# PRELIMINARY DRAINAGE REPORT

## BREAKWATER

**City of Imperial Beach, CA**
**October 2011**
**Project # MF 1062**

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## 1. INTRODUCTION

This preliminary drainage report supports the entitlement package submittal for the proposed Breakwater project. The project is bound by Palm Avenue/SR75 to the north, 7th Street to the west, 9th Street to the east, and a public alley (located north of Donax Avenue) to the south. The total project ownership consists of 5.11 acres, including the easterly half-width of 8th Avenue within the site boundary. The project includes the proposed dedication of the existing alley along the southerly site perimeter, so the total project area is 4.75 acres. Figure 1 below shows the vicinity map for the project.

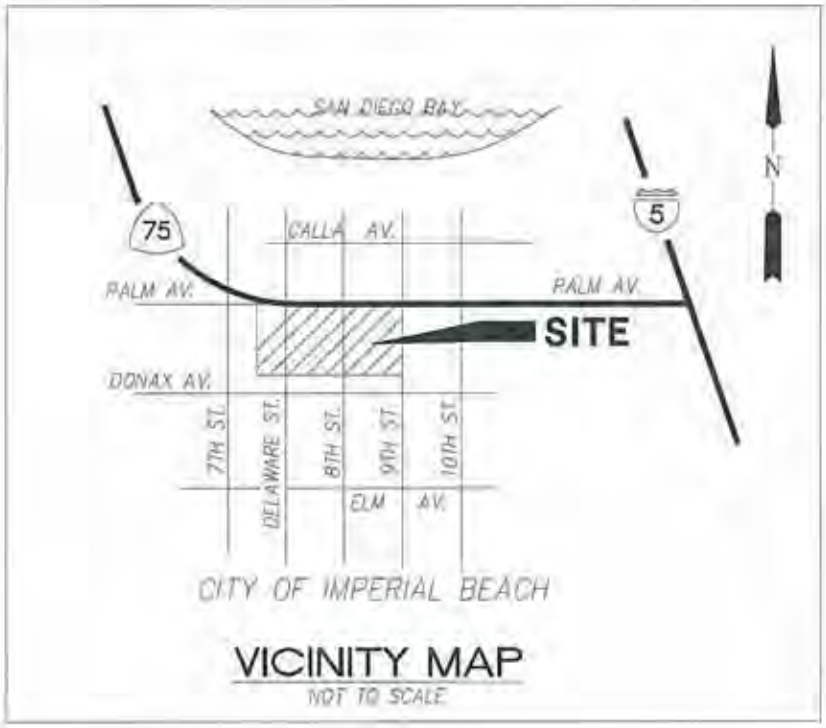



***Figure 1: Vicinity Map***

The proposed project consists of the redevelopment of an existing commercial development. The project proposes to demolish the existing parking lots and commercial buildings and elevate the site with imported fill material to bring the site up to grade with Palm Avenue. The project will consist of the construction of seven proposed commercial buildings and associated parking lots,

utilities, and landscaping. In addition to the onsite improvements, the offsite public improvements include realigning a portion of Palm Avenue by eliminating the existing through lanes adjacent to the site's northerly frontage. The project will also replace and realign the storm drain within 9th Street and upsize the pipe diameter to increase the conveyance capacity. The storm drain improvements within 9th Street will be constructed by the City under a separate project, or will be constructed with the Breakwater project as a reimbursement. The project area currently consists of an existing commercial development with at-grade parking lots. The site is mostly impervious, with minimal areas of onsite landscaping.

This study focuses on evaluating the drainage issues associated with the project including an analysis of onsite and upstream existing flooding conditions with respect to the existing backbone storm drain system along 8th Street. The purpose of this report is to determine hydrologic or hydraulic impact, if any, to the existing City of Imperial Beach storm drain facilities and to provide peak 5-, 10-, and 100-year discharge values for existing and proposed conditions. The drainage analyses presented herein reflect a tentative map level-of-effort, which include peak storm event hydrologic analyses using relative grades, and limited preliminary hydraulic calculations. Hydraulic analyses for proposed inlets, pipe inverts, and hydraulic grade lines (HGL's) will be provided during final engineering.

## 2. EXISTING AND PROPOSED DRAINAGE PATTERNS AND IMPROVEMENTS

The following sections provide descriptions of the existing and proposed drainage patterns and improvements for the project.

### 2.1 Existing Onsite Drainage Patterns

Under existing conditions, runoff generally drains towards the middle of the site along the extension of the 8th Street alignment. Approximately half of the site drains to the south towards the alley along the site's southerly boundary and enters a grate inlet near the alley's intersection with 8th Street. The other portion of the site drains via surface flow to a low point near the northerly property boundary along the extension of the 8th Street alignment. Because the

existing underground storm drain system is undersized, portions of the site and some upstream properties currently experience flooding during large storm events. The site is situated several feet below Palm Avenue, so the runoff in excess of the Palm Avenue pipe capacity collects on the surface and floods the lower portions of the site since it has no overland release. Refer to Exhibit A-1 and A-2 for an overview of onsite and offsite drainage patterns for the existing condition.

## 2.2 Existing Offsite Drainage Patterns

The project is situated in a sump area downstream of a much larger drainage basin that includes drainage areas that roughly represent the area in between 7th Avenue to the west, Encina Avenue to the south, and 10th Street to the east. Refer to Exhibit A-1 for existing condition drainage patterns of the offsite area. The surrounding development includes mostly single-family residential homes, except for the commercial area east of 9th Street and north of Donax Avenue. There are two main drainage areas that are analyzed in this report. System 100 represents the runoff that drains to the sump inlet at Node 150 near the intersection of 8th Street and the alley. System 200 represents the runoff that drains to the northerly sump area (Node 270 per Exhibit A-2). System 200 includes a large portion of the upstream watershed from areas east of 9th Street. Note that under existing 100-year peak flow conditions, the existing 15-inch pipe collecting the runoff at the intersection of 9th Street and Palm Avenue is inadequate to convey the peak flow. Based on the existing topography, the excess drainage at the intersection ponds in 9th Street and then flows overland onto the site and then subsequently flows westerly in the northerly parking lot towards the existing inlets at Node 270.

There are very few storm drain systems within the regional drainage basin and much of the drainage area is relatively flat. The storm drain pipe information and inverts for storm drain systems within and near the project site were obtained from a field survey performed by Project Design Consultants (PDC). There is an existing 18-inch line within the alley running north-south in between 8th Street and Delaware Street. Just to the south of the site, the alignment of the 18-inch line heads east through the alley and also switches to a double 18-inch line from Node 145 to 150. At Node 150, there is a grate inlet and the 18-inch pipe is extremely shallow at that

location. Based on PDC's field topography, there is an 18-inch CMP line that runs from the alley, which drains into the 36-inch Caltrans CMP line that crosses Palm Avenue. At that location, the 15-inch line from 9th Street also connects into the junction. Immediately west of the inlet, there is an additional inlet and it is assumed that an 18-inch line parallel to the 36-inch line also crosses Palm Avenue. These pipes connect with additional drainage systems north of Palm Avenue and combine into a single 36-inch RCP line that heads in a northerly direction through the CVS Pharmacy parking lot. The 36-inch RCP line continues to the north after passing through an existing F-type catch basin in the parking lot north of the CVS Pharmacy. This location was used as the downstream control for the hydraulic analysis for this study.

### 2.3 Proposed Drainage Improvements

The proposed project will include an onsite private storm drain system consisting of inlets, pipes, roof drains, and water quality features. Refer to the Preliminary Water Quality Technical Report for the proposed water quality features for the project. The private storm drain system will connect into the public storm drain system at various locations. The existing public 18-inch CMP line within the site boundaries will be removed and replaced with a larger pipe (36-inch RCP from Node 270 to 280). The existing public 15-inch pipe collecting the 9th Street drainage will be upsized to a 36-inch RCP line and realigned. This proposed change will significantly reduce the existing ponding potential at the 9th Street/Palm Avenue intersection.

## 3. HYDROLOGY CRITERIA, METHODOLOGY, AND RESULTS

### 3.1 Hydrology Criteria

Table 1 summarizes the key hydrology assumptions and criteria used for the hydrologic modeling.

*Table 1: Hydrology Criteria*

| | |
|---|---|
| Existing and Proposed Hydrology: | 100-year storm frequency for design purposes. (Additional calculations for the 5- year storm frequency and the 10-year storm frequency are also included for comparison purposes.) |
| Soil Type: | Hydrologic Soil Group D |
| Land Use / Runoff Coefficients: | Assigned for each drainage area based on estimated/observed percent imperviousness (C values range from C=0.57 to C=0.87) |
| Rainfall intensity: | Based on intensity duration frequency relationships in the 2003 County of San Diego Hydrology Manual |

## 3.2 Hydrologic Methodology

The Rational Method was used to determine the 100-year peak discharge flows for the evaluation of the existing and proposed drainage patterns. Note that the City's Master Drainage Plan includes Rational Method Calculations for this area for the 2-, 5-, and 10-year storms but does not include a model for the 100-year return interval. Discussions with City staff indicated that flooding is a frequent occurrence during rain events within the City of Imperial Beach (compared with some other cities), due to undersized storm drain facilities, flat topography, and backwater conditions. For the purposes of analyzing the impacts of this project, the 100-year storm was selected as the design storm instead of any of the smaller storm events per the City's Master Drainage Plan. The 100-year analysis was chosen in order to be consistent with the County Drainage Design Manual and as a conservative design standard consistent with standard practice for similar projects within San Diego County. However, the 5-year and 10-year storm calculations are also included in this report.

The offsite drainage area was delineated using 2-foot contours provided by the City and the drainage delineations were verified during a detailed site visit. The offsite drainage area roughly corresponds to areas H-1 through H-6 of the City's Master Drainage Plan. (For comparison, refer to Master Plan excerpts in Appendix 6). In general, the runoff coefficients used in the

model for the offsite areas generally reflect the runoff coefficients used in the City's Master Drainage Plan. One exception is the area north of Donax Avenue and east of 9th Street, as this area is more impervious than the rest of the offsite area due to the commercial land use.

The goal of the Project hydrologic analysis was to:

- Determine existing peak flows for the evaluation of the onsite and offsite storm drain system, inlets, and catch basins that convey flow to the discharge locations.
- Determine the potential for flooding both upstream of the project and within the site boundary in order to compare the proposed condition to the existing condition.
- Verify that the Project will not adversely impact the existing storm drain improvements, or will not worsen the existing flooding conditions in the vicinity of the project.

### 3.3 Description of Hydrologic Modeling Software

The Advanced Engineering Software (AES) Rational Method Program was used to perform the Rational Method hydrologic calculations. This section provides a brief explanation of the computational procedure used in the computer model.

The AES Modified Rational Method Hydrology Program is a computer-aided design program where the user develops a node link model of the watershed. Developing independent node link models for each interior watershed and linking these sub-models together at confluence points creates the node link model. The intensity-duration-frequency relationships are applied to each of the drainage areas in the model to get the peak flow rates at each point of interest.

### 3.4 Hydrology Results

Table 2 summarizes the hydrology results for the project outfalls for the existing and proposed conditions. Refer to Appendices 2 and 3 for the Rational Method model results. The peak flow rates listed in the table represent the undetained peak flows and were used to create inflow

hydrographs for the storage-routing (detention) analysis. Note that the project does not propose to increase the imperviousness of the site, so there is no increase in peak flows.

***Table 2: Hydrology Results***

| | EXISTING CONDITIONS | | | | | PROPOSED CONDITIONS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *Outfall of Interest* | *$Q_5$ (cfs)* | *$Q_{10}$ (cfs)* | *$Q_{100}$ (cfs)* | *Contrib. Area (acres)* | *Composite C* | *$Q_5$ (cfs)* | *$Q_{10}$ (cfs)* | *$Q_{100}$ (cfs)* | *Contrib. Area (acres)* | *Composite C* |
| System 100, Offsite sump area (Node 150) | 33.0 | 39.7 | 61.5 | 38.6 | 0.587 | 30.3 | 36.4 | 56.4 | 36.0 | 0.570 |
| System 200 (Node 270 for Existing Conditions; Node 280 for Proposed Conditions) | 27.4 | 33.1 | 51.5 | 26.9 | 0.704 | 29.9 | 36.1 | 56.2 | 29.5 | 0.711 |
| **Sum:** | **60.4** | **72.8** | **113.0** | **65.5** | - | **60.2** | **72.5** | **112.6** | **65.5** | - |
| **Composite:** | - | - | - | - | **0.635** | - | - | - | - | **0.634** |

## 4. HYDRAULIC CRITERIA, METHODOLOGY, AND RESULTS

Detailed hydraulic calculations will be performed during final engineering. However, a preliminary storage routing (detention) analysis for the project has been completed in order to model the sump areas and to show the difference in the modeled flooding conditions for existing and proposed conditions. This analysis was accomplished using the interconnected pond routine in PondPack. The purpose of the analysis is to determine if filling the site (as a part of the proposed development plan) will adversely affect the flooding condition for either upstream or downstream properties.

### 4.1 Generation of Hydrographs for Input into Storage-Routing Model

The results of the Rational Method were input into the Rick Rational Method Design Storm Hydrograph program in order to create 5-, 10-, and 100-year, 6-hour storm hydrographs for flood storage routing for Systems 100 and 200 for both existing and proposed conditions. The hydrographs were then input as user-defined hydrographs into the respective PondPack models for existing and proposed conditions. Both the existing and proposed PondPack models were set up similarly. The program input variables include the elevation-area relationship, the

hydrographs, and the input data for the basin outlet structures. The level-pool routing routine is used to generate the detained outflow hydrograph. The models were set up to model two interconnected ponds with a tailwater rating curve at the downstream outfall. See Figure 2 below for a graphical representation of how the PondPack models were set up.

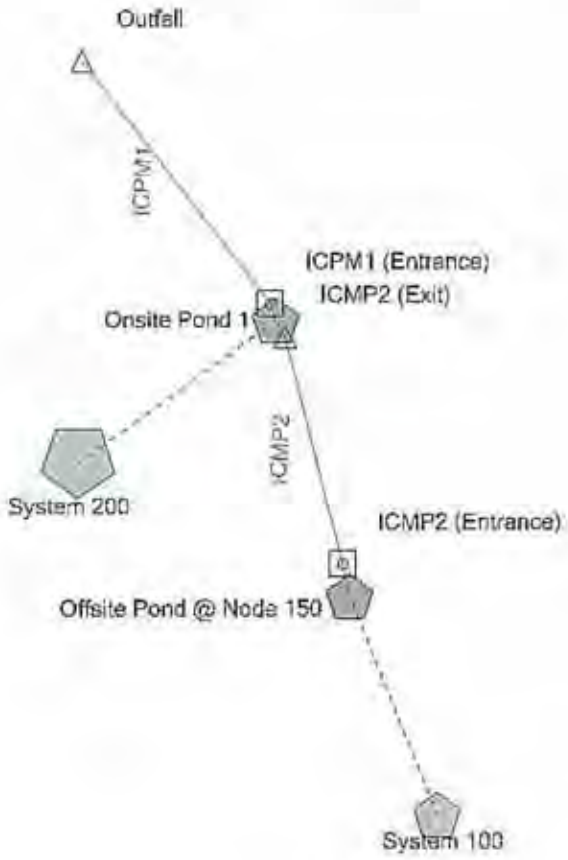



***Figure 2: Network Diagram for PondPack Models***

## 4.2 Approximation for Tailwater Boundary Condition for Storage-Routing Model

Since the storm drain system is extremely flat, the culvert hydraulics are primarily governed by culverts under outlet control. Therefore, the flow rate out of the interconnected ponds is mostly controlled by the size of the downstream culverts and the downstream tailwater condition. Therefore, selection of an appropriate downstream tailwater condition is an important boundary condition for the storage-routing model. The location representative of the outfall for the

downstream end of the PondPack analysis was selected as the F-type catch basin located to the north of the CVS Pharmacy. Based on the site topography, this catch basin is the first downstream inlet past Palm Avenue that would get surcharged if the downstream pipe's capacity was exceeded. Runoff in excess of the pipe's capacity would flow out of the F-type openings and would flow overland in a northerly direction. Based on the City's Master Drainage Plan, the pipe at this location and downstream of this location is approximately 0.3%. The elevation-flow curve was calculated at this location and was used to approximate the boundary condition for both of the PondPack models. The boundary condition elevation-flow curve was created by generating a normal-depth rating curve for a 36-inch pipe using FlowMaster from the invert to the soffit elevation with an assumed slope of 0.3%. For elevations higher than the soffit elevation, the elevation-flow curve was extended to include the additional overland flow that would flow out of the F-type openings. The elevation-flow relationship for the overland flow was based on a triangular channel approximation of the downstream street section. The street section was approximated based on the topography shown on the exhibit in the CVS Drainage Study, which is included in Appendix 7 for reference.

### 4.3 Existing Condition Storage Routing Modeling

Under existing conditions, there are two separate ponding locations. System 100 drains to the offsite sump located at Node 150 and System 200 drains to the onsite sump (Pond 1) located at Node 270. The stage-storage relationships for each of the ponds were estimated based on the project topography and were input into the model. The outlet structure between the outfall and Pond 1 was approximated with a 36-inch RCP, although in reality the 36-inch pipe splits into a 36-inch CMP and an 18-inch RCP for the short distance underneath Palm Avenue. This approximation was assumed sufficient. The outlet structures between the onsite pond (Pond 1) and the upstream offsite pond include an 18-inch CMP culvert and a broad-crested weir at the elevation where flow from one basin would spill overland into the other basin. Because the interconnected pond routing routine can produce significant oscillations in the hydrograph when the water surface elevations are nearly level, the interconnected pond routing time step was set at a very low interval in order to reduce the oscillations in the results. The results of the stage-storage routing are shown in the hydrographs and supporting documentation in Appendix 4. The

graph shows that the offsite pond contains significantly more detention volume than the onsite pond.

### 4.4 Proposed Condition Storage Routing Modeling

Under proposed conditions, the existing condition onsite pond will be filled in and elevated. In addition, the volume of the offsite pond is reduced slightly because the southerly portion of the site that currently floods will also be filled in and elevated. Since a large portion of the offsite flow from the area east of 9th Street will be rerouted to Node 280, the cleanout at Node 280 was modeled as the onsite pond (Pond 1) for the proposed condition model. The storage within Pond 1 was modeled according to the inside dimensions of the cleanout. This was done in order to estimate how the time-varying relationship between the inflow from System 200 and the routed hydrograph from System 100 would affect the flow rate and storage routing of the hydrographs. The pipe between Pond 1 and the upstream offsite Pond was modeled as a 24-inch RCP per the proposed utility plan. The results of the stage-storage routing are shown in the hydrographs and supporting documentation in Appendix 4.

### 4.5 Results of Storage Routing Modeling

By comparing the two outflow hydrographs, the project impacts can be evaluated. Based on the results of the models, the upstream water surface elevations in the offsite pond are essentially the same for both existing and proposed conditions. The peak flow out of the system is roughly equivalent under existing and proposed conditions for the 100-year storm. For the 5- and 10-year storms, the proposed condition maximum water surface elevation is slightly lower than existing conditions, which indicates that the project reduces upstream flooding conditions. Therefore, there is no adverse effect on upstream or downstream flooding due to the development of the project. Although there is not a significant difference in the maximum water surface elevation for the two scenarios for the 100-year storm, the duration of the ponding in the offsite basin is much shorter in the proposed condition than the existing condition for all storm events analyzed, since the increase in pipe diameter reduces the flow restrictions. The graphs indicate that flow spills over the weir between the upstream and downstream ponds under existing conditions. Under proposed conditions, there is a small duration in the routed 100-year

hydrograph where the water surface elevation in Pond 1 exceeds that of the upstream offsite pond and therefore the culvert flows in reverse for a small period in time. The reverse flow cannot be eliminated, and it is not in any way detrimental to the system being proposed. Further, the offsite ponding cannot be eliminated, as ponding is dictated by the constraints of the downstream storm drain system. Table 3 summarizes the results of the interconnected pond storage-routing analysis. Refer to the hydrographs in Appendix 4 for a graphical representation of the results.

***Table 3: Storage-Routing Results***

| | EXISTING CONDITIONS | | PROPOSED CONDITIONS | |
|---|---|---|---|---|
| ***Storage Routing Results*** | ***$Q_{100}$ (at outfall) (cfs)*** | ***Offsite Pond Max. Water Surface Elevation (ft)*** | ***$Q_{100}$ (at outfall) (cfs)*** | ***Offsite Pond Max. Water Surface Elevation (ft)*** |
| Project Outfall for 100-year storm | 46.4 | 14.0 | 46.2 | 14.0 |
| Project Outfall for 10-year storm | 35.8 | 13.5 | 36.5 | 13.0 |
| Project Outfall for 5-year storm | 31.8 | 13.3 | 36.9 | 12.9 |

## 5. CONCLUSION

This drainage report has been prepared in support of the entitlement application of the Breakwater project. The project proposes to redevelop commercial property that currently experiences flooding during peak storm events. The property will be elevated above existing grade with the import of fill material, thereby eliminating the ponding conditions onsite. The project proposes to upsize the public storm drain system in 9th Street to reduce the existing flooding potential at the 9th Street/Palm Avenue intersection. Further, the project also proposes to upsize the 18-inch CMP public storm drain system within the site so that downstream and upstream properties do not experience future flooding that is any worse than the existing

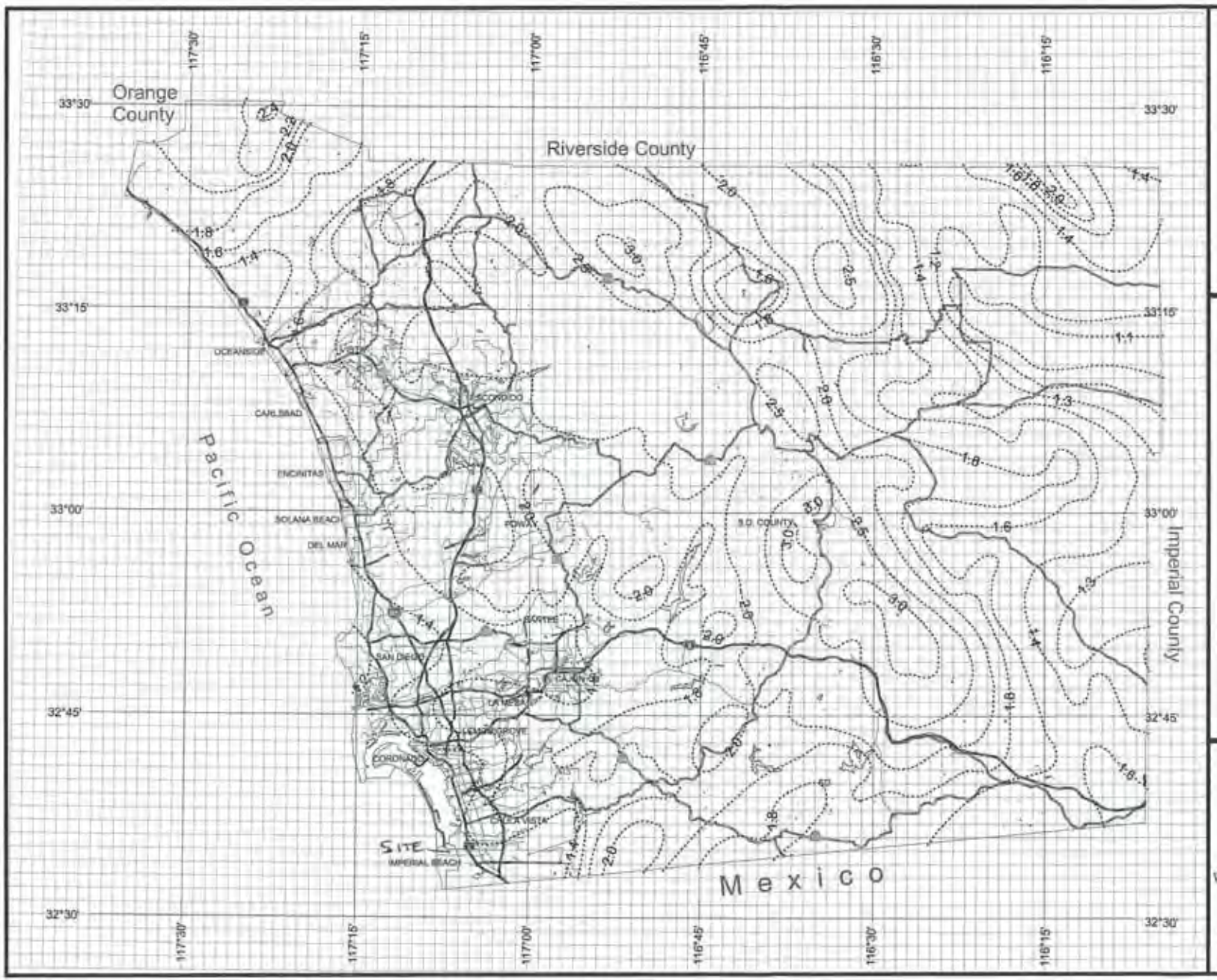
condition flooding situation. The project will not increase the depth of flooding upstream and will significantly reduce the duration of ponding upstream during peak storm events. Therefore, from a drainage perspective, the project will be an improvement over the existing condition.

# APPENDIX 1

## Supplemental Information (Isopluvials, IDF Curve, Runoff Coefficients, and FIRM Panel)

# County of San Diego Hydrology Manual

*Rainfall Isopluvials*




**5 Year Rainfall Event - 6 Hours**

Isopluvial (inches)

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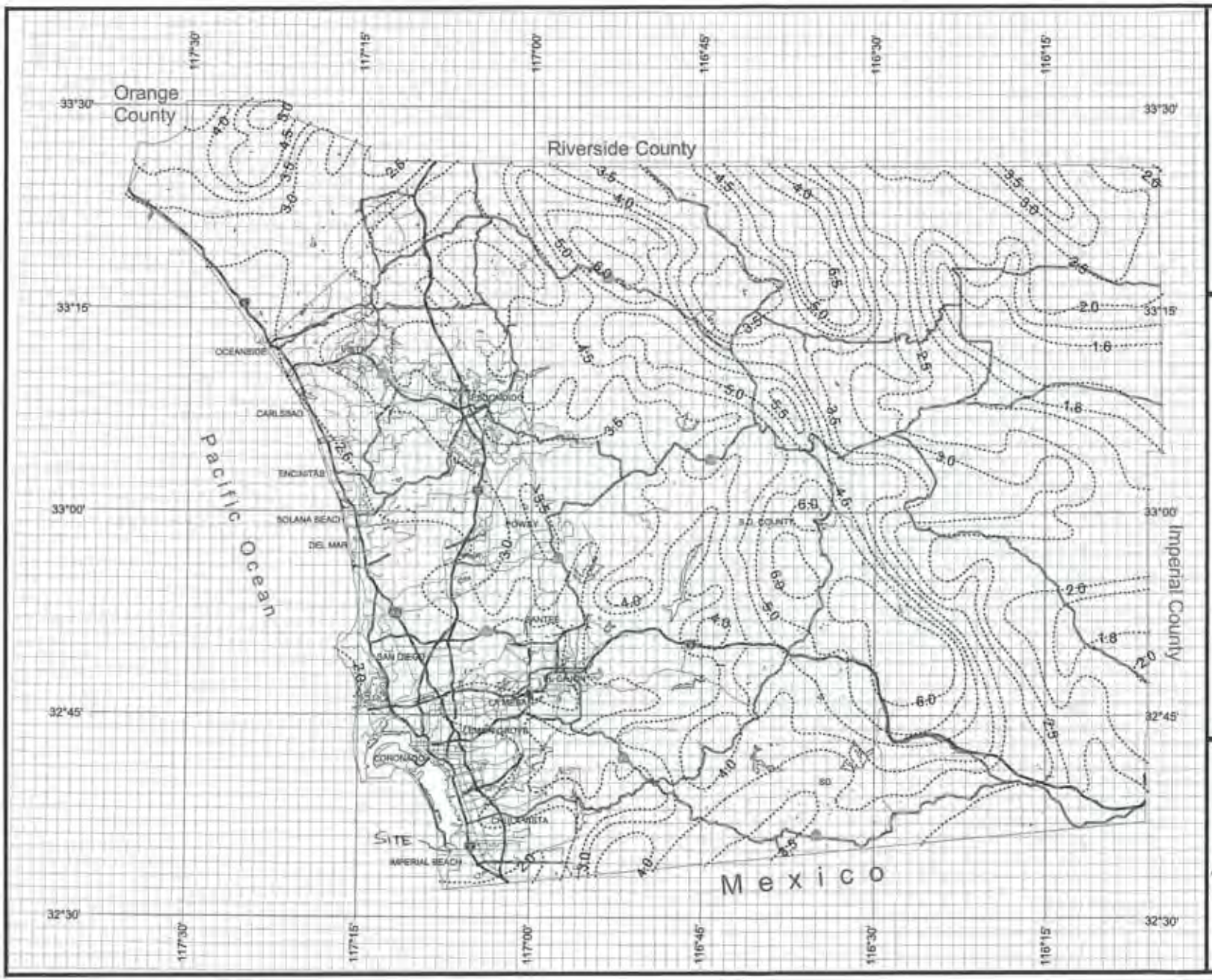
# County of San Diego Hydrology Manual

*Rainfall Isopluvials*




**5 Year Rainfall Event - 24 Hours**

Isopluvial (inches)

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N W E S

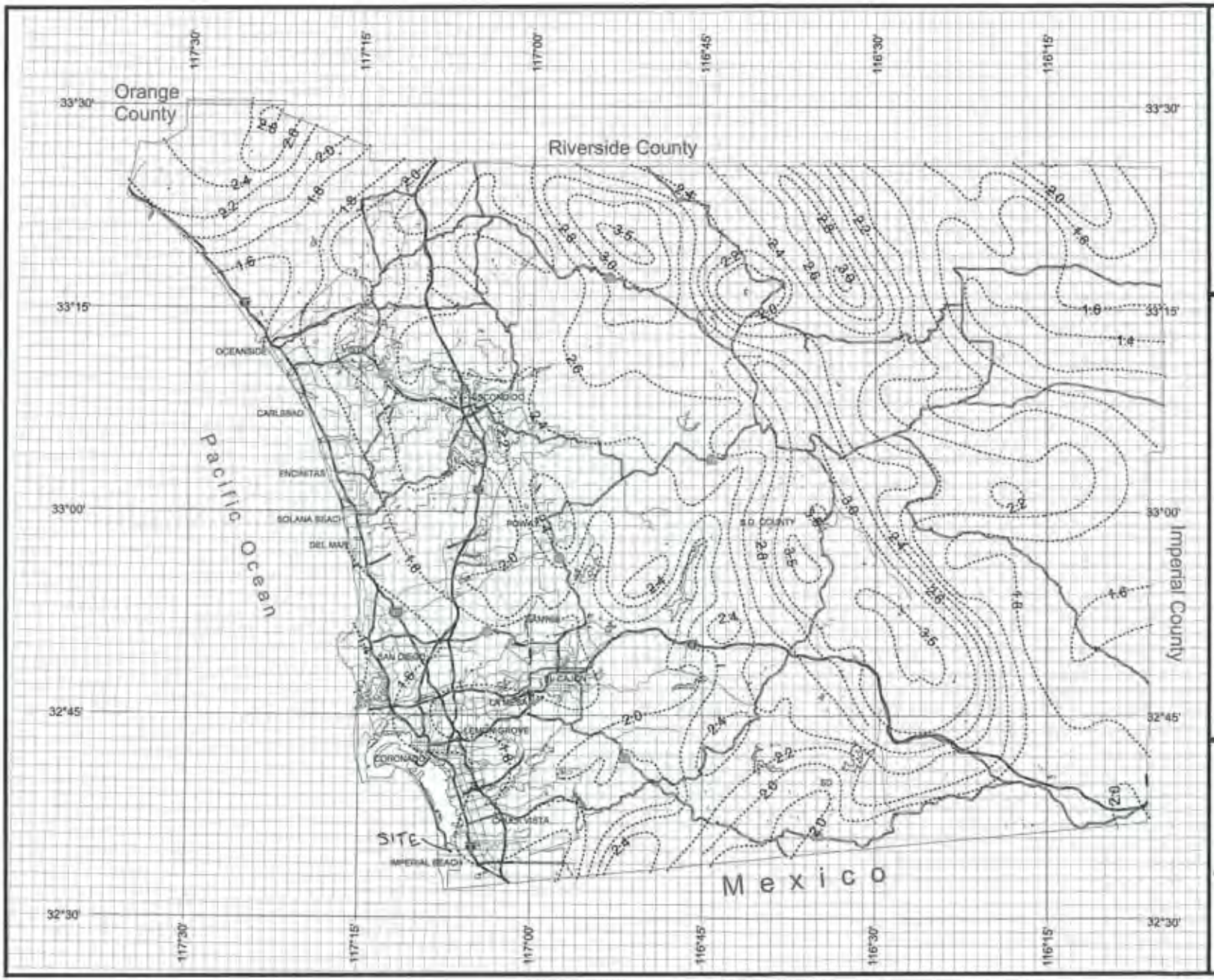
3 0 3 Miles

# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**10 Year Rainfall Event - 6 Hours**

Isopluvial (inches)

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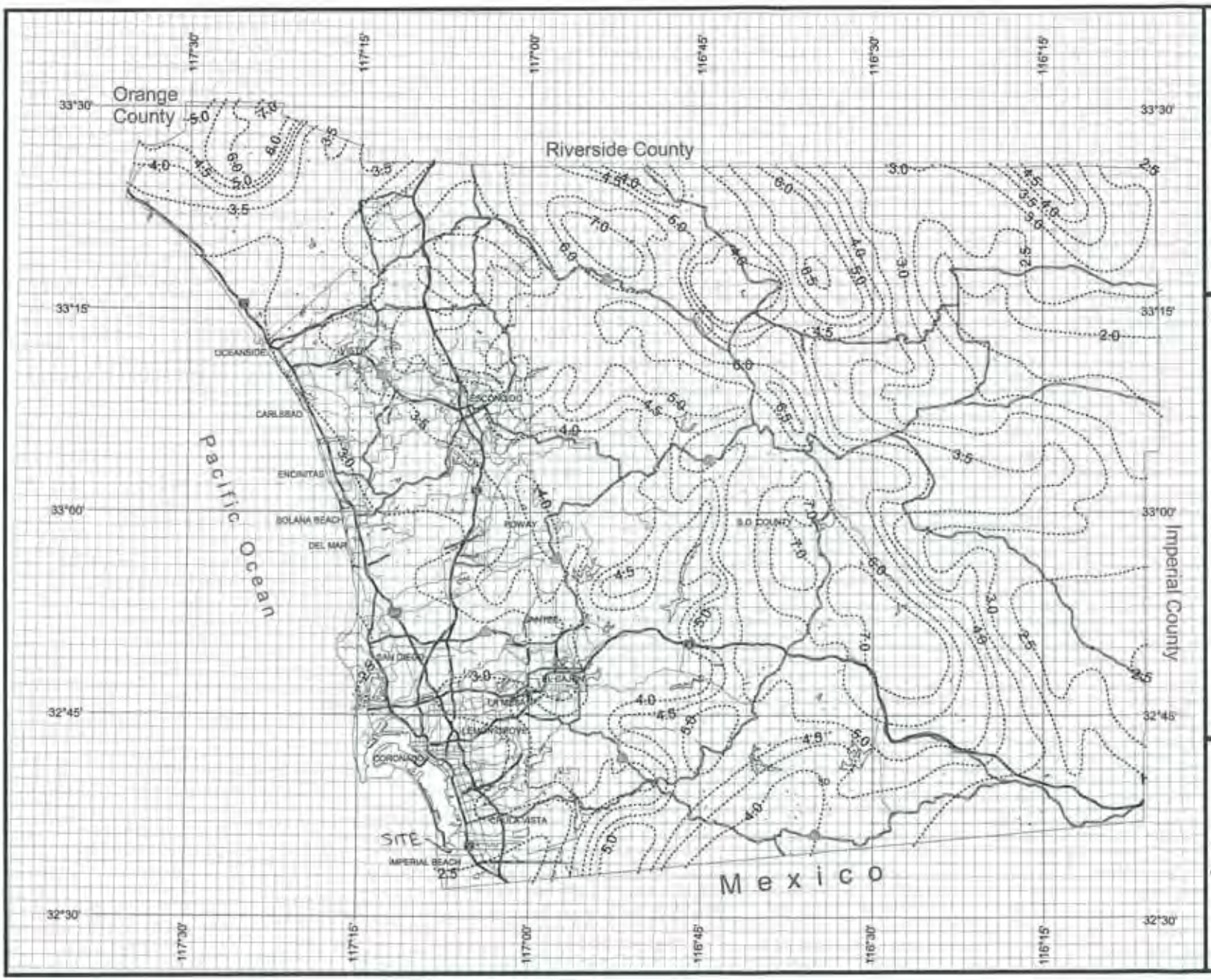


# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**10 Year Rainfall Event - 24 Hours**

Isopluvial (inches)

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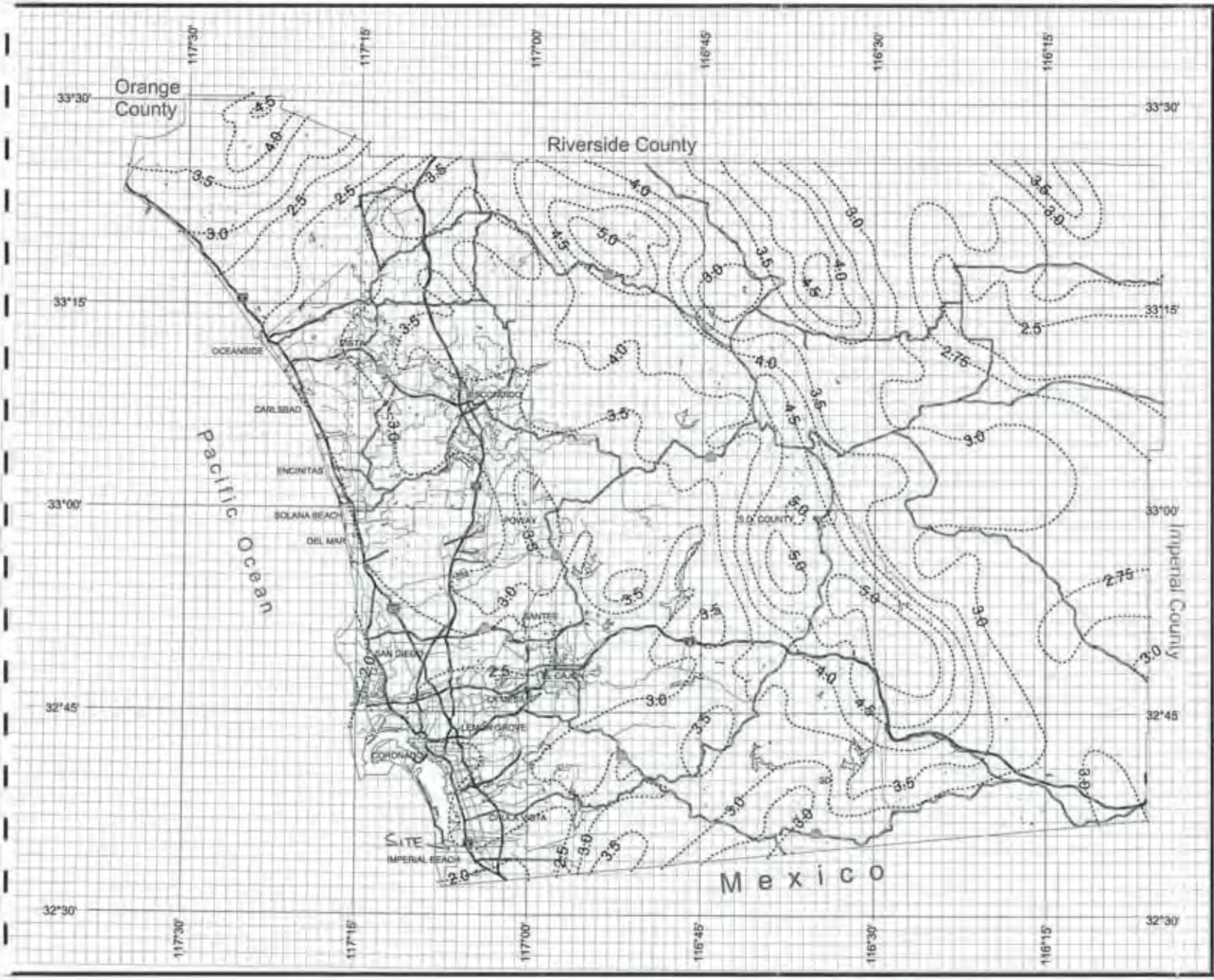
# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**100 Year Rainfall Event - 6 Hours**

Isopluvial (inches)

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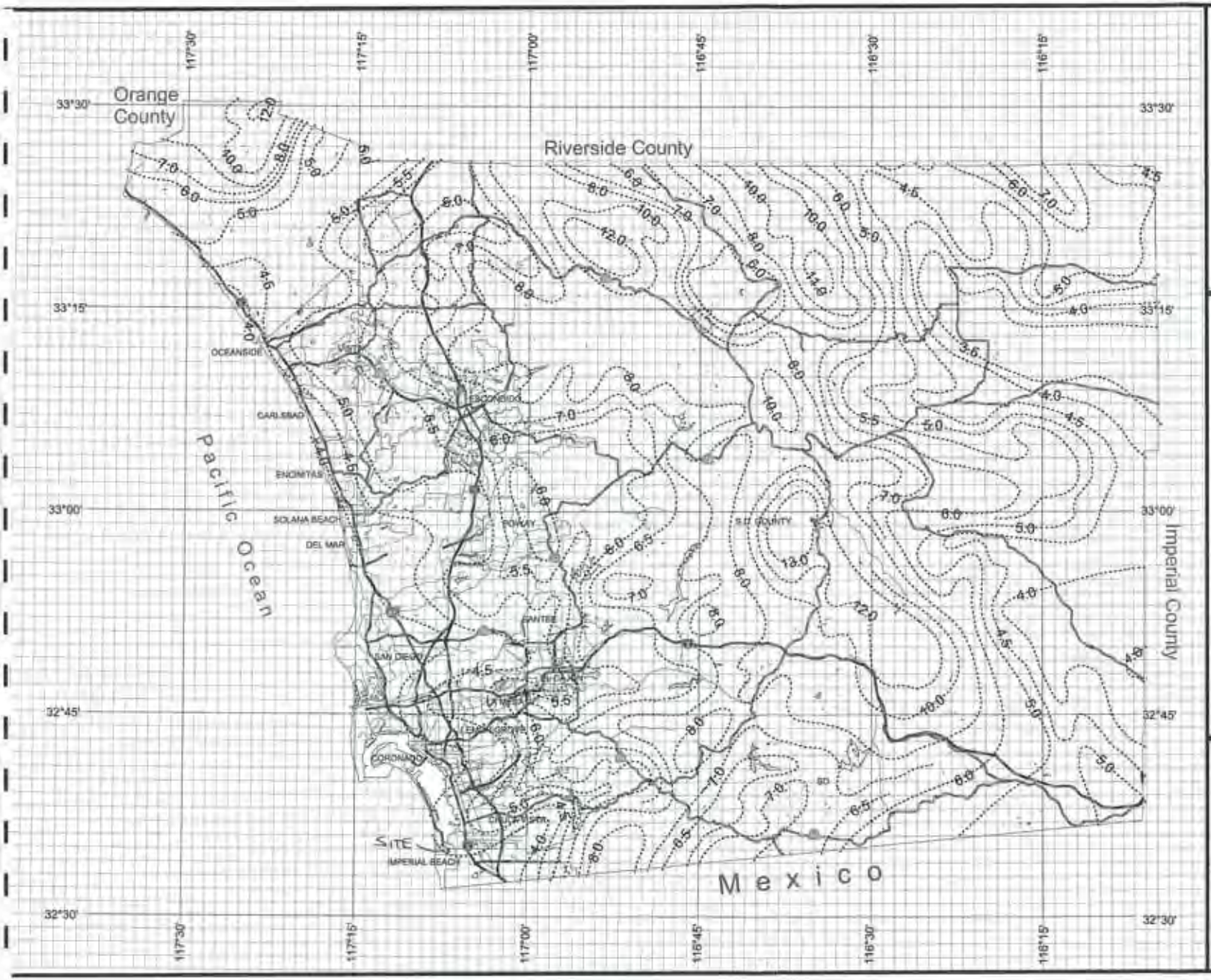
3 0 3 Miles

# County of San Diego Hydrology Manual

*Rainfall Isopluvials*

**100 Year Rainfall Event - 24 Hours**

Isopluvial (inches)

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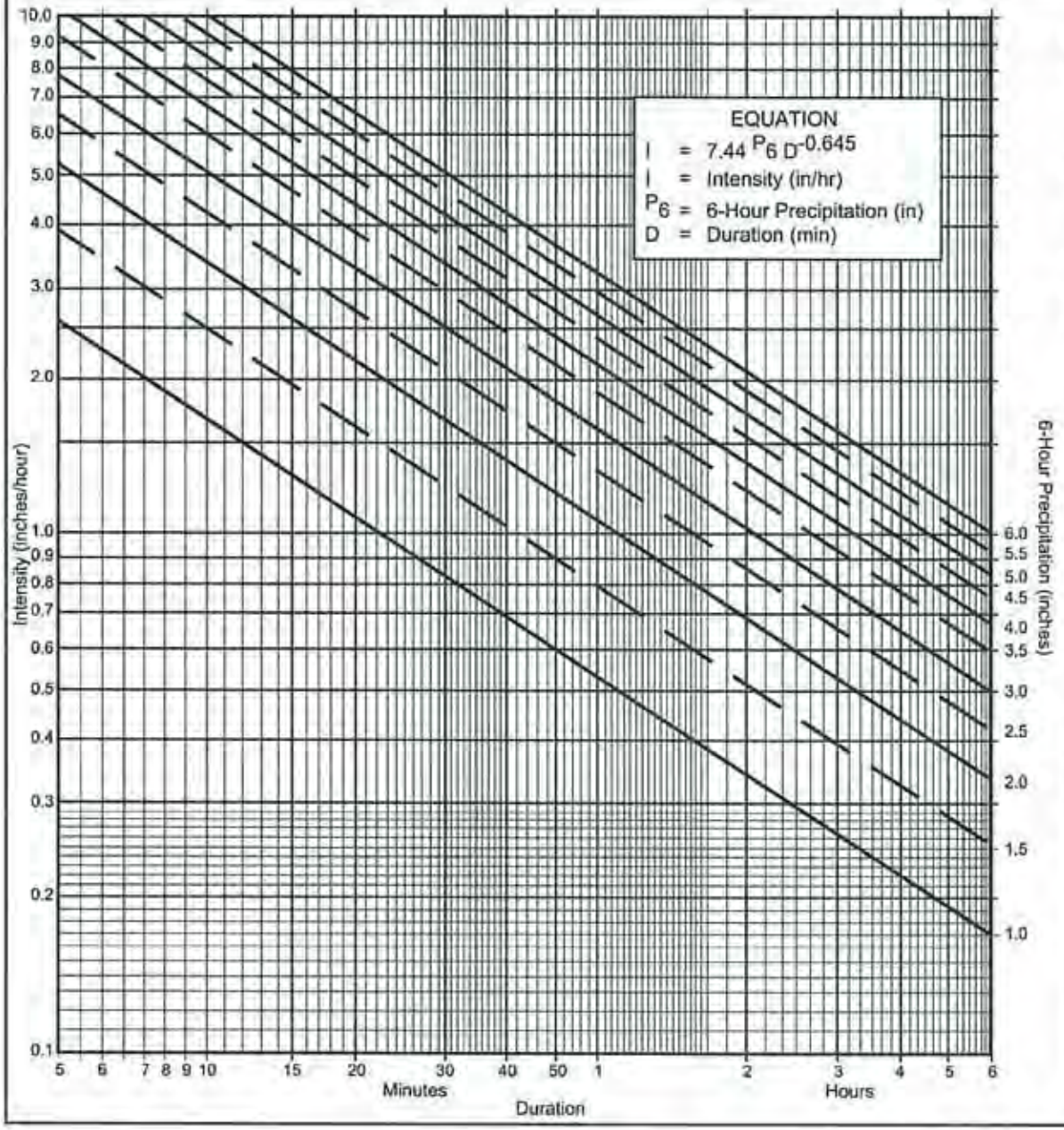



**Directions for Application:**

(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 5 year

(b) $P_6$ = 1.35 in., $P_{24}$ = 2.2, $\frac{P_6}{P_{24}}$ = 61.4 %(2)

(c) Adjusted $P_6$(2) = 1.35 in.

(d) $t_x$ = _____ min.

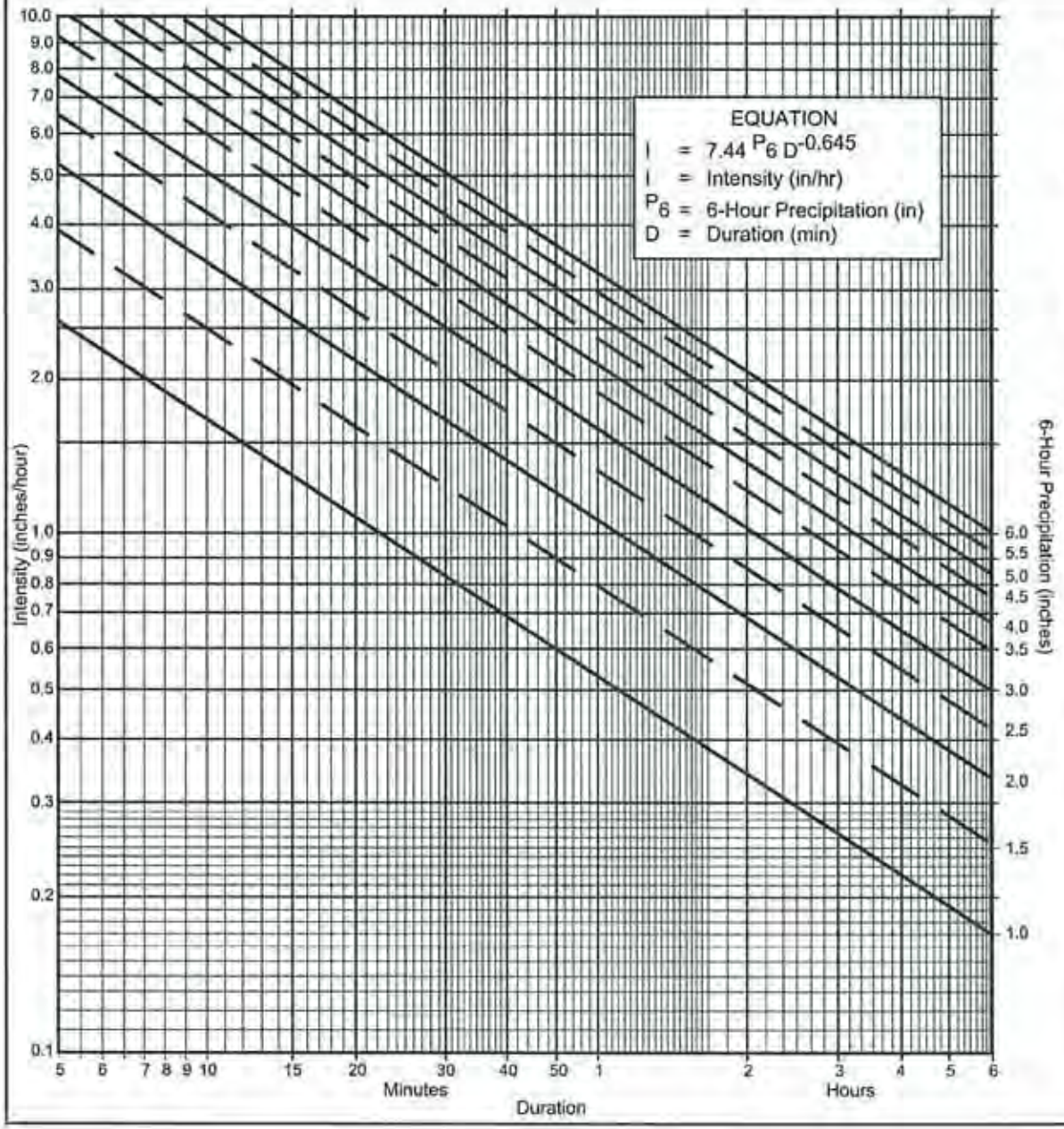
(e) I = _____ in./hr.

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**




**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 10 year

(b) $P_6$ = 1.6 in., $P_{24}$ = 2.7, $\frac{P_6}{P_{24}}$ = 59.3 %(2)

(c) Adjusted $P_6$(2) = 1.6 in.

(d) $t_x$ = _____ min.

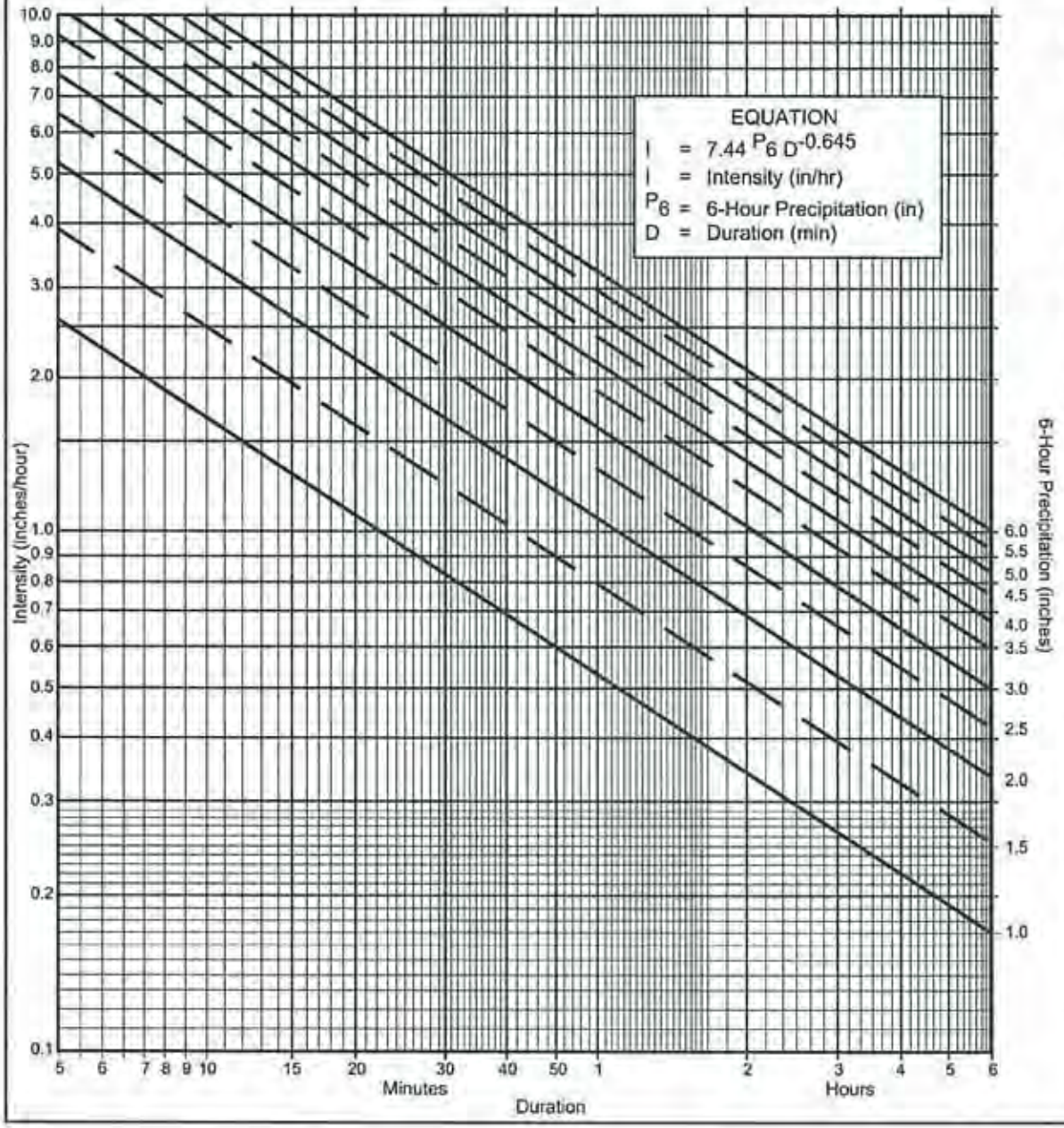
(e) I = _____ in./hr.

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

| P6 / Duration | 1 | 1.5 | 2 | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 | 5.5 | 6 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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




**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) $P_6$ = 2.4 in., $P_{24}$ = 4.0, $\frac{P_6}{P_{24}}$ = 60 %(2)

(c) Adjusted $P_6^{(2)}$ = 2.4 in.

(d) $t_x$ = _____ min.

(e) I = _____ in./hr.

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**

## 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

Hydrologic Soil Group—San Diego County Area, California
(9th and Palm)

## MAP LEGEND

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

**Soils**
- Soil Map Units

**Soil Ratings**
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

**Political Features**
- Cities

**Water Features**
- Streams and Canals

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

## MAP INFORMATION

Map Scale: 1:1,570 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

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

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

Date(s) aerial images were photographed: 6/7/2005

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.

# Hydrologic Soil Group

| Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638) | | | | |
|---|---|---|---|---|
| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
| HuC | Huerhuero-Urban land complex, 2 to 9 percent slopes | D | 5.9 | 100.0% |
| Totals for Area of Interest | | | 5.9 | 100.0% |

## Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

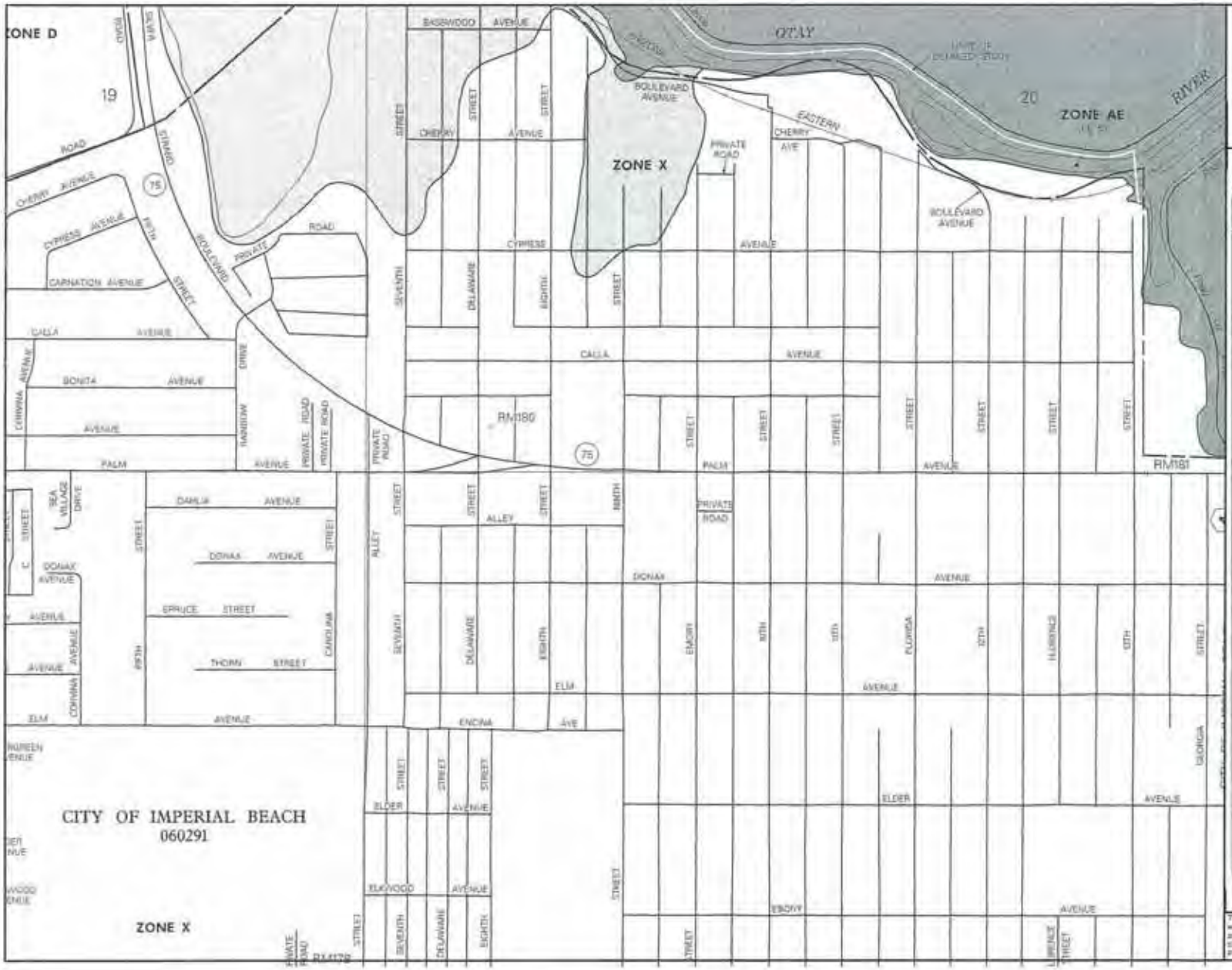
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* *None Specified*

*Tie-break Rule:* Higher




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

# APPENDIX 2

## Existing Conditions Rational Method Computer Output

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

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                       2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2010 Advanced Engineering Software (aes)
            Ver. 17.0 Release Date: 07/01/2010  License ID 1509

                          Analysis prepared by:


 ************************** DESCRIPTION OF STUDY **************************
* 9TH AND PALM PDC JOB 3813                                               *
* EXISTING CONDITIONS                                                     *
* SYSTEM 100                                                              *
 **************************************************************************

  FILE NAME: S100E100.DAT
  TIME/DATE OF STUDY: 19:06 07/04/2011
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.400
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   32.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**********************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
======================================================================
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    51.00
 UPSTREAM ELEVATION(FEET) =     33.00
 DOWNSTREAM ELEVATION(FEET) =     32.50
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.858
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.157
 SUBAREA RUNOFF(CFS) =      0.44
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   32.50  DOWNSTREAM ELEVATION(FEET) =   20.00
 STREET LENGTH(FEET) =  1167.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.43
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.39
   HALFSTREET FLOOD WIDTH(FEET) =   13.37
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.74
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.08
 STREET FLOW TRAVEL TIME(MIN.) =   7.10   Tc(MIN.) =   13.96
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.260
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =   10.42      SUBAREA RUNOFF(CFS) =   19.37
 TOTAL AREA(ACRES) =       10.6        PEAK FLOW RATE(CFS) =      19.64

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.47   HALFSTREET FLOOD WIDTH(FEET) =  17.20
 FLOW VELOCITY(FEET/SEC.) =  3.19   DEPTH*VELOCITY(FT*FT/SEC.) =   1.50
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L = 1167.0 FT WITH ELEVATION-DROP =  12.5 FT, IS   28.7 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    105.00
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1218.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
```

```
 UPSTREAM ELEVATION(FEET) =   20.00  DOWNSTREAM ELEVATION(FEET) =   16.50
 STREET LENGTH(FEET) =   528.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      21.25
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.63
   HALFSTREET FLOOD WIDTH(FEET) =   31.95
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.05
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.93
 STREET FLOW TRAVEL TIME(MIN.) =   2.89   Tc(MIN.) =   16.85
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.888
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    1.95      SUBAREA RUNOFF(CFS) =    3.21
 TOTAL AREA(ACRES) =       12.5       PEAK FLOW RATE(CFS) =      20.61

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.63   HALFSTREET FLOOD WIDTH(FEET) =  31.33
 FLOW VELOCITY(FEET/SEC.) =  3.04   DEPTH*VELOCITY(FT*FT/SEC.) =   1.91
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =    1746.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.888
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5700
 SUBAREA AREA(ACRES) =    6.02   SUBAREA RUNOFF(CFS) =    9.91
 TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      30.52
 TC(MIN.) =   16.85

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    122.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    11.68  DOWNSTREAM(FEET) =    11.17
 FLOW LENGTH(FEET) =   159.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.62
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      30.52
 PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =   17.58
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1905.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   17.58
 RAINFALL INTENSITY(INCH/HR) =   2.81
 TOTAL STREAM AREA(ACRES) =    18.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     30.52

****************************************************************************
 FLOW PROCESS FROM NODE    117.00 TO NODE    119.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =     28.50
 DOWNSTREAM ELEVATION(FEET) =     28.00
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.935
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    58.08
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.694
 SUBAREA RUNOFF(CFS) =      0.24
 TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
 FLOW PROCESS FROM NODE    119.00 TO NODE    120.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   28.00  DOWNSTREAM ELEVATION(FEET) =   19.00
 STREET LENGTH(FEET) =   631.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
```

```
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.77
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    8.19
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.39
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.69
 STREET FLOW TRAVEL TIME(MIN.) =   4.40   Tc(MIN.) =   12.33
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.533
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    3.45      SUBAREA RUNOFF(CFS) =    6.95
 TOTAL AREA(ACRES) =       3.5       PEAK FLOW RATE(CFS) =       7.13

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  10.81
 FLOW VELOCITY(FEET/SEC.) =  2.77   DEPTH*VELOCITY(FT*FT/SEC.) =   0.95
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    120.00 =     696.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    14.00  DOWNSTREAM(FEET) =    11.17
 FLOW LENGTH(FEET) =   136.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.29
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.13
 PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   12.60
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    122.00 =     832.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   12.60
 RAINFALL INTENSITY(INCH/HR) =   3.48
 TOTAL STREAM AREA(ACRES) =     3.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.13

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       30.52    17.58        2.810         18.54
    2        7.13    12.60        3.483          3.54
```

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc       INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1        29.01    12.60       3.483
    2        36.27    17.58       2.810

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      36.27   Tc(MIN.) =   17.58
 TOTAL AREA(ACRES) =       22.1
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1905.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    128.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    11.17  DOWNSTREAM(FEET) =    10.10
 FLOW LENGTH(FEET) =   439.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.15
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      36.27
 PIPE TRAVEL TIME(MIN.) =   2.32    Tc(MIN.) =   19.90
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    2344.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    122.00 TO NODE    128.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   19.90
 RAINFALL INTENSITY(INCH/HR) =   2.59
 TOTAL STREAM AREA(ACRES) =    22.08
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     36.27

****************************************************************************
 FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
 UPSTREAM ELEVATION(FEET) =     22.00
 DOWNSTREAM ELEVATION(FEET) =     21.50
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.180
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
```

```
          THE MAXIMUM OVERLAND FLOW LENGTH =    53.75
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.603
SUBAREA RUNOFF(CFS) =      0.39
TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   21.50  DOWNSTREAM ELEVATION(FEET) =   13.50
 STREET LENGTH(FEET) =   880.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.22
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.38
   HALFSTREET FLOOD WIDTH(FEET) =   12.59
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.41
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.91
 STREET FLOW TRAVEL TIME(MIN.) =   6.07   Tc(MIN.) =   14.25
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.217
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    8.35      SUBAREA RUNOFF(CFS) =   15.31
 TOTAL AREA(ACRES) =       8.5       PEAK FLOW RATE(CFS) =      15.59

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.45   HALFSTREET FLOOD WIDTH(FEET) =  16.26
 FLOW VELOCITY(FEET/SEC.) =  2.82   DEPTH*VELOCITY(FT*FT/SEC.) =   1.27
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L =  880.0 FT WITH ELEVATION-DROP =   8.0 FT, IS   22.6 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    128.00
 LONGEST FLOWPATH FROM NODE    124.00 TO NODE    128.00 =     960.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
```

```
 TIME OF CONCENTRATION(MIN.) =   14.25
 RAINFALL INTENSITY(INCH/HR) =   3.22
 TOTAL STREAM AREA(ACRES) =      8.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.59

 ** CONFLUENCE DATA **
 STREAM      RUNOFF        Tc       INTENSITY      AREA
 NUMBER       (CFS)      (MIN.)   (INCH/HOUR)    (ACRE)
    1         36.27     19.90        2.594         22.08
    2         15.59     14.25        3.217          8.50

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF        Tc       INTENSITY
 NUMBER       (CFS)      (MIN.)   (INCH/HOUR)
    1         44.84     14.25        3.217
    2         48.84     19.90        2.594

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      48.84   Tc(MIN.) =   19.90
 TOTAL AREA(ACRES) =       30.6
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    2344.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    10.10  DOWNSTREAM(FEET) =     9.47
 FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.46
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =      48.84
 PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =   20.94
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    134.00 =    2559.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   20.94
 RAINFALL INTENSITY(INCH/HR) =   2.51
 TOTAL STREAM AREA(ACRES) =    30.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     48.84

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
```

```
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    86.00
 UPSTREAM ELEVATION(FEET) =     14.00
 DOWNSTREAM ELEVATION(FEET) =     13.00
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.450
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    67.44
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.889
 SUBAREA RUNOFF(CFS) =      0.22
 TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   13.00  DOWNSTREAM ELEVATION(FEET) =   12.00
 STREET LENGTH(FEET) =   153.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.64
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.26
   HALFSTREET FLOOD WIDTH(FEET) =    6.54
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.50
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.39
 STREET FLOW TRAVEL TIME(MIN.) =   1.70   Tc(MIN.) =    9.15
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.283
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    1.16      SUBAREA RUNOFF(CFS) =    2.83
 TOTAL AREA(ACRES) =       1.2        PEAK FLOW RATE(CFS) =       3.03

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.76
 FLOW VELOCITY(FEET/SEC.) =  1.71   DEPTH*VELOCITY(FT*FT/SEC.) =   0.52
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     239.00 FEET.
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.15
 RAINFALL INTENSITY(INCH/HR) =   4.28
 TOTAL STREAM AREA(ACRES) =     1.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.03

 ** CONFLUENCE DATA **
 STREAM      RUNOFF        Tc       INTENSITY       AREA
 NUMBER       (CFS)      (MIN.)    (INCH/HOUR)     (ACRE)
    1        48.84     20.94         2.511          30.58
    2         3.03      9.15         4.283           1.24

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        31.66      9.15         4.283
    2        50.62     20.94         2.511

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      50.62   Tc(MIN.) =   20.94
 TOTAL AREA(ACRES) =       31.8
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    134.00 =    2559.00 FEET.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 FLOW PROCESS FROM NODE    134.00 TO NODE    145.00 IS CODE =  41
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     9.47  DOWNSTREAM(FEET) =     9.15
 FLOW LENGTH(FEET) =    46.00   MANNING'S N =  0.024
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.89
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =      50.62
 PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   21.20
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    145.00 =    2605.00 FEET.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =  41
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     9.15  DOWNSTREAM(FEET) =     8.66
```

```
 FLOW LENGTH(FEET) =   205.80   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.12
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      50.62
 PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =   22.30
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2810.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   22.30
 RAINFALL INTENSITY(INCH/HR) =   2.41
 TOTAL STREAM AREA(ACRES) =    31.82
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     50.62

****************************************************************************
 FLOW PROCESS FROM NODE    146.00 TO NODE    147.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    68.00
 UPSTREAM ELEVATION(FEET) =     28.50
 DOWNSTREAM ELEVATION(FEET) =     27.90
 ELEVATION DIFFERENCE(FEET) =      0.60
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.798
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    61.47
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.747
 SUBAREA RUNOFF(CFS) =      0.46
 TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.46

****************************************************************************
 FLOW PROCESS FROM NODE    147.00 TO NODE    150.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   27.90  DOWNSTREAM ELEVATION(FEET) =   11.00
 STREET LENGTH(FEET) =   744.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020
```

```
 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.77
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.35
   HALFSTREET FLOOD WIDTH(FEET) =   11.06
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.56
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.24
 STREET FLOW TRAVEL TIME(MIN.) =   3.49   Tc(MIN.) =   11.29
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.740
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    4.00      SUBAREA RUNOFF(CFS) =    8.53
 TOTAL AREA(ACRES) =       4.2        PEAK FLOW RATE(CFS) =       8.89

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.41   HALFSTREET FLOOD WIDTH(FEET) =  14.23
 FLOW VELOCITY(FEET/SEC.) =  4.15   DEPTH*VELOCITY(FT*FT/SEC.) =   1.70
 LONGEST FLOWPATH FROM NODE    146.00 TO NODE    150.00 =     812.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.740
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6660
 SUBAREA AREA(ACRES) =    2.60   SUBAREA RUNOFF(CFS) =    7.97
 TOTAL AREA(ACRES) =       6.8   TOTAL RUNOFF(CFS) =      16.87
 TC(MIN.) =   11.29

****************************************************************************
 FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.29
 RAINFALL INTENSITY(INCH/HR) =   3.74
 TOTAL STREAM AREA(ACRES) =     6.77
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.87

 ** CONFLUENCE DATA **
 STREAM      RUNOFF        Tc       INTENSITY      AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)    (ACRE)
     1        50.62     22.30         2.410        31.82
     2        16.87     11.29         3.740         6.77
```

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc       INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       49.48    11.29       3.740
     2       61.48    22.30       2.410

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      61.48   Tc(MIN.) =   22.30
 TOTAL AREA(ACRES) =       38.6
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2810.80 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       38.6  TC(MIN.) =     22.30
 PEAK FLOW RATE(CFS)   =      61.48
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

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

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
       (c) Copyright 1982-2010 Advanced Engineering Software (aes)
           Ver. 17.0 Release Date: 07/01/2010  License ID 1509

                          Analysis prepared by:
```

```
 ************************** DESCRIPTION OF STUDY **************************
* 9TH AND PALM PDC JOB 3813                                               *
* EXISTING CONDITIONS                                                     *
* SYSTEM 200                                                              *
 *************************************************************************

  FILE NAME: S200E100.DAT
  TIME/DATE OF STUDY: 15:40 10/10/2011
-------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.400
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ==================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   32.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**************************************************************************
  FLOW PROCESS FROM NODE    252.00 TO NODE    253.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==========================================================================
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    77.00
 UPSTREAM ELEVATION(FEET) =     31.00
 DOWNSTREAM ELEVATION(FEET) =     30.00
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.289
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    69.48
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.959
 SUBAREA RUNOFF(CFS) =      0.31
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
 FLOW PROCESS FROM NODE    253.00 TO NODE    254.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   30.00  DOWNSTREAM ELEVATION(FEET) =   26.00
 STREET LENGTH(FEET) =   647.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.29
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.37
   HALFSTREET FLOOD WIDTH(FEET) =   12.43
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.98
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
 STREET FLOW TRAVEL TIME(MIN.) =   5.45   Tc(MIN.) =   12.74
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.460
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    2.96      SUBAREA RUNOFF(CFS) =    5.84
 TOTAL AREA(ACRES) =       3.1        PEAK FLOW RATE(CFS) =       6.05

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.44   HALFSTREET FLOOD WIDTH(FEET) =  15.87
 FLOW VELOCITY(FEET/SEC.) =  2.30   DEPTH*VELOCITY(FT*FT/SEC.) =   1.02
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    254.00 =     724.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    254.00 TO NODE    255.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
================================================================================
 UPSTREAM ELEVATION(FEET) =   26.00  DOWNSTREAM ELEVATION(FEET) =   19.90
 STREET LENGTH(FEET) =   710.50   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      12.88
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.52
   HALFSTREET FLOOD WIDTH(FEET) =   21.17
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.14
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.65
 STREET FLOW TRAVEL TIME(MIN.) =   3.78   Tc(MIN.) =   16.51
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.926
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    8.16      SUBAREA RUNOFF(CFS) =   13.61
 TOTAL AREA(ACRES) =      11.2        PEAK FLOW RATE(CFS) =      18.73

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.59   HALFSTREET FLOOD WIDTH(FEET) =  27.27
 FLOW VELOCITY(FEET/SEC.) =  3.36   DEPTH*VELOCITY(FT*FT/SEC.) =   1.97
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L =  710.5 FT WITH ELEVATION-DROP =   6.1 FT, IS   22.0 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    255.00
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    255.00 =    1434.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    255.00 TO NODE    260.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
================================================================================
 UPSTREAM ELEVATION(FEET) =   19.90  DOWNSTREAM ELEVATION(FEET) =   11.30
 STREET LENGTH(FEET) =   494.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     22.27
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.56
  HALFSTREET FLOOD WIDTH(FEET) =   24.30
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.62
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.57
 STREET FLOW TRAVEL TIME(MIN.) =   1.78   Tc(MIN.) =   18.29
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.739
 NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7900
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  94
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.620
 SUBAREA AREA(ACRES) =    3.27      SUBAREA RUNOFF(CFS) =    7.08
 TOTAL AREA(ACRES) =       14.5        PEAK FLOW RATE(CFS) =      24.61

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.57   HALFSTREET FLOOD WIDTH(FEET) =  26.02
 FLOW VELOCITY(FEET/SEC.) =  4.69   DEPTH*VELOCITY(FT*FT/SEC.) =   2.69
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L =  494.0 FT WITH ELEVATION-DROP =   8.6 FT, IS   16.3 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    260.00
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    260.00 =    1928.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    256.00 TO NODE    260.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.739
 NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7900
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  94
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6852
 SUBAREA AREA(ACRES) =    9.08   SUBAREA RUNOFF(CFS) =   19.65
 TOTAL AREA(ACRES) =       23.6   TOTAL RUNOFF(CFS) =      44.26
 TC(MIN.) =   18.29

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    264.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    11.34  DOWNSTREAM(FEET) =    10.58
 FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.12
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      44.26
 PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   18.47
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    264.00 =    1993.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    264.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
================================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   18.47
 RAINFALL INTENSITY(INCH/HR) =   2.72
 TOTAL STREAM AREA(ACRES) =    23.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     44.26

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 FLOW PROCESS FROM NODE    261.00 TO NODE    262.00 IS CODE =  21
--------------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
================================================================================
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    53.00
 UPSTREAM ELEVATION(FEET) =     18.60
 DOWNSTREAM ELEVATION(FEET) =     18.30
 ELEVATION DIFFERENCE(FEET) =      0.30
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.585
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    51.32
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.44
 TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.44

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 FLOW PROCESS FROM NODE    262.00 TO NODE    264.00 IS CODE =  62
--------------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
================================================================================
 UPSTREAM ELEVATION(FEET) =   18.30  DOWNSTREAM ELEVATION(FEET) =   15.80
 STREET LENGTH(FEET) =   412.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.81
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.32
   HALFSTREET FLOOD WIDTH(FEET) =    9.66
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.72
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
 STREET FLOW TRAVEL TIME(MIN.) =   3.99   Tc(MIN.) =    7.58
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.836
GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) =  97
AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
SUBAREA AREA(ACRES) =    0.64     SUBAREA RUNOFF(CFS) =    2.69
TOTAL AREA(ACRES) =       0.7       PEAK FLOW RATE(CFS) =       3.03

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.04
FLOW VELOCITY(FEET/SEC.) =  1.93   DEPTH*VELOCITY(FT*FT/SEC.) =   0.71
LONGEST FLOWPATH FROM NODE    261.00 TO NODE    264.00 =     465.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    262.00 TO NODE    264.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =    7.58
RAINFALL INTENSITY(INCH/HR) =   4.84
TOTAL STREAM AREA(ACRES) =     0.72
PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.03

** CONFLUENCE DATA **
STREAM     RUNOFF       Tc      INTENSITY      AREA
NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       44.26    18.47        2.722         23.58
    2        3.03     7.58        4.836          0.72

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

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       21.19     7.58       4.836
    2       45.96    18.47       2.722

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      45.96   Tc(MIN.) =   18.47
TOTAL AREA(ACRES) =       24.3
LONGEST FLOWPATH FROM NODE    252.00 TO NODE    264.00 =    1993.50 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    264.00 TO NODE    270.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    10.58  DOWNSTREAM(FEET) =     8.55
FLOW LENGTH(FEET) =   325.00   MANNING'S N =  0.013
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.47
(PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
```

```
 AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      45.96
 PIPE TRAVEL TIME(MIN.) =   1.21    Tc(MIN.) =   19.68
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    270.00 =    2318.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    264.00 TO NODE    270.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   19.68
 RAINFALL INTENSITY(INCH/HR) =   2.61
 TOTAL STREAM AREA(ACRES) =    24.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     45.96

****************************************************************************
 FLOW PROCESS FROM NODE    266.00 TO NODE    269.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   375.00
 UPSTREAM ELEVATION(FEET) =     26.60
 DOWNSTREAM ELEVATION(FEET) =     19.30
 ELEVATION DIFFERENCE(FEET) =      7.30
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.764
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    69.47
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.66
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.66

****************************************************************************
 FLOW PROCESS FROM NODE    267.00 TO NODE    269.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8700
 SUBAREA AREA(ACRES) =    0.15   SUBAREA RUNOFF(CFS) =    0.83
 TOTAL AREA(ACRES) =       0.3   TOTAL RUNOFF(CFS) =      1.49
 TC(MIN.) =    2.76

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
```

```
------------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.323
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8252
 SUBAREA AREA(ACRES) =    2.31   SUBAREA RUNOFF(CFS) =   11.98
 TOTAL AREA(ACRES) =       2.6   TOTAL RUNOFF(CFS) =     13.46
 TC(MIN.) =    2.76

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 FLOW PROCESS FROM NODE    266.00 TO NODE    269.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    2.76
 RAINFALL INTENSITY(INCH/HR) =   6.32
 TOTAL STREAM AREA(ACRES) =     2.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     13.46

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       45.96    19.68        2.613         24.30
    2       13.46     2.76        6.323          2.58

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       32.46     2.76        6.323
    2       51.53    19.68        2.613

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      51.53   Tc(MIN.) =   19.68
 TOTAL AREA(ACRES) =       26.9
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    269.00 =    2318.50 FEET.
==============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       26.9  TC(MIN.) =     19.68
 PEAK FLOW RATE(CFS)   =      51.53
==============================================================================
==============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

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

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
       (c) Copyright 1982-2010 Advanced Engineering Software (aes)
           Ver. 17.0 Release Date: 07/01/2010  License ID 1509

                          Analysis prepared by:


 ************************** DESCRIPTION OF STUDY **************************
* 9TH AND PALM PDC JOB 3813                                               *
* EXISTING CONDITIONS                                                     *
* SYSTEM 100                                                              *
 **************************************************************************

  FILE NAME: S100E10.DAT
  TIME/DATE OF STUDY: 16:14 10/10/2011
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ====  =====  ======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   32.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**********************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    102.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
======================================================================
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    51.00
 UPSTREAM ELEVATION(FEET) =     33.00
 DOWNSTREAM ELEVATION(FEET) =     32.50
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.858
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.438
 SUBAREA RUNOFF(CFS) =      0.29
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   32.50  DOWNSTREAM ELEVATION(FEET) =   20.00
 STREET LENGTH(FEET) =  1167.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.74
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.35
   HALFSTREET FLOOD WIDTH(FEET) =   11.14
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.48
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.87
 STREET FLOW TRAVEL TIME(MIN.) =   7.84   Tc(MIN.) =   14.70
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.103
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =   10.42      SUBAREA RUNOFF(CFS) =   12.49
 TOTAL AREA(ACRES) =       10.6        PEAK FLOW RATE(CFS) =      12.67

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.46
 FLOW VELOCITY(FEET/SEC.) =  2.87   DEPTH*VELOCITY(FT*FT/SEC.) =   1.19
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1218.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   20.00  DOWNSTREAM ELEVATION(FEET) =   16.50
 STREET LENGTH(FEET) =   528.00   CURB HEIGHT(INCHES) =  6.0
```

```
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.70
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.56
   HALFSTREET FLOOD WIDTH(FEET) =   24.30
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.85
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.58
 STREET FLOW TRAVEL TIME(MIN.) =   3.09   Tc(MIN.) =   17.79
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.859
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    1.95      SUBAREA RUNOFF(CFS) =    2.07
 TOTAL AREA(ACRES) =       12.5        PEAK FLOW RATE(CFS) =      13.27

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.55   HALFSTREET FLOOD WIDTH(FEET) =  23.67
 FLOW VELOCITY(FEET/SEC.) =  2.84   DEPTH*VELOCITY(FT*FT/SEC.) =   1.56
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =    1746.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================

   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.859
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5700
 SUBAREA AREA(ACRES) =    6.02   SUBAREA RUNOFF(CFS) =    6.38
 TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      19.65
 TC(MIN.) =  17.79

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    122.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    11.68  DOWNSTREAM(FEET) =    11.17
 FLOW LENGTH(FEET) =   159.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.62
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
```

```
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      19.65
 PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =   18.53
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1905.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   18.53
 RAINFALL INTENSITY(INCH/HR) =   1.81
 TOTAL STREAM AREA(ACRES) =    18.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.65

****************************************************************************
 FLOW PROCESS FROM NODE    117.00 TO NODE    119.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =     28.50
 DOWNSTREAM ELEVATION(FEET) =     28.00
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.935
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    58.08
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.130
 SUBAREA RUNOFF(CFS) =      0.16
 TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.16

****************************************************************************
 FLOW PROCESS FROM NODE    119.00 TO NODE    120.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   28.00  DOWNSTREAM ELEVATION(FEET) =   19.00
 STREET LENGTH(FEET) =   631.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.46
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.26
  HALFSTREET FLOOD WIDTH(FEET) =    6.63
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.21
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.57
 STREET FLOW TRAVEL TIME(MIN.) =   4.76   Tc(MIN.) =   12.70
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.311
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    3.45      SUBAREA RUNOFF(CFS) =    4.54
 TOTAL AREA(ACRES) =       3.5        PEAK FLOW RATE(CFS) =       4.66

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   8.92
 FLOW VELOCITY(FEET/SEC.) =  2.55   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    120.00 =     696.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    14.00  DOWNSTREAM(FEET) =    11.17
 FLOW LENGTH(FEET) =   136.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.40
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       4.66
 PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =   13.01
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    122.00 =     832.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   13.01
 RAINFALL INTENSITY(INCH/HR) =   2.28
 TOTAL STREAM AREA(ACRES) =     3.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.66

 ** CONFLUENCE DATA **
 STREAM      RUNOFF        Tc      INTENSITY      AREA
 NUMBER       (CFS)      (MIN.)   (INCH/HOUR)    (ACRE)
     1        19.65     18.53        1.811         18.54
     2         4.66     13.01        2.275          3.54

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

```
** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc       INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       18.46    13.01       2.275
    2       23.36    18.53       1.811

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      23.36   Tc(MIN.) =   18.53
TOTAL AREA(ACRES) =       22.1
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1905.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    122.00 TO NODE    128.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    11.17  DOWNSTREAM(FEET) =    10.10
FLOW LENGTH(FEET) =   439.00   MANNING'S N =  0.013
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.15
(PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
 AT DEPTH = 0.94 * DIAMETER)
GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      23.36
PIPE TRAVEL TIME(MIN.) =   2.32    Tc(MIN.) =   20.85
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    2344.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    122.00 TO NODE    128.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   20.85
RAINFALL INTENSITY(INCH/HR) =   1.68
TOTAL STREAM AREA(ACRES) =    22.08
PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.36

****************************************************************************
FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) =  87
INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
UPSTREAM ELEVATION(FEET) =     22.00
DOWNSTREAM ELEVATION(FEET) =     21.50
ELEVATION DIFFERENCE(FEET) =      0.50
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.180
WARNING:  INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    53.75
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.069
SUBAREA RUNOFF(CFS) =      0.26
TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   21.50  DOWNSTREAM ELEVATION(FEET) =   13.50
 STREET LENGTH(FEET) =   880.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.35
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.34
   HALFSTREET FLOOD WIDTH(FEET) =   10.48
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.20
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.74
 STREET FLOW TRAVEL TIME(MIN.) =   6.67   Tc(MIN.) =   14.85
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.089
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    8.35      SUBAREA RUNOFF(CFS) =    9.94
 TOTAL AREA(ACRES) =       8.5       PEAK FLOW RATE(CFS) =      10.12

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.68
 FLOW VELOCITY(FEET/SEC.) =  2.54   DEPTH*VELOCITY(FT*FT/SEC.) =   1.02
 LONGEST FLOWPATH FROM NODE    124.00 TO NODE    128.00 =     960.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   14.85
 RAINFALL INTENSITY(INCH/HR) =   2.09
 TOTAL STREAM AREA(ACRES) =     8.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.12

 ** CONFLUENCE DATA **
```

```
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1        23.36    20.85        1.679         22.08
    2        10.12    14.85        2.089          8.50

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
    1        28.89    14.85        2.089
    2        31.49    20.85        1.679

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      31.49   Tc(MIN.) =   20.85
 TOTAL AREA(ACRES) =       30.6
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    2344.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    10.10  DOWNSTREAM(FEET) =     9.47
 FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.46
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =      31.49
 PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =   21.88
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    134.00 =    2559.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   21.88
 RAINFALL INTENSITY(INCH/HR) =   1.63
 TOTAL STREAM AREA(ACRES) =    30.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     31.49

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    86.00
```

```
 UPSTREAM ELEVATION(FEET) =     14.00
 DOWNSTREAM ELEVATION(FEET) =     13.00
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.450
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    67.44
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.259
 SUBAREA RUNOFF(CFS) =      0.15
 TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.15

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   13.00  DOWNSTREAM ELEVATION(FEET) =   12.00
 STREET LENGTH(FEET) =   153.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.08
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.23
   HALFSTREET FLOOD WIDTH(FEET) =    5.23
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.38
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.32
 STREET FLOW TRAVEL TIME(MIN.) =   1.84   Tc(MIN.) =    9.29
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.826
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    1.16      SUBAREA RUNOFF(CFS) =    1.87
 TOTAL AREA(ACRES) =       1.2       PEAK FLOW RATE(CFS) =       2.00

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =   7.28
 FLOW VELOCITY(FEET/SEC.) =  1.54   DEPTH*VELOCITY(FT*FT/SEC.) =   0.42
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     239.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.29
 RAINFALL INTENSITY(INCH/HR) =   2.83
 TOTAL STREAM AREA(ACRES) =     1.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.00

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc       INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       31.49    21.88        1.627         30.58
     2        2.00     9.29        2.826          1.24

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
     1       20.12     9.29        2.826
     2       32.64    21.88        1.627

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      32.64   Tc(MIN.) =   21.88
 TOTAL AREA(ACRES) =       31.8
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    134.00 =    2559.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    134.00 TO NODE    145.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     9.47  DOWNSTREAM(FEET) =     9.15
 FLOW LENGTH(FEET) =    46.00   MANNING'S N =  0.024
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.89
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =      32.64
 PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   22.15
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    145.00 =    2605.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     9.15  DOWNSTREAM(FEET) =     8.66
 FLOW LENGTH(FEET) =   205.80   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.12
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =      32.64
 PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =   23.25
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2810.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   23.25
 RAINFALL INTENSITY(INCH/HR) =   1.56
 TOTAL STREAM AREA(ACRES) =    31.82
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     32.64

****************************************************************************
 FLOW PROCESS FROM NODE    146.00 TO NODE    147.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    68.00
 UPSTREAM ELEVATION(FEET) =     28.50
 DOWNSTREAM ELEVATION(FEET) =     27.90
 ELEVATION DIFFERENCE(FEET) =      0.60
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.798
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    61.47
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.165
 SUBAREA RUNOFF(CFS) =      0.31
 TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.31

****************************************************************************
 FLOW PROCESS FROM NODE    147.00 TO NODE    150.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   27.90  DOWNSTREAM ELEVATION(FEET) =   11.00
 STREET LENGTH(FEET) =   744.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.12
```

```
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    9.17
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.26
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.01
 STREET FLOW TRAVEL TIME(MIN.) =   3.81   Tc(MIN.) =   11.60
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.449
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    4.00      SUBAREA RUNOFF(CFS) =    5.58
 TOTAL AREA(ACRES) =       4.2       PEAK FLOW RATE(CFS) =       5.82

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  11.96
 FLOW VELOCITY(FEET/SEC.) =  3.76   DEPTH*VELOCITY(FT*FT/SEC.) =   1.37
 LONGEST FLOWPATH FROM NODE    146.00 TO NODE    150.00 =     812.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.449
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6660
 SUBAREA AREA(ACRES) =    2.60   SUBAREA RUNOFF(CFS) =    5.22
 TOTAL AREA(ACRES) =       6.8   TOTAL RUNOFF(CFS) =      11.04
 TC(MIN.) =   11.60

****************************************************************************
 FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.60
 RAINFALL INTENSITY(INCH/HR) =   2.45
 TOTAL STREAM AREA(ACRES) =     6.77
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.04

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       32.64    23.25        1.564         31.82
    2       11.04    11.60        2.449          6.77

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
```

```
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1        31.89     11.60        2.449
     2        39.69     23.25        1.564

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      39.69   Tc(MIN.) =   23.25
 TOTAL AREA(ACRES) =       38.6
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2810.80 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =       38.6  TC(MIN.) =     23.25
 PEAK FLOW RATE(CFS)    =      39.69
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

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

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2010 Advanced Engineering Software (aes)
            Ver. 17.0 Release Date: 07/01/2010  License ID 1509

                          Analysis prepared by:


 ************************** DESCRIPTION OF STUDY **************************
* 9TH AND PALM PDC JOB 3813                                               *
* EXISTING CONDITIONS                                                     *
* SYSTEM 200                                                              *
 **************************************************************************

  FILE NAME: S200E10.DAT
  TIME/DATE OF STUDY: 16:30 10/10/2011
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =  10.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.600
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ==================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   32.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**********************************************************************
  FLOW PROCESS FROM NODE    252.00 TO NODE    253.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
======================================================================
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    77.00
 UPSTREAM ELEVATION(FEET) =     31.00
 DOWNSTREAM ELEVATION(FEET) =     30.00
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.289
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    69.48
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.306
 SUBAREA RUNOFF(CFS) =      0.21
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.21

****************************************************************************
 FLOW PROCESS FROM NODE    253.00 TO NODE    254.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   30.00  DOWNSTREAM ELEVATION(FEET) =   26.00
 STREET LENGTH(FEET) =   647.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.14
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.33
   HALFSTREET FLOOD WIDTH(FEET) =   10.32
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.81
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.60
 STREET FLOW TRAVEL TIME(MIN.) =   5.96   Tc(MIN.) =   13.25
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.249
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    2.96      SUBAREA RUNOFF(CFS) =    3.79
 TOTAL AREA(ACRES) =       3.1        PEAK FLOW RATE(CFS) =       3.94

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.39   HALFSTREET FLOOD WIDTH(FEET) =  13.37
 FLOW VELOCITY(FEET/SEC.) =  2.07   DEPTH*VELOCITY(FT*FT/SEC.) =   0.81
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    254.00 =     724.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    254.00 TO NODE    255.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
================================================================================
 UPSTREAM ELEVATION(FEET) =   26.00  DOWNSTREAM ELEVATION(FEET) =   19.90
 STREET LENGTH(FEET) =   710.50   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.33
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.46
   HALFSTREET FLOOD WIDTH(FEET) =   16.80
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.83
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.31
 STREET FLOW TRAVEL TIME(MIN.) =   4.18   Tc(MIN.) =   17.43
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.884
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    8.16      SUBAREA RUNOFF(CFS) =    8.76
 TOTAL AREA(ACRES) =       11.2       PEAK FLOW RATE(CFS) =      12.06

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  20.23
 FLOW VELOCITY(FEET/SEC.) =  3.08   DEPTH*VELOCITY(FT*FT/SEC.) =   1.59
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L =  710.5 FT WITH ELEVATION-DROP =   6.1 FT, IS   14.7 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    255.00
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    255.00 =    1434.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    255.00 TO NODE    260.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
================================================================================
 UPSTREAM ELEVATION(FEET) =   19.90  DOWNSTREAM ELEVATION(FEET) =   11.30
 STREET LENGTH(FEET) =   494.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     14.33
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.49
  HALFSTREET FLOOD WIDTH(FEET) =   18.13
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.21
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    2.06
 STREET FLOW TRAVEL TIME(MIN.) =   1.96   Tc(MIN.) =   19.39
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.759
 NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7900
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  94
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.620
 SUBAREA AREA(ACRES) =    3.27      SUBAREA RUNOFF(CFS) =    4.54
 TOTAL AREA(ACRES) =      14.5        PEAK FLOW RATE(CFS) =      15.80

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  18.98
 FLOW VELOCITY(FEET/SEC.) =  4.31   DEPTH*VELOCITY(FT*FT/SEC.) =   2.17
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    260.00 =    1928.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    256.00 TO NODE    260.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.759
 NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7900
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  94
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.6852
 SUBAREA AREA(ACRES) =    9.08   SUBAREA RUNOFF(CFS) =   12.62
 TOTAL AREA(ACRES) =      23.6   TOTAL RUNOFF(CFS) =     28.42
 TC(MIN.) =   19.39

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    264.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    11.34  DOWNSTREAM(FEET) =    10.58
 FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.12
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      28.42
 PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   19.56
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    264.00 =    1993.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    260.00 TO NODE    264.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
```

```
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   19.56
 RAINFALL INTENSITY(INCH/HR) =   1.75
 TOTAL STREAM AREA(ACRES) =    23.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     28.42

****************************************************************************
 FLOW PROCESS FROM NODE    261.00 TO NODE    262.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    53.00
 UPSTREAM ELEVATION(FEET) =     18.60
 DOWNSTREAM ELEVATION(FEET) =     18.30
 ELEVATION DIFFERENCE(FEET) =      0.30
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.585
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    51.32
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.216
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.29
 TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
 FLOW PROCESS FROM NODE    262.00 TO NODE    264.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   18.30  DOWNSTREAM ELEVATION(FEET) =   15.80
 STREET LENGTH(FEET) =   412.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.17
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.29
   HALFSTREET FLOOD WIDTH(FEET) =    7.94
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.57
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.45
 STREET FLOW TRAVEL TIME(MIN.) =   4.38   Tc(MIN.) =    7.96
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.123
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  97
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =     0.64     SUBAREA RUNOFF(CFS) =     1.74
 TOTAL AREA(ACRES) =       0.7      PEAK FLOW RATE(CFS) =       1.96

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =   9.99
 FLOW VELOCITY(FEET/SEC.) =  1.75   DEPTH*VELOCITY(FT*FT/SEC.) =   0.57
 LONGEST FLOWPATH FROM NODE    261.00 TO NODE    264.00 =     465.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    262.00 TO NODE    264.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.96
 RAINFALL INTENSITY(INCH/HR) =   3.12
 TOTAL STREAM AREA(ACRES) =     0.72
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.96

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc       INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       28.42     19.56        1.749         23.58
    2        1.96      7.96        3.123          0.72

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
    1       13.52      7.96        3.123
    2       29.51     19.56        1.749

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      29.51   Tc(MIN.) =   19.56
 TOTAL AREA(ACRES) =       24.3
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    264.00 =    1993.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    264.00 TO NODE    270.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    10.58  DOWNSTREAM(FEET) =     8.55
 FLOW LENGTH(FEET) =   325.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.47
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      29.51
```

```
 PIPE TRAVEL TIME(MIN.) =   1.21    Tc(MIN.) =   20.78
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    270.00 =    2318.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    264.00 TO NODE    270.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   20.78
 RAINFALL INTENSITY(INCH/HR) =   1.68
 TOTAL STREAM AREA(ACRES) =    24.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     29.51

****************************************************************************
 FLOW PROCESS FROM NODE    266.00 TO NODE    269.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   375.00
 UPSTREAM ELEVATION(FEET) =     26.60
 DOWNSTREAM ELEVATION(FEET) =     19.30
 ELEVATION DIFFERENCE(FEET) =      7.30
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.764
 WARNING:  INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    69.47
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.216
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.44
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.44

****************************************************************************
 FLOW PROCESS FROM NODE    267.00 TO NODE    269.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.216
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8700
 SUBAREA AREA(ACRES) =    0.15   SUBAREA RUNOFF(CFS) =    0.55
 TOTAL AREA(ACRES) =       0.3   TOTAL RUNOFF(CFS) =      0.99
 TC(MIN.) =    2.76

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
  10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.216
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8252
 SUBAREA AREA(ACRES) =    2.31   SUBAREA RUNOFF(CFS) =    7.99
 TOTAL AREA(ACRES) =       2.6   TOTAL RUNOFF(CFS) =      8.98
 TC(MIN.) =    2.76

****************************************************************************
 FLOW PROCESS FROM NODE    266.00 TO NODE    269.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    2.76
 RAINFALL INTENSITY(INCH/HR) =   4.22
 TOTAL STREAM AREA(ACRES) =     2.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.98

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc       INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       29.51    20.78        1.682         24.30
    2        8.98     2.76        4.216          2.58

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc       INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
    1       20.75     2.76        4.216
    2       33.10    20.78        1.682

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      33.10   Tc(MIN.) =   20.78
 TOTAL AREA(ACRES) =       26.9
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    269.00 =    2318.50 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       26.9  TC(MIN.) =     20.78
 PEAK FLOW RATE(CFS)   =      33.10
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

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

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2010 Advanced Engineering Software (aes)
            Ver. 17.0 Release Date: 07/01/2010  License ID 1509

                          Analysis prepared by:


 ************************** DESCRIPTION OF STUDY **************************
* 9TH AND PALM PDC JOB 3813                                               *
* EXISTING CONDITIONS                                                     *
* SYSTEM 100                                                              *
 ************************************************************************

  FILE NAME: S100E05.DAT
  TIME/DATE OF STUDY: 16:18 10/10/2011
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =   5.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.350
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  =====  ====  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   32.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

 ************************************************************************
  FLOW PROCESS FROM NODE     100.00 TO NODE     102.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
========================================================================
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    51.00
 UPSTREAM ELEVATION(FEET) =     33.00
 DOWNSTREAM ELEVATION(FEET) =     32.50
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.858
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.901
 SUBAREA RUNOFF(CFS) =      0.25
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
 FLOW PROCESS FROM NODE    102.00 TO NODE    105.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   32.50  DOWNSTREAM ELEVATION(FEET) =   20.00
 STREET LENGTH(FEET) =  1167.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.63
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.33
   HALFSTREET FLOOD WIDTH(FEET) =   10.32
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.38
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.79
 STREET FLOW TRAVEL TIME(MIN.) =   8.18   Tc(MIN.) =   15.04
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.748
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =   10.42      SUBAREA RUNOFF(CFS) =   10.38
 TOTAL AREA(ACRES) =       10.6        PEAK FLOW RATE(CFS) =      10.53

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.40   HALFSTREET FLOOD WIDTH(FEET) =  13.45
 FLOW VELOCITY(FEET/SEC.) =  2.73   DEPTH*VELOCITY(FT*FT/SEC.) =   1.08
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1218.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    105.00 TO NODE    110.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   20.00  DOWNSTREAM ELEVATION(FEET) =   16.50
 STREET LENGTH(FEET) =   528.00   CURB HEIGHT(INCHES) =  6.0
```

```
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.39
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.53
   HALFSTREET FLOOD WIDTH(FEET) =   21.33
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.75
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.45
 STREET FLOW TRAVEL TIME(MIN.) =   3.20   Tc(MIN.) =   18.23
    5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.544
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    1.95      SUBAREA RUNOFF(CFS) =    1.72
 TOTAL AREA(ACRES) =       12.5        PEAK FLOW RATE(CFS) =      11.02

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.52   HALFSTREET FLOOD WIDTH(FEET) =  20.86
 FLOW VELOCITY(FEET/SEC.) =  2.73   DEPTH*VELOCITY(FT*FT/SEC.) =   1.42
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =    1746.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.544
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.5700
 SUBAREA AREA(ACRES) =    6.02   SUBAREA RUNOFF(CFS) =    5.30
 TOTAL AREA(ACRES) =       18.5   TOTAL RUNOFF(CFS) =      16.32
 TC(MIN.) =   18.23

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    122.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    11.68  DOWNSTREAM(FEET) =    11.17
 FLOW LENGTH(FEET) =   159.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.62
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
```

```
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      16.32
 PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =   18.97
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1905.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    110.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   18.97
 RAINFALL INTENSITY(INCH/HR) =   1.51
 TOTAL STREAM AREA(ACRES) =    18.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     16.32

****************************************************************************
 FLOW PROCESS FROM NODE    117.00 TO NODE    119.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    65.00
 UPSTREAM ELEVATION(FEET) =     28.50
 DOWNSTREAM ELEVATION(FEET) =     28.00
 ELEVATION DIFFERENCE(FEET) =      0.50
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.935
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    58.08
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.641
 SUBAREA RUNOFF(CFS) =      0.14
 TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.14

****************************************************************************
 FLOW PROCESS FROM NODE    119.00 TO NODE    120.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   28.00  DOWNSTREAM ELEVATION(FEET) =   19.00
 STREET LENGTH(FEET) =   631.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.07
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.25
  HALFSTREET FLOOD WIDTH(FEET) =    6.05
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.13
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.53
 STREET FLOW TRAVEL TIME(MIN.) =   4.93   Tc(MIN.) =   12.87
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.933
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    3.45      SUBAREA RUNOFF(CFS) =    3.80
 TOTAL AREA(ACRES) =       3.5        PEAK FLOW RATE(CFS) =       3.90

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   8.27
 FLOW VELOCITY(FEET/SEC.) =  2.43   DEPTH*VELOCITY(FT*FT/SEC.) =   0.71
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    120.00 =     696.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    14.00  DOWNSTREAM(FEET) =    11.17
 FLOW LENGTH(FEET) =   136.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.05
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.90
 PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =   13.19
 LONGEST FLOWPATH FROM NODE    117.00 TO NODE    122.00 =     832.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    120.00 TO NODE    122.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   13.19
 RAINFALL INTENSITY(INCH/HR) =   1.90
 TOTAL STREAM AREA(ACRES) =     3.54
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.90

 ** CONFLUENCE DATA **
 STREAM      RUNOFF        Tc       INTENSITY      AREA
 NUMBER       (CFS)      (MIN.)   (INCH/HOUR)    (ACRE)
     1       16.32      18.97        1.505         18.54
     2        3.90      13.19        1.903          3.54

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

```
** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       15.25    13.19       1.903
    2       19.40    18.97       1.505

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      19.40   Tc(MIN.) =   18.97
TOTAL AREA(ACRES) =       22.1
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    122.00 =    1905.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    122.00 TO NODE    128.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    11.17  DOWNSTREAM(FEET) =    10.10
FLOW LENGTH(FEET) =   439.00   MANNING'S N =  0.013
ASSUME FULL-FLOWING PIPELINE
PIPE-FLOW VELOCITY(FEET/SEC.) =   3.15
(PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
 AT DEPTH = 0.94 * DIAMETER)
GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      19.40
PIPE TRAVEL TIME(MIN.) =   2.32    Tc(MIN.) =   21.29
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    2344.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    122.00 TO NODE    128.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =   21.29
RAINFALL INTENSITY(INCH/HR) =   1.40
TOTAL STREAM AREA(ACRES) =    22.08
PEAK FLOW RATE(CFS) AT CONFLUENCE =     19.40

****************************************************************************
FLOW PROCESS FROM NODE    124.00 TO NODE    126.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) =  87
INITIAL SUBAREA FLOW-LENGTH(FEET) =    80.00
UPSTREAM ELEVATION(FEET) =     22.00
DOWNSTREAM ELEVATION(FEET) =     21.50
ELEVATION DIFFERENCE(FEET) =      0.50
SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.180
WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
         THE MAXIMUM OVERLAND FLOW LENGTH =    53.75
         (Reference: Table 3-1B of Hydrology Manual)
         THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
```

```
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.589
 SUBAREA RUNOFF(CFS) =      0.22
 TOTAL AREA(ACRES) =      0.15   TOTAL RUNOFF(CFS) =      0.22

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   21.50  DOWNSTREAM ELEVATION(FEET) =   13.50
 STREET LENGTH(FEET) =   880.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.46
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.32
   HALFSTREET FLOOD WIDTH(FEET) =    9.74
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.09
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.67
 STREET FLOW TRAVEL TIME(MIN.) =   7.02   Tc(MIN.) =   15.20
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.736
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    8.35      SUBAREA RUNOFF(CFS) =    8.26
 TOTAL AREA(ACRES) =       8.5        PEAK FLOW RATE(CFS) =       8.41

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.66
 FLOW VELOCITY(FEET/SEC.) =  2.44   DEPTH*VELOCITY(FT*FT/SEC.) =   0.93
 LONGEST FLOWPATH FROM NODE    124.00 TO NODE    128.00 =     960.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    126.00 TO NODE    128.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   15.20
 RAINFALL INTENSITY(INCH/HR) =   1.74
 TOTAL STREAM AREA(ACRES) =     8.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.41

 ** CONFLUENCE DATA **
```

```
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1        19.40     21.29       1.397         22.08
    2         8.41     15.20       1.736          8.50

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

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF       Tc      INTENSITY
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)
    1        24.02     15.20       1.736
    2        26.17     21.29       1.397

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      26.17   Tc(MIN.) =   21.29
 TOTAL AREA(ACRES) =       30.6
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    128.00 =    2344.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    10.10  DOWNSTREAM(FEET) =     9.47
 FLOW LENGTH(FEET) =   215.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.46
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =      26.17
 PIPE TRAVEL TIME(MIN.) =   1.04    Tc(MIN.) =   22.32
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    134.00 =    2559.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    128.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   22.32
 RAINFALL INTENSITY(INCH/HR) =   1.36
 TOTAL STREAM AREA(ACRES) =    30.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     26.17

****************************************************************************
 FLOW PROCESS FROM NODE    130.00 TO NODE    132.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    86.00
```

```
 UPSTREAM ELEVATION(FEET) =     14.00
 DOWNSTREAM ELEVATION(FEET) =     13.00
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.450
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    67.44
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.750
 SUBAREA RUNOFF(CFS) =      0.13
 TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.13

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   13.00  DOWNSTREAM ELEVATION(FEET) =   12.00
 STREET LENGTH(FEET) =   153.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.91
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.22
   HALFSTREET FLOOD WIDTH(FEET) =    4.74
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.33
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.29
 STREET FLOW TRAVEL TIME(MIN.) =   1.91   Tc(MIN.) =    9.36
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.373
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    1.16      SUBAREA RUNOFF(CFS) =    1.57
 TOTAL AREA(ACRES) =       1.2       PEAK FLOW RATE(CFS) =       1.68

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   6.63
 FLOW VELOCITY(FEET/SEC.) =  1.50   DEPTH*VELOCITY(FT*FT/SEC.) =   0.39
 LONGEST FLOWPATH FROM NODE    130.00 TO NODE    134.00 =     239.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    132.00 TO NODE    134.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    9.36
 RAINFALL INTENSITY(INCH/HR) =   2.37
 TOTAL STREAM AREA(ACRES) =     1.24
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.68

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY      AREA
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1        26.17    22.32        1.355         30.58
     2         1.68     9.36        2.373          1.24

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)
     1        16.62     9.36        2.373
     2        27.13    22.32        1.355

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      27.13   Tc(MIN.) =   22.32
 TOTAL AREA(ACRES) =       31.8
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    134.00 =    2559.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    134.00 TO NODE    145.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     9.47  DOWNSTREAM(FEET) =     9.15
 FLOW LENGTH(FEET) =    46.00   MANNING'S N =  0.024
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   2.89
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   2
 PIPE-FLOW(CFS) =      27.13
 PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   22.59
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    145.00 =    2605.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     9.15  DOWNSTREAM(FEET) =     8.66
 FLOW LENGTH(FEET) =   205.80   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   3.12
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
```

```
 PIPE-FLOW(CFS) =      27.13
 PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =   23.69
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2810.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    145.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   23.69
 RAINFALL INTENSITY(INCH/HR) =   1.30
 TOTAL STREAM AREA(ACRES) =    31.82
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     27.13

****************************************************************************
 FLOW PROCESS FROM NODE    146.00 TO NODE    147.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    68.00
 UPSTREAM ELEVATION(FEET) =     28.50
 DOWNSTREAM ELEVATION(FEET) =     27.90
 ELEVATION DIFFERENCE(FEET) =      0.60
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.798
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    61.47
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.670
 SUBAREA RUNOFF(CFS) =      0.26
 TOTAL AREA(ACRES) =      0.17   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
 FLOW PROCESS FROM NODE    147.00 TO NODE    150.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   27.90  DOWNSTREAM ELEVATION(FEET) =   11.00
 STREET LENGTH(FEET) =   744.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.62
```

```
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.30
  HALFSTREET FLOOD WIDTH(FEET) =    8.51
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.11
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.92
STREET FLOW TRAVEL TIME(MIN.) =   3.99   Tc(MIN.) =   11.79
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.045
RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) =  87
AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
SUBAREA AREA(ACRES) =    4.00      SUBAREA RUNOFF(CFS) =    4.66
TOTAL AREA(ACRES) =       4.2       PEAK FLOW RATE(CFS) =       4.86

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.35   HALFSTREET FLOOD WIDTH(FEET) =  11.14
FLOW VELOCITY(FEET/SEC.) =  3.58   DEPTH*VELOCITY(FT*FT/SEC.) =   1.25
LONGEST FLOWPATH FROM NODE    146.00 TO NODE    150.00 =     812.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.045
GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) =  95
AREA-AVERAGE RUNOFF COEFFICIENT = 0.6660
SUBAREA AREA(ACRES) =    2.60   SUBAREA RUNOFF(CFS) =    4.36
TOTAL AREA(ACRES) =       6.8   TOTAL RUNOFF(CFS) =       9.22
TC(MIN.) =   11.79

****************************************************************************
FLOW PROCESS FROM NODE    149.00 TO NODE    150.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =   11.79
RAINFALL INTENSITY(INCH/HR) =   2.05
TOTAL STREAM AREA(ACRES) =     6.77
PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.22

** CONFLUENCE DATA **
STREAM     RUNOFF       Tc      INTENSITY      AREA
NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1       27.13    23.69        1.304         31.82
    2        9.22    11.79        2.045          6.77

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

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
      1        26.52     11.79        2.045
      2        33.01     23.69        1.304

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      33.01   Tc(MIN.) =   23.69
  TOTAL AREA(ACRES) =       38.6
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    150.00 =    2810.80 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =       38.6  TC(MIN.) =     23.69
  PEAK FLOW RATE(CFS)    =      33.01
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

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

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                        2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2010 Advanced Engineering Software (aes)
            Ver. 17.0 Release Date: 07/01/2010  License ID 1509

                          Analysis prepared by:


 ************************** DESCRIPTION OF STUDY **************************
* 9TH AND PALM PDC JOB 3813                                               *
* EXISTING CONDITIONS                                                     *
* SYSTEM 200                                                              *
 **************************************************************************

  FILE NAME: S200E05.DAT
  TIME/DATE OF STUDY: 16:36 10/10/2011
--------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
--------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) =   5.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   1.350
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ==================  ======  =====  ====  =====  ======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150
  2   32.0     20.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.50 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

**********************************************************************
  FLOW PROCESS FROM NODE    252.00 TO NODE    253.00 IS CODE =  21
----------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
======================================================================
  RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
  SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  87
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    77.00
 UPSTREAM ELEVATION(FEET) =     31.00
 DOWNSTREAM ELEVATION(FEET) =     30.00
 ELEVATION DIFFERENCE(FEET) =      1.00
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.289
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    69.48
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.789
 SUBAREA RUNOFF(CFS) =      0.17
 TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
 FLOW PROCESS FROM NODE    253.00 TO NODE    254.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   30.00  DOWNSTREAM ELEVATION(FEET) =   26.00
 STREET LENGTH(FEET) =   647.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL) =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL) =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.79
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.32
   HALFSTREET FLOOD WIDTH(FEET) =    9.58
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.73
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
 STREET FLOW TRAVEL TIME(MIN.) =   6.25   Tc(MIN.) =   13.54
    5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.871
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    2.96      SUBAREA RUNOFF(CFS) =    3.16
 TOTAL AREA(ACRES) =       3.1        PEAK FLOW RATE(CFS) =       3.27

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  12.35
 FLOW VELOCITY(FEET/SEC.) =  1.99   DEPTH*VELOCITY(FT*FT/SEC.) =   0.74
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    254.00 =     724.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    254.00 TO NODE    255.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>(STREET TABLE SECTION #  2 USED)<<<<<
=============================================================================
 UPSTREAM ELEVATION(FEET) =   26.00  DOWNSTREAM ELEVATION(FEET) =   19.90
 STREET LENGTH(FEET) =   710.50   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.92
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.44
   HALFSTREET FLOOD WIDTH(FEET) =   15.63
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.70
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.19
 STREET FLOW TRAVEL TIME(MIN.) =   4.39   Tc(MIN.) =   17.92
    5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.561
 RESIDENTIAL (7.3 DU/AC OR LESS) RUNOFF COEFFICIENT = .5700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.570
 SUBAREA AREA(ACRES) =    8.16      SUBAREA RUNOFF(CFS) =    7.26
 TOTAL AREA(ACRES) =       11.2        PEAK FLOW RATE(CFS) =       9.99

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  18.05
 FLOW VELOCITY(FEET/SEC.) =  2.96   DEPTH*VELOCITY(FT*FT/SEC.) =   1.44
 *NOTE: INITIAL SUBAREA NOMOGRAPH WITH SUBAREA PARAMETERS,
        AND L =  710.5 FT WITH ELEVATION-DROP =   6.1 FT, IS   12.4 CFS,
        WHICH EXCEEDS THE TOP-OF-CURB STREET CAPACITY AT NODE    255.00
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    255.00 =    1434.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    255.00 TO NODE    260.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   19.90  DOWNSTREAM ELEVATION(FEET) =   11.30
 STREET LENGTH(FEET) =   494.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300
```

```
    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      11.87
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   16.88
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.86
  STREET FLOW TRAVEL TIME(MIN.) =   2.06   Tc(MIN.) =   19.98
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.456
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7900
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.620
  SUBAREA AREA(ACRES) =    3.27      SUBAREA RUNOFF(CFS) =    3.76
  TOTAL AREA(ACRES) =       14.5        PEAK FLOW RATE(CFS) =      13.08

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.48   HALFSTREET FLOOD WIDTH(FEET) =  17.51
  FLOW VELOCITY(FEET/SEC.) =  4.11   DEPTH*VELOCITY(FT*FT/SEC.) =   1.96
  LONGEST FLOWPATH FROM NODE    252.00 TO NODE    260.00 =    1928.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    256.00 TO NODE    260.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.456
  NEIGHBORHOOD COMMERCIAL RUNOFF COEFFICIENT = .7900
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  94
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.6852
  SUBAREA AREA(ACRES) =    9.08   SUBAREA RUNOFF(CFS) =   10.44
  TOTAL AREA(ACRES) =       23.6   TOTAL RUNOFF(CFS) =      23.52
  TC(MIN.) =   19.98

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    264.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    11.34  DOWNSTREAM(FEET) =    10.58
  FLOW LENGTH(FEET) =    65.00   MANNING'S N =  0.013
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.12
  (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
   AT DEPTH = 0.94 * DIAMETER)
  GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      23.52
  PIPE TRAVEL TIME(MIN.) =   0.18    Tc(MIN.) =   20.16
  LONGEST FLOWPATH FROM NODE    252.00 TO NODE    264.00 =    1993.50 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    260.00 TO NODE    264.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
```

```
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   20.16
 RAINFALL INTENSITY(INCH/HR) =   1.45
 TOTAL STREAM AREA(ACRES) =    23.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     23.52

****************************************************************************
 FLOW PROCESS FROM NODE    261.00 TO NODE    262.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    53.00
 UPSTREAM ELEVATION(FEET) =     18.60
 DOWNSTREAM ELEVATION(FEET) =     18.30
 ELEVATION DIFFERENCE(FEET) =      0.30
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.585
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    51.32
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.557
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.25
 TOTAL AREA(ACRES) =      0.08   TOTAL RUNOFF(CFS) =      0.25

****************************************************************************
 FLOW PROCESS FROM NODE    262.00 TO NODE    264.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  2 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   18.30  DOWNSTREAM ELEVATION(FEET) =   15.80
 STREET LENGTH(FEET) =   412.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 32.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0300

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.98
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.27
  HALFSTREET FLOOD WIDTH(FEET) =    7.37
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.49
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.41
 STREET FLOW TRAVEL TIME(MIN.) =   4.62   Tc(MIN.) =    8.21
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.584
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
```

```
 S.C.S. CURVE NUMBER (AMC II) =  97
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.870
 SUBAREA AREA(ACRES) =     0.64     SUBAREA RUNOFF(CFS) =     1.44
 TOTAL AREA(ACRES) =       0.7      PEAK FLOW RATE(CFS) =       1.62

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =   9.25
 FLOW VELOCITY(FEET/SEC.) =  1.66   DEPTH*VELOCITY(FT*FT/SEC.) =   0.52
 LONGEST FLOWPATH FROM NODE    261.00 TO NODE    264.00 =     465.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    262.00 TO NODE    264.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.21
 RAINFALL INTENSITY(INCH/HR) =   2.58
 TOTAL STREAM AREA(ACRES) =     0.72
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.62

 ** CONFLUENCE DATA **
 STREAM      RUNOFF        Tc       INTENSITY       AREA
 NUMBER       (CFS)      (MIN.)    (INCH/HOUR)     (ACRE)
    1        23.52     20.16         1.447          23.58
    2         1.62      8.21         2.584           0.72

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

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        11.20      8.21         2.584
    2        24.43     20.16         1.447

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      24.43   Tc(MIN.) =   20.16
 TOTAL AREA(ACRES) =       24.3
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    264.00 =    1993.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    264.00 TO NODE    270.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    10.58  DOWNSTREAM(FEET) =     8.55
 FLOW LENGTH(FEET) =   325.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.47
 (PIPE FLOW VELOCITY CORRESPONDING TO NORMAL-DEPTH FLOW
  AT DEPTH = 0.94 * DIAMETER)
 GIVEN PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      24.43
```

```
 PIPE TRAVEL TIME(MIN.) =   1.21    Tc(MIN.) =   21.37
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    270.00 =    2318.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    264.00 TO NODE    270.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   21.37
 RAINFALL INTENSITY(INCH/HR) =   1.39
 TOTAL STREAM AREA(ACRES) =    24.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     24.43

****************************************************************************
 FLOW PROCESS FROM NODE    266.00 TO NODE    269.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   375.00
 UPSTREAM ELEVATION(FEET) =     26.60
 DOWNSTREAM ELEVATION(FEET) =     19.30
 ELEVATION DIFFERENCE(FEET) =      7.30
 SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.764
 WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
          THE MAXIMUM OVERLAND FLOW LENGTH =    69.47
          (Reference: Table 3-1B of Hydrology Manual)
          THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.557
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 SUBAREA RUNOFF(CFS) =      0.37
 TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.37

****************************************************************************
 FLOW PROCESS FROM NODE    267.00 TO NODE    269.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.557
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 GENERAL INDUSTRIAL RUNOFF COEFFICIENT = .8700
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  97
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8700
 SUBAREA AREA(ACRES) =    0.15   SUBAREA RUNOFF(CFS) =    0.46
 TOTAL AREA(ACRES) =       0.3   TOTAL RUNOFF(CFS) =      0.84
 TC(MIN.) =    2.76

****************************************************************************
 FLOW PROCESS FROM NODE    270.00 TO NODE    270.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
   5 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.557
 NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
 GENERAL COMMERCIAL RUNOFF COEFFICIENT = .8200
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  95
 AREA-AVERAGE RUNOFF COEFFICIENT = 0.8252
 SUBAREA AREA(ACRES) =    2.31   SUBAREA RUNOFF(CFS) =    6.74
 TOTAL AREA(ACRES) =       2.6   TOTAL RUNOFF(CFS) =      7.57
 TC(MIN.) =    2.76

****************************************************************************
 FLOW PROCESS FROM NODE    266.00 TO NODE    269.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    2.76
 RAINFALL INTENSITY(INCH/HR) =   3.56
 TOTAL STREAM AREA(ACRES) =     2.58
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      7.57

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY      AREA
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
    1        24.43    21.37        1.394         24.30
    2         7.57     2.76        3.557          2.58

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

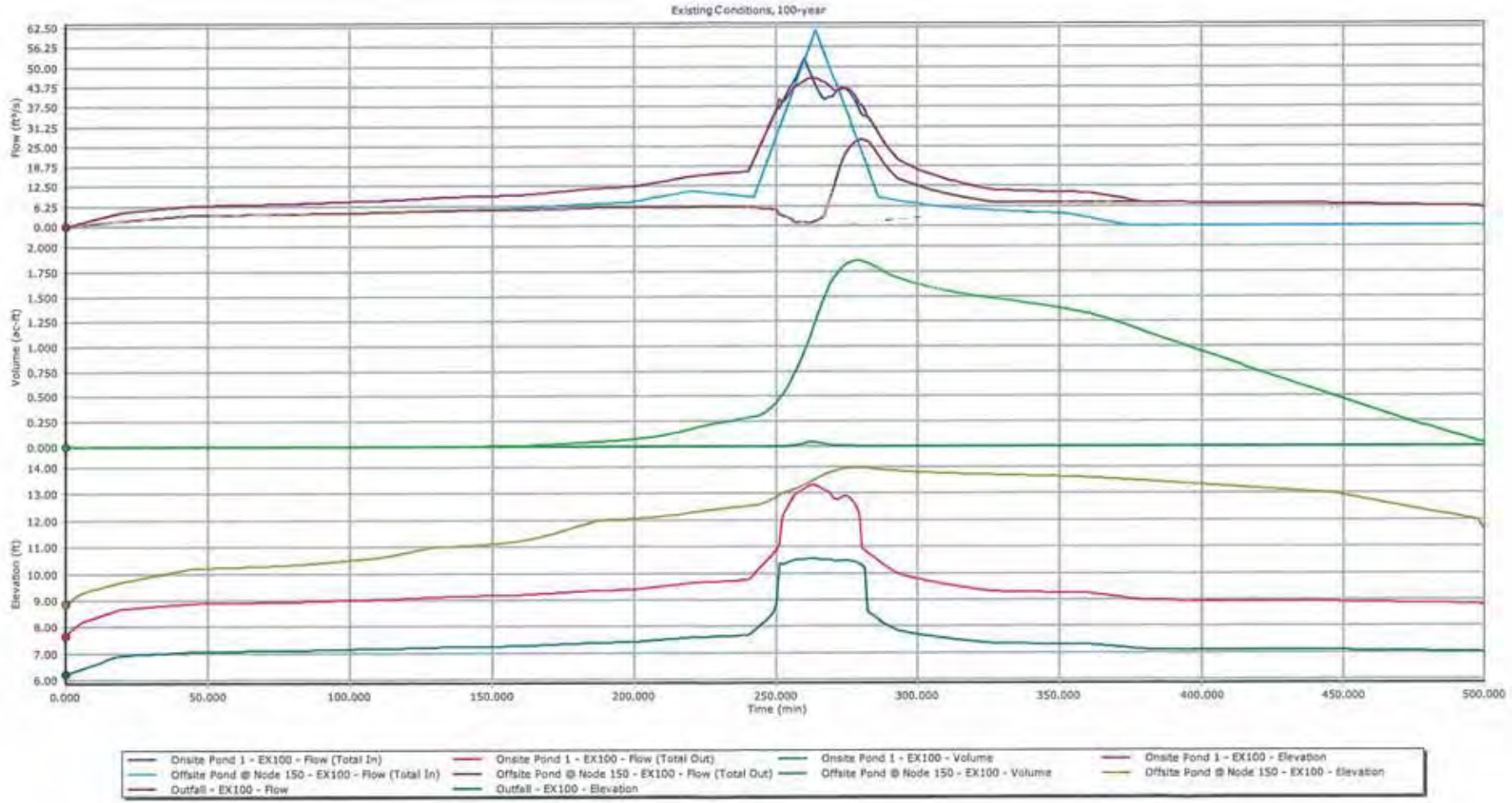
 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)   (INCH/HOUR)
    1        17.14     2.76        3.557
    2        27.39    21.37        1.394

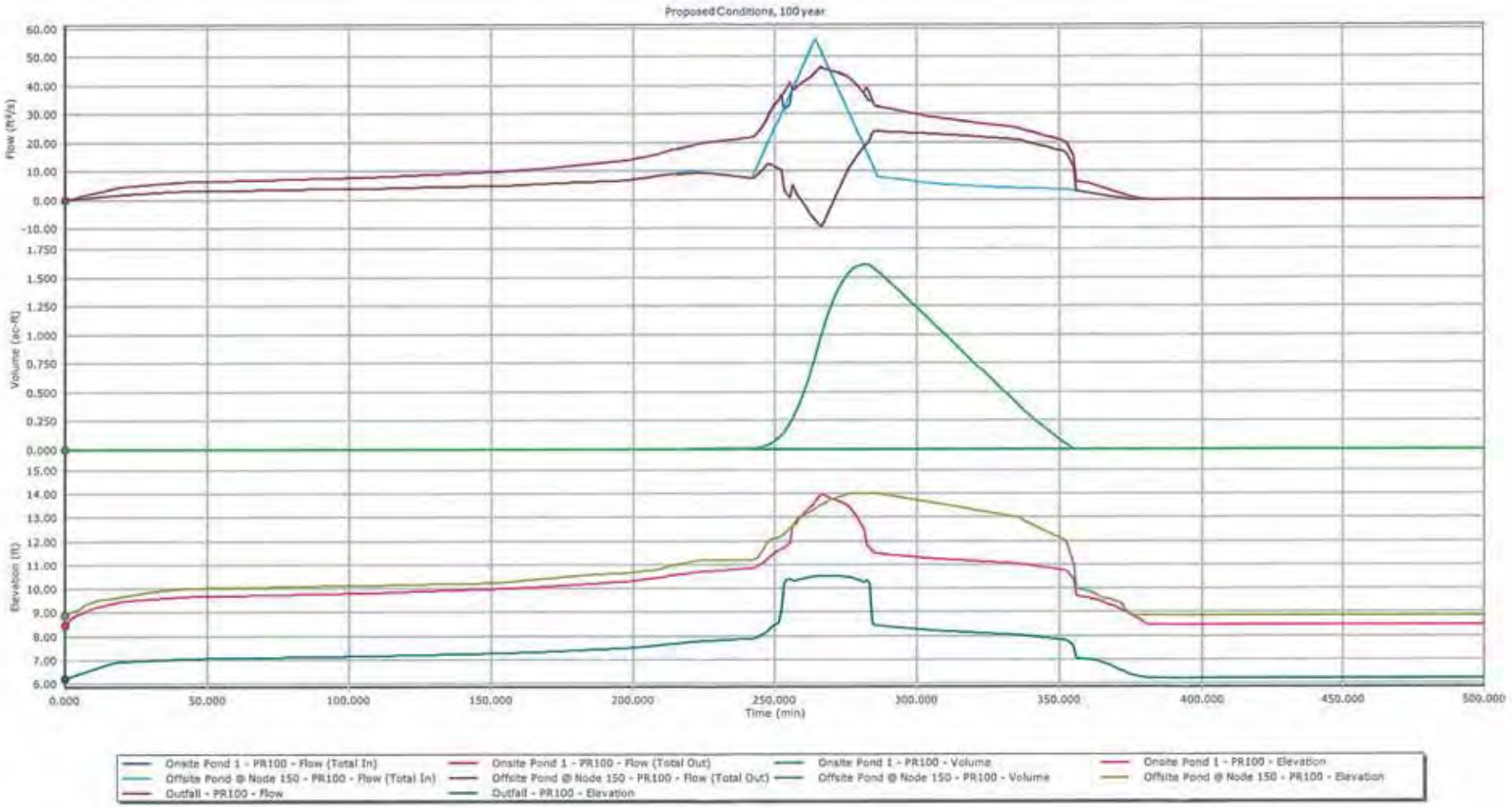
 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      27.39   Tc(MIN.) =   21.37
 TOTAL AREA(ACRES) =       26.9
 LONGEST FLOWPATH FROM NODE    252.00 TO NODE    269.00 =    2318.50 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)     =       26.9  TC(MIN.) =     21.37
 PEAK FLOW RATE(CFS)   =      27.39
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

# APPENDIX 4

## Preliminary Storage Routing Calculations

# 100-year Storm: Routing Calculations and Results


Existing Conditions, 100-year
Flow (ft³/s)
62.50
56.25
50.00
43.75
37.50
31.25
25.00
18.75
12.50
6.25
0.00
Volume (ac-ft)
2.000
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
Elevation (ft)
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
0.000
50.000
100.000
150.000
200.000
250.000
300.000
350.000
400.000
450.000
500.000
Time (min)
Onsite Pond 1 - EX100 - Flow (Total In)
Offsite Pond @ Node 150 - EX100 - Flow (Total In)
Outfall - EX100 - Flow
Onsite Pond 1 - EX100 - Flow (Total Out)
Offsite Pond @ Node 150 - EX100 - Flow (Total Out)
Outfall - EX100 - Elevation
Onsite Pond 1 - EX100 - Volume
Offsite Pond @ Node 150 - EX100 - Volume
Onsite Pond 1 - EX100 - Elevation
Offsite Pond @ Node 150 - EX100 - Elevation


Proposed Conditions, 100 year
Flow (ft^3/s)
60.00
50.00
40.00
30.00
20.00
10.00
0.00
-10.00
Volume (ac-ft)
1.750
1.500
1.250
1.000
0.750
0.500
0.250
0.000
Elevation (ft)
15.00
14.00
13.00
12.00
11.00
10.00
9.00
8.00
7.00
6.00
0.000
50.000
100.000
150.000
200.000
250.000
300.000
350.000
400.000
450.000
500.000
Time (min)
Onsite Pond 1 - PR100 - Flow (Total In)
Offsite Pond @ Node 150 - PR100 - Flow (Total In)
Outfall - PR100 - Flow
Onsite Pond 1 - PR100 - Flow (Total Out)
Offsite Pond @ Node 150 - PR100 - Flow (Total Out)
Outfall - PR100 - Elevation
Onsite Pond 1 - PR100 - Volume
Offsite Pond @ Node 150 - PR100 - Volume
Onsite Pond 1 - PR100 - Elevation
Offsite Pond @ Node 150 - PR100 - Elevation

## PROPOSED CONDITIONS COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Note: The following are composite values for each system.

**SYSTEM 200**

| C | A | C*A |
|---|---|---|
| 0.57 | 0.11 | 0.0627 |
| 0.57 | 2.96 | 1.6872 |
| 0.57 | 8.16 | 4.6512 |
| 0.79 | 3.27 | 2.5833 |
| 0.79 | 9.08 | 7.1732 |
| 0.87 | 0.08 | 0.0696 |
| 0.87 | 0.82 | 0.7134 |
| 0.82 | 0.06 | 0.0492 |
| 0.82 | 0.36 | 0.2952 |
| 0.82 | 0.03 | 0.0246 |
| 0.82 | 0.27 | 0.2214 |
| 0.82 | 0.03 | 0.0246 |
| 0.82 | 0.52 | 0.4264 |
| 0.82 | 0.03 | 0.0246 |
| 0.82 | 0.3 | 0.246 |
| 0.82 | 0.05 | 0.041 |
| 0.82 | 0.22 | 0.1804 |
| 0.82 | 0.27 | 0.2214 |
| 0.82 | 0.1 | 0.082 |
| 0.52 | 0.29 | 0.1508 |
| 0.82 | 0.04 | 0.0328 |
| 0.82 | 0.8 | 0.656 |
| 0.82 | 0.04 | 0.0328 |
| 0.82 | 1.06 | 0.8692 |
| 0.87 | 0.11 | 0.0957 |
| 0.82 | 0.44 | 0.3608 |
| Sum: | 29.5 | 20.9755 |

**COMPOSITE C= 0.711**

**SYSTEM 100**

| C | A | C*A |
|---|---|---|
| 0.57 | 0.15 | 0.0855 |
| 0.57 | 10.42 | 5.9394 |
| 0.57 | 1.95 | 1.1115 |
| 0.57 | 6.02 | 3.4314 |
| 0.57 | 0.09 | 0.0513 |
| 0.57 | 3.45 | 1.9665 |
| 0.57 | 0.15 | 0.0855 |
| 0.57 | 8.35 | 4.7595 |
| 0.57 | 0.08 | 0.0456 |
| 0.57 | 1.16 | 0.6612 |
| 0.57 | 0.17 | 0.0969 |
| 0.57 | 4.06 | 2.3142 |
| Sum: | 36.05 | 20.5485 |

**COMPOSITE C= 0.570**

## EXISTING CONDITIONS COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Note: The following are composite values for each system.

**SYSTEM 200**

| C | A | C*A | |
|---|---|---|---|
| 0.57 | 0.11 | 0.0627 | |
| 0.57 | 2.96 | 1.6872 | |
| 0.57 | 8.16 | 4.6512 | |
| 0.79 | 3.27 | 2.5833 | |
| 0.79 | 9.08 | 7.1732 | |
| 0.87 | 0.08 | 0.0696 | |
| 0.87 | 0.64 | 0.5568 | |
| 0.87 | 0.12 | 0.1044 | |
| 0.87 | 0.15 | 0.1305 | |
| 0.82 | 2.31 | 1.8942 | |
| Sum: | 26.88 | 18.9131 | |
| | **COMPOSITE C=** | | **0.704** |

**SYSTEM 100**

| C | A | C*A | |
|---|---|---|---|
| 0.57 | 0.15 | 0.0855 | |
| 0.57 | 10.42 | 5.9394 | |
| 0.57 | 1.95 | 1.1115 | |
| 0.57 | 6.02 | 3.4314 | |
| 0.57 | 0.09 | 0.0513 | |
| 0.57 | 3.45 | 1.9665 | |
| 0.57 | 0.15 | 0.0855 | |
| 0.57 | 8.35 | 4.7595 | |
| 0.57 | 0.08 | 0.0456 | |
| 0.57 | 1.16 | 0.6612 | |
| 0.57 | 0.17 | 0.0969 | |
| 0.57 | 4 | 2.28 | |
| 0.82 | 2.6 | 2.132 | |
| Sum: | 38.59 | 22.6463 | |
| | **COMPOSITE C=** | | **0.587** |

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RUN DATE 10/10/2011
**HYDROGRAPH FILE NAME S100E100.TXT**
TIME OF CONCENTRATION 22 MIN.
6 HOUR RAINFALL 2.4 INCHES
BASIN AREA 38.6 ACRES
RUNOFF COEFFICIENT 0.587
PEAK DISCHARGE 61.5 CFS

| | |
|---|---|
| TIME (MIN) = 0 | DISCHARGE (CFS) = 0 |
| TIME (MIN) = 22 | DISCHARGE (CFS) = 1.9 |
| TIME (MIN) = 44 | DISCHARGE (CFS) = 3.5 |
| TIME (MIN) = 66 | DISCHARGE (CFS) = 3.7 |
| TIME (MIN) = 88 | DISCHARGE (CFS) = 4 |
| TIME (MIN) = 110 | DISCHARGE (CFS) = 4.3 |
| TIME (MIN) = 132 | DISCHARGE (CFS) = 4.9 |
| TIME (MIN) = 154 | DISCHARGE (CFS) = 5.3 |
| TIME (MIN) = 176 | DISCHARGE (CFS) = 6.5 |
| TIME (MIN) = 198 | DISCHARGE (CFS) = 7.4 |
| TIME (MIN) = 220 | DISCHARGE (CFS) = 10.9 |
| TIME (MIN) = 242 | DISCHARGE (CFS) = 9 |
| TIME (MIN) = 264 | DISCHARGE (CFS) = 61.5 |
| TIME (MIN) = 286 | DISCHARGE (CFS) = 8.8 |
| TIME (MIN) = 308 | DISCHARGE (CFS) = 5.9 |
| TIME (MIN) = 330 | DISCHARGE (CFS) = 4.6 |
| TIME (MIN) = 352 | DISCHARGE (CFS) = 3.8 |
| TIME (MIN) = 374 | DISCHARGE (CFS) = 0 |

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RUN DATE 10/10/2011
**HYDROGRAPH FILE NAME S200E100.TXT**
TIME OF CONCENTRATION 20 MIN.
6 HOUR RAINFALL 2.4 INCHES
BASIN AREA 26.9 ACRES
RUNOFF COEFFICIENT 0.704
PEAK DISCHARGE 51.5 CFS

| | | | |
|---|---|---|---|
| TIME (MIN) = | 0 | DISCHARGE (CFS) = | 0 |
| TIME (MIN) = | 20 | DISCHARGE (CFS) = | 2.7 |
| TIME (MIN) = | 40 | DISCHARGE (CFS) = | 2.9 |
| TIME (MIN) = | 60 | DISCHARGE (CFS) = | 3.1 |
| TIME (MIN) = | 80 | DISCHARGE (CFS) = | 3.2 |
| TIME (MIN) = | 100 | DISCHARGE (CFS) = | 3.6 |
| TIME (MIN) = | 120 | DISCHARGE (CFS) = | 3.8 |
| TIME (MIN) = | 140 | DISCHARGE (CFS) = | 4.4 |
| TIME (MIN) = | 160 | DISCHARGE (CFS) = | 4.7 |
| TIME (MIN) = | 180 | DISCHARGE (CFS) = | 5.8 |
| TIME (MIN) = | 200 | DISCHARGE (CFS) = | 6.6 |
| TIME (MIN) = | 220 | DISCHARGE (CFS) = | 9.7 |
| TIME (MIN) = | 240 | DISCHARGE (CFS) = | 11.1 |
| TIME (MIN) = | 260 | DISCHARGE (CFS) = | 51.5 |
| TIME (MIN) = | 280 | DISCHARGE (CFS) = | 7.8 |
| TIME (MIN) = | 300 | DISCHARGE (CFS) = | 5.2 |
| TIME (MIN) = | 320 | DISCHARGE (CFS) = | 4.1 |
| TIME (MIN) = | 340 | DISCHARGE (CFS) = | 3.4 |
| TIME (MIN) = | 360 | DISCHARGE (CFS) = | 3 |
| TIME (MIN) = | 380 | DISCHARGE (CFS) = | 0 |

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RUN DATE 10/10/2011
**HYDROGRAPH FILE NAME S100P100.TXT**
TIME OF CONCENTRATION 22 MIN.
6 HOUR RAINFALL 2.4 INCHES
BASIN AREA 36 ACRES
RUNOFF COEFFICIENT 0.57
PEAK DISCHARGE 56.4 CFS

| | | | |
|---|---|---|---|
| TIME (MIN) = | 0 | DISCHARGE (CFS) = | 0 |
| TIME (MIN) = | 22 | DISCHARGE (CFS) = | 1.9 |
| TIME (MIN) = | 44 | DISCHARGE (CFS) = | 3.2 |
| TIME (MIN) = | 66 | DISCHARGE (CFS) = | 3.3 |
| TIME (MIN) = | 88 | DISCHARGE (CFS) = | 3.7 |
| TIME (MIN) = | 110 | DISCHARGE (CFS) = | 3.9 |
| TIME (MIN) = | 132 | DISCHARGE (CFS) = | 4.5 |
| TIME (MIN) = | 154 | DISCHARGE (CFS) = | 4.8 |
| TIME (MIN) = | 176 | DISCHARGE (CFS) = | 5.9 |
| TIME (MIN) = | 198 | DISCHARGE (CFS) = | 6.7 |
| TIME (MIN) = | 220 | DISCHARGE (CFS) = | 9.9 |
| TIME (MIN) = | 242 | DISCHARGE (CFS) = | 7.4 |
| TIME (MIN) = | 264 | DISCHARGE (CFS) = | 56.4 |
| TIME (MIN) = | 286 | DISCHARGE (CFS) = | 7.9 |
| TIME (MIN) = | 308 | DISCHARGE (CFS) = | 5.3 |
| TIME (MIN) = | 330 | DISCHARGE (CFS) = | 4.1 |
| TIME (MIN) = | 352 | DISCHARGE (CFS) = | 3.5 |
| TIME (MIN) = | 374 | DISCHARGE (CFS) = | 0 |

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RUN DATE 10/10/2011
**HYDROGRAPH FILE NAME S200P100.TXT**
TIME OF CONCENTRATION 19 MIN.
6 HOUR RAINFALL 2.4 INCHES
BASIN AREA 29.5 ACRES
RUNOFF COEFFICIENT 0.711
PEAK DISCHARGE 56.2 CFS

| | | | |
|---|---|---|---|
| TIME (MIN) = | 0 | DISCHARGE (CFS) = | 0 |
| TIME (MIN) = | 19 | DISCHARGE (CFS) = | 2.7 |
| TIME (MIN) = | 38 | DISCHARGE (CFS) = | 3.1 |
| TIME (MIN) = | 57 | DISCHARGE (CFS) = | 3.3 |
| TIME (MIN) = | 76 | DISCHARGE (CFS) = | 3.5 |
| TIME (MIN) = | 95 | DISCHARGE (CFS) = | 3.7 |
| TIME (MIN) = | 114 | DISCHARGE (CFS) = | 4.1 |
| TIME (MIN) = | 133 | DISCHARGE (CFS) = | 4.4 |
| TIME (MIN) = | 152 | DISCHARGE (CFS) = | 5 |
| TIME (MIN) = | 171 | DISCHARGE (CFS) = | 5.4 |
| TIME (MIN) = | 190 | DISCHARGE (CFS) = | 6.6 |
| TIME (MIN) = | 209 | DISCHARGE (CFS) = | 7.6 |
| TIME (MIN) = | 228 | DISCHARGE (CFS) = | 11.1 |
| TIME (MIN) = | 247 | DISCHARGE (CFS) = | 15.5 |
| TIME (MIN) = | 266 | DISCHARGE (CFS) = | 56.2 |
| TIME (MIN) = | 285 | DISCHARGE (CFS) = | 8.9 |
| TIME (MIN) = | 304 | DISCHARGE (CFS) = | 6 |
| TIME (MIN) = | 323 | DISCHARGE (CFS) = | 4.7 |
| TIME (MIN) = | 342 | DISCHARGE (CFS) = | 3.9 |
| TIME (MIN) = | 361 | DISCHARGE (CFS) = | 3.4 |
| TIME (MIN) = | 380 | DISCHARGE (CFS) = | 0 |

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