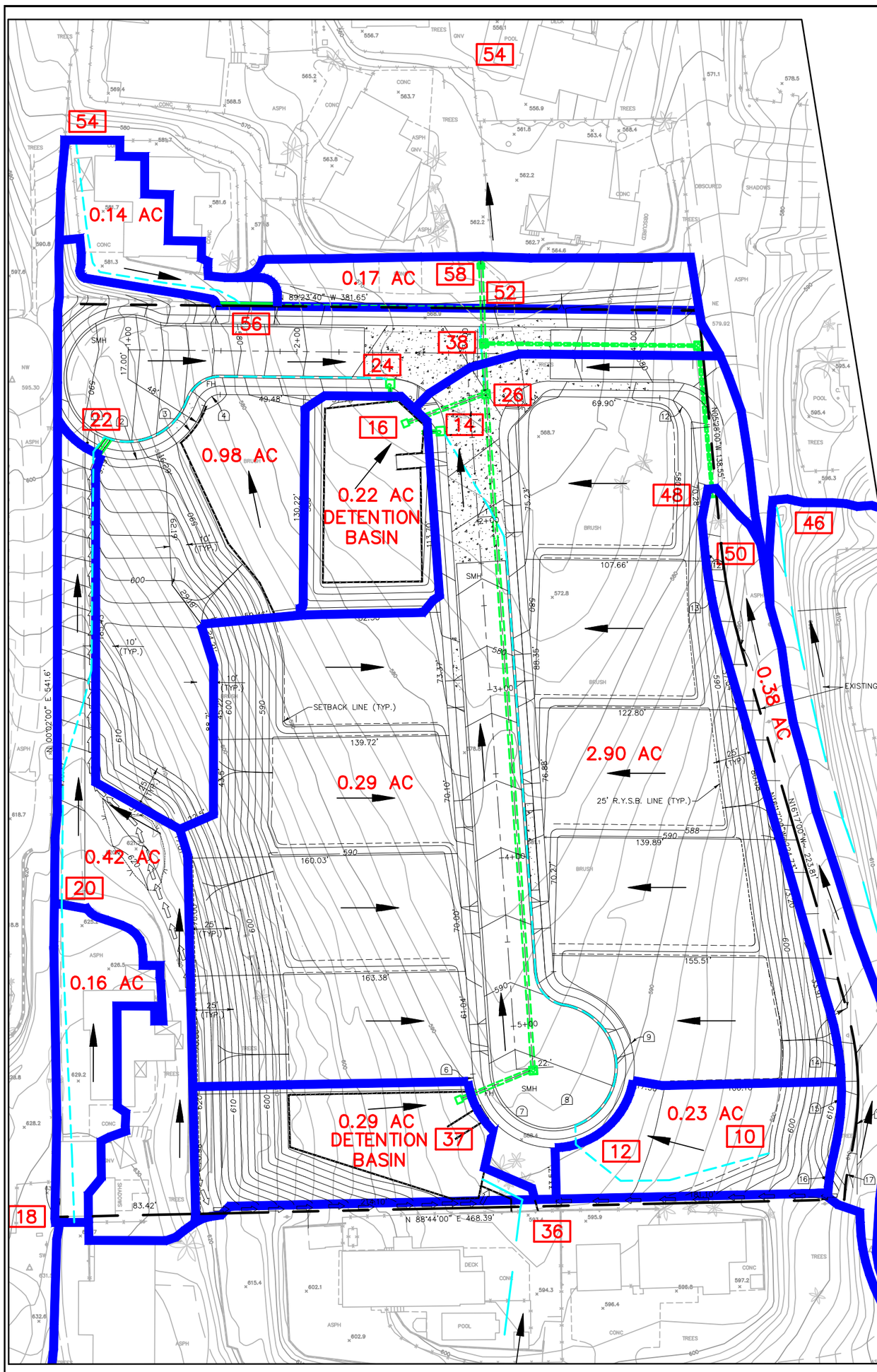
1" = 60'
0 60

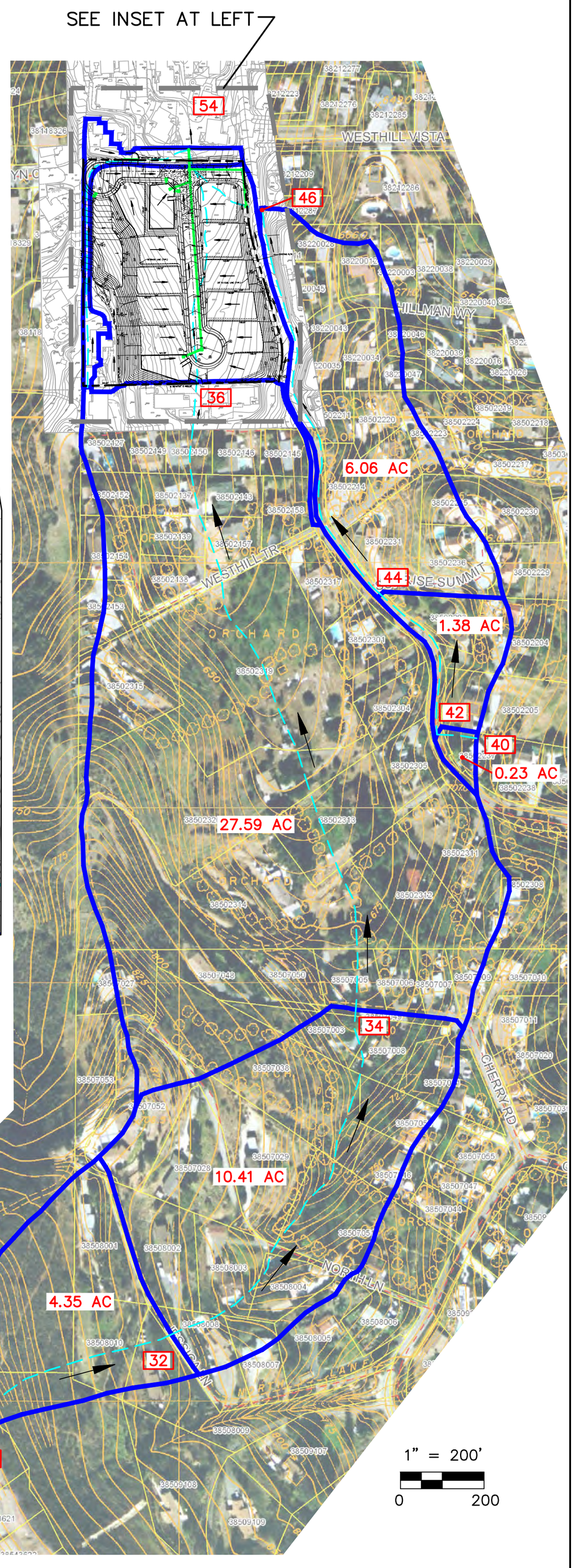
INSET DETAIL

LEGEND:

- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- DIRECTION OF FLOW
- PROPERTY BOUNDARY

PROPOSED CONDITION – ALTERNATIVE A
RATIONAL METHOD WORK MAP





Node	Area, ac	Q100, cfs
12	0.23	0.4
14	3.13	5
16	4.91	7
20	0.16	0.3
22	0.58	1
24	1.56	3
26	47.55	65
32	4.35	9
34	14.76	24
36	42.35	59
37	42.64	59
38	55.60	79
42	0.23	0.6
44	1.61	3
46	7.67	14
48	8.05	15
52	55.74	79
56	0.14	0.2
58	55.91	79
60	55.91	79

SUMMARY OF OVERALL RESULTS
TRIBUTARY TO NODE

1" = 60'
0 60

INSET DETAIL

LEGEND:

- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW PATH
- 3.62 AC DRAINAGE BASIN AREA
- 10 RATIONAL METHOD NODE NUMBER
- DIRECTION OF FLOW
- PROPERTY BOUNDARY

1" = 200'
0 200

PROPOSED CONDITION – ALTERNATIVE B
RATIONAL METHOD WORK MAP